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About the Journal

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Editorial

Dear authors, reviewers, and readers

It has been a month since I was given the privilege to serve as the Chief Editor of the International Journal for Innovation Education and Research (IJIER). It is a great pleasure for me to shoulder this duty and to welcome you to **THE VOL-8, ISSUE-8 of IJIER** which is scheduled to be published on **1st August 2019.**

International Journal for Innovation Education and Research (IJIER) is an open access, peer-reviewed and refereed multidisciplinary journal which is published by the International Educative Research Foundation and Publisher (IERFP). IJIER aims to promote academic interchange and attempts to sustain a closer cooperation among academics, researchers, policy makers and practitioners from a wide range of disciplines, which contribute to state of the art in science, education, and humanities. It provides a forum for the exchange of information in the fields mentioned above by welcoming original research papers, survey papers, and work-in-progress reports on promising developments, case studies, and best practice papers. The journal will continue to publish high-quality papers and will also ensure that the published papers achieve broad international credibility.

The Chief Editor, appointed by the Associate Editors and the Editorial Board, is in charge for every task for publication and other editorial issues related to the Journal. All submitted manuscripts are first screened by the editorial board. Those papers judged by the editors to be of insufficient general interest or otherwise inappropriate are rejected promptly without external review. Those papers that seem most likely to meet our editorial criteria are sent to experts for formal review, typically to one reviewer, but sometimes more if special advice is needed. The chief editor and the editors then make a decision based on the reviewers' advice.

We wish to encourage more contributions from the scientific community to ensure a continued success of the journal. We also welcome comments and suggestions that could improve the quality of the journal.

I would like to express my gratitude to all members of the editorial board for their courageous attempt, to authors and readers who have supported the journal and to those who are going to be with us on our journey to the journal to the higher level.

Thanks,
Dr Eleni Griva
Ass. Professor of Applied Linguistics
Department of Primary Education
University of Western Macedonia- Greece
Email: chiefeditor@ijier.net

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Repositioning the Funding of Adult and Non-formal Education (ANFE) in Anambra State, Nigeria.

Dr. Catherine Omeriyang Madu[1], Dr. Johnson Nnadi Ewelum[2*], Kennedy Ogochukwu Okunna[3]

Department of Adult and Continuing Education, Nnamdi Azikiwe University, Awka, Anambra State, Nigeria.

Email: co.madu@unizik.edu.ng,   ewelumjohnson@gmail.com

Abstract

The need for repositioning the funding of adult and non-formal education (ANFE) in Anambra State cannot be overlooked as manpower and material resources needed for such programmes can be acquired when there is adequate funding. The study focused on the repositioning the funding of ANFE in Anambra State. Descriptive survey research design was adopted in this study, guided by three research questions. The population of the study comprised 331 instructors in all the government owned adult education centres in Anambra State. There was no sampling because the population was manageable. Questionnaire was the instrument for data collection which was validated by two experts in the Department of Adult and Continuing Education, Nnamdi Azikiwe University, Awka. Cronbach Alpha was used to determine the internal consistency of the instrument and the overall reliability coefficient of 0.79 was obtained. Mean statistics was used to answer the research questions. The findings indicated that ANFE is funded to a low extent in Anambra State. The study also revealed that some of the challenges confronting ANFE in Anambra State include: difficulties in identifying budget meant for ANFE, lack of information on funding by individuals, inadequate funding by the government, among others. The study further showed that the strategies to be adopted in repositioning the funding of ANFE in Anambra State are: distinct budget allocation by federal and state government for ANFE, effective utilization of fund accruing to ANFE, assisting of ANFE through regular funding by international bodies and NGOs, among others. Conclusion was drawn and the study recommended that governments both federal and state should provide adequate support to ANFE, especially through proper funding and adequate monitoring of such funds.

Key words: Repositioning, Funding, ANFE

Introduction

Education is the bedrock for human and national development. Education plays a crucial role in the development of human personality. Nigeria has over the years initiated educational programmes in order to eradicate illiteracy which is one of the major barriers to human development, particularly among the adults. One of these educational programmes is the introduction of Adult and Non- Formal Education (ANFE) to enable adults, children and youths, who missed their earlier opportunity for formal education acquire knowledge and skills for better adaptation in the society. Mba (2014) noted that the recognition of

the fact that the work force of the nation is made up of adults and the fact that these adults cannot contribute to the development of the country beyond the level of their education prompted the Federal Government decision to include adults in Universal Basic Education (UBE) Programme.

Adult education according to Obidiegwu (2013) is defined as any educational activity be it formal, informal or non- formal designed for adults to enable them acquire knowledge and skills for self-sustenance. Afolabi (2012) is of the opinion that the purpose of adult education is to help move people from whatever level of consciousness they currently operate to a level of critical consciousness where they can ask questions about things around them as well as attain capacity to change their lives positively to the benefit of the society. On the other hand, Obiozor and Madu (2014) defined Non formal education as *''any planned and organised education activity or training outside the framework of the formal school system. It is geared towards meeting the needs of the specific groups, such as dropout, illiterate men and women, farmers, children and youths, workers or other marginalized group, for the purpose of raising their consciousness and improving their standard of living''* (p. 20).

ANFE therefore, is a continuous process of education for acquisition of wide – range of experiences in and out of school in all facets of life. It is a life saver and can be seen as related to the concept of recurrent and lifelong learning.

More so, the FGN (2013) in recognition of the relevance of ANFE in Nigeria outlined the following objectives in its National Policy on Education as; The provision of functional literacy and continuing education for the adults and youths, provision of functional and remedial education for the dropouts, further education for different categories of completers of formal schools, in-service, on the job, vocational and professional training for different categories of workers and the necessary aesthetics, cultural and civic education for public enlightenment.

However, the realization of the above objectives depends greatly on adequate funding for effective implementation by different states of the federation. Oluchi as cited in Onwuadi (2012) observed that insufficient funds by the government remain the most outstanding disincentive in ANFE programmes and due to lack of funding the education offered in ANFE represents very poor and second-class education. In the same vein, Hanachor and Needom (2014) stated that inadequate funds to run ANFE programmes in Nigeria seems to be the most hindrance to the promotion of the sector. Hanachor and Needom further noted that one other difficulty is that both government and non- governmental organisations are usually reluctant to reveal information on their finances. The consequences of this problem is that there may be lack of researched information on the economic and financing of adult education and related activities.

To buttress further, Abu and Fabumni (2005) asserted that the successful planning and implementation of ANFE programmes depends largely on the availability of funding by the government and NGOS. Gbadamosi, Onuoha and Nwosu (2013) stressed that many governments sponsored adult education programmes have been chronically anaemic due to inadequate funding and poor implementation as a result of lack of information and vision for ANFE as a strategy goal and instrument for national development. Similarly, Jaiyeoba (2007) submitted that much of the funds being injected into ANFE may not be properly accounted for, thus, the whole purpose of such funds may be defeated. Hence, accountability and proper management of such funds is a vital tool for the success of ANFE programmes.

These submissions imply that provision of adequate funding for effective running of ANFE programmes could enhance the status of the programmes in Nigeria and Anambra state in particular.

Recently, in Anambra state, it was reported that the state government has established 283 adults and non-formal education centres in the state (Nzeagwu, 2019). This was done in a bid to give opportunity to adults who were not privileged to attend formal education. This is a welcome development and a demonstration of the level of importance attached to ANFE. The question is: How much funds was released by the state government to run those centres established? Funding has always been a major constraint to the development and progress of ANFE. For instance, in an interaction with some instructors in the centres, many expressed their negative feelings on the N4, 500.00 paid as monthly stipend which sometime does not come at and when due. All these constitute a gap that needs to be bridged. It is possible that these problems could be reversed if appropriate strategies are employed in handling the budget meant for ANFE in the state. It is on this background that the researchers focussed on repositioning the funding of ANFE in Anambra state for better enhancement of the programmes.

Purpose of the Study

The main purpose of the study was to reposition the funding of ANFE in Anambra state, Nigeria. Specifically, the study determined:

1. The extent ANFE is funded in Anambra state
2. The challenges confronting the funding of ANFE in Anambra state
3. The strategies in repositioning the funding of ANFE in Anambra state.

Research Questions

The following research questions guided the study:

1. To what extent is ANFE funded in Anambra state?
2. What are the challenges confronting the funding of ANFE in Anambra state?
3. What are the strategies for repositioning ANFE in Anambra state?

Materials and Methods

A descriptive survey research design was used for the study. This design was adopted because the researchers were interested in finding out the opinions of instructors on the funding of ANFE in Anambra state with a view to repositioning it.   The population of the study consisted of 331 instructors in all the government own adult education centres in Anambra state. There was no sampling because the population was manageable. Questionnaire was used for data collection which was validated by two experts. Cronbach alpha technique was used to determine the internal consistency of the instrument. The reliability of 0.81, 0.72 and 0. 84 were obtained in the three clusters. The overall reliability was 0.79 indicating a high reliability. Out of 331 copies of the questionnaire distributed to instructors during their three days' capacity building workshop with the help of two research assistants, only 286 copies were rightly completed and returned which was used for the analysis. The weighted mean was used to answer the research questions.

Boundary limit was used to answer research question one with response categories of Very High Extent (VHE) 3.5 - 4.00, High Extent (HE) 2.5 – 3.49, Low Extent (LE 1.5 - 2.49) and Very Low Extent (VLE) 1- 1.49 while the response mode of Strongly Agree (SA) - 4, Agree (A) - 3, Disagree (D) - 2 and Strongly Disagree (SD) -1 was used for research questions two and three. A criterion mean of 2.50 was used as decision rule to answer research questions two and three. This means that any item with a weighted mean value of 2.50 and above was considered agree while any mean below 2.50 was considered disagree.

Results

Research Question One

To what extent is ANFE funded in Anambra State?

Table 1: Mean Scores on the Extent to which ANFE is Funded in Anambra State.

SN	Extent of Funding ANFE	VHE 4	HE 3	LE 2	VLE 1	Total Score	Mean n=285	Decision
1.	Government provides funding of ANFE in the State.	20 40	65 195	80 160	120 120	285 555	1.95	LE
2.	NGOs such as UNESCO, World Bank, UNDP fund ANFE in the State.	10 40	16 48	120 240	139 139	285 467	1.64	LE
3.	Philanthropists aids the funding of ANFE.	100 400	150 450	20 40	15 15	285 905	3.18	HE
4.	Adult learners contribute money for the funding.	59 236	40 120	60 120	126 126	285 602	2.11	LE
5.	Centres generate internal revenue for the development of the programme.	55 220	70 210	70 140	90 90	285 660	2.32	LE
6.	Community members contribute funds for the programme.	40 160	48 144	17 34	180 180	285 518	1.82	LE
	Grand mean						**2.17**	**LE**

Table 1 shows that items 1,2,4,5 and 6 have mean scores of 1.95, 1.64, 2.11, 2.32 and 1.82 respectively. These means fall within the decision rule of low extent. The table also shows that item 3 has mean score of 3.18, which is within the decision rule of high extent. The grand mean of 2.17 is also within the decision rule of low extent. This implies that adult and non-formal education is funded to a low extent in Anambra State.

Research Question Two

What are the challenges confronting the funding of ANFE in Anambra State?

Table 2: Mean Scores on the Challenges confronting the Funding of ANFE in Anambra State.

SN	Challenges of Funding ANFE	SA 4	A 3	D 2	SD 1	Total Score	Mean n=285	Decision
7.	Difficulties in identifying budgets meant for ANFE.	160 640	60 180	40 80	25 25	285 925	3.25	Agree
8.	Lack of information on funding by individuals.	155 620	75 225	38 76	17 17	285 938	3.29	Agree
9.	Inadequate funding by the government.	172 688	113 339	- -	- -	285 1027	3,60	Agree
10.	Lack of political will to fund ANFE.	146 584	80 240	50 100	9 9	285 933	3.27	Agree
11.	Inadequate information on sharing of fund for ANFE by government agencies.	158 632	76 228	48 96	3 3	285 959	3.36	Agree
12.	Embezzlement by government officials.	175 700	65 195	45 90	- -	285 985	3.46	Agree
13.	Misconception of ANFE by government.	180 720	76 228	29 58	- -	285 1006	3.53	Agree
	Grand mean						**3.39**	**Agree**

   Table 2 shows that all the items were agreed by the respondents as challenges confronting the funding of ANFE in Anambra State. This is because all have mean scores above the criterion mean of 2.50. The grand mean of 3.39 is also above the criterion of 2.50. The table indicates that difficulties in identifying budgets meant for the adults and non- formal education, lack of information on funding by individuals, inadequate funding by the government, misconception of ANFE by the government, among others are challenges confronting ANFE in Anambra State.

Research Question Three

What are the strategies for repositioning ANFE in Anambra State?

Table 3: Mean Scores on the Strategies for Re-positioning the funding of ANFE in Anambra State.

SN	Suggested Strategies are:	SA 4	A 3	D 2	SD 1	Total Score	Mean N=285	Decision
14.	Allocation of distinct budget by the federal and State government for ANFE.	183 732	70 210	30 60	2 2	285 1004	3.52	Agree
15.	Effective utilization of fund accruing to ANFE	175 700	85 255	10 20	15 15	285 990	3.47	Agree
16.	Assisting of ANFE through regular funding by international bodies.	125 500	90 270	60 120	10 10	285 900	3.16	Agree
17.	Improving in the funding of ANFE in the state by NGOs.	155 620	96 288	34 68	- -	285 976	3.42	Agree
18.	Individuals should bear the cost of their education.	40 160	48 144	122 244	75 75	285 623	2.19	Disagree
19.	Stakeholders in education, institutions and private sectors should assist in the funding of ANFE.	168 672	76 228	30 60	11 11	285 971	3.41	Agree
20.	Proper monitoring of the fund released for ANFE in the state	190 760	85 255	10 20	- -	285 1035	3.63	Agree
21	Internally generated revenue should be adopted by different centres of ANFE.	186 744	75 225	24 48	- -	285 1017	3.57	Agree
	Grand Mean						**3.30**	**Agree**

Table 3 reveals that all the suggested strategies for repositioning ANFE in Anambra State were agreed by the respondents except item 18 with mean score below 2.19.   The grand mean of 3.30 is also within the decision rule of agree. This implies that allocation of distinct budget by the federal and state government for ANFE, effective utilization of fund accruing to ANFE, assisting of ANFE through regular funding by international bodies, proper monitoring of funds released to ANFE, among others, are some of the suggested strategies to be adopted in repositioning ANFE in Anambra State.

Discussion

The findings in research question 1 revealed that adult and non- formal education in Anambra State is funded to a low extent. This indicates that ANFE is not properly funded in the state. This finding

is in line with the views of Oluchi as cited in Onwuadi (2012) that insufficient funds remain the most outstanding disincentive in ANFE programmes in Nigeria and due to lack of funding, the education offered in Adult education programmes represents very poor and second-class education. This finding corroborates with the assertion of Nke, Abua and Eneh (2018) that financing adult education in Nigeria generally is very inadequate and as such adult education administrators are faced with the problem of how to allocate scarce and limited resources at their disposal for the smooth running of the programmes.

The findings in research question 2 showed that there are lots of challenges confronting the funding of ANFE in Anambra State. These challenges include; difficulties in identifying budgets meant for ANFE, lack of information on funding, inadequate funding by the government, embezzlement of funds by government officials, among others. This affirms Hanachor and Needom (2014) submission that inadequate funds to run ANFE programmes in Nigeria seems to be the most hindrance to the promotion of the sector. Onuoha and Nwosu (2013) pointed out that many governments sponsored adult education programmes have been chronically anaemic due to inadequate funding and poor implementation as a result of lack of information and vision for ANFE as a strategy goal and instrument for national development. The authors further noted that embezzlement of funds meant for ANFE by some government officials constitute a challenge to the progress of ANFE. It is imperative to state that in many states of the federation, when funds are released by the federal government for a particular project, some government officials divert the funds to their own pockets; Anambra state is not an exception.

The findings in research question 3 revealed the strategies to be adopted by the state government in repositioning the funding of ANFE in the state. These strategies are; there should be distinct budget allocation by the federal and state government for ANFE, funding accruing for ANFE should be effectively utilized, international bodies and NGOs should assist regularly in financing ANFE, proper monitoring of the fund released for ANFE in the state, among others. This finding is in consonant with the opinion of Gbadamosi, Onuoha and Nwosu (2013) that if there is distinct budget allocation for ANFE in all the states, it will go a long way in improving the status of ANFE programmes. To buttress further, Olaye and Onajite (2015) asserted that considering the relevance of ANFE in nation building, international organisations, non-governmental agencies and individuals should participate in improving the status of ANFE programmes through the provision of adequate funding. In addition, Jaiyeoba (2007) suggested that there should be proper monitoring of the funds injected into ANFE for the achievement of it goal.

Conclusion

From the findings of the study, it can be concluded that ANFE is funded to a low extent in Anambra state. Also, there are enormous challenges confronting the funding of ANFE in the state. These challenges include difficulty in identifying budget meant for ANFE, lack of information on funding, inadequate funding by the government, embezzlement of fund meant for ANFE by government officials, among others. Some of the suggested strategies in repositioning ANFE in Anambra state are that; there should be a distinct budget allocation by federal and state government for ANFE, funding accruing for ANFE should be effectively utilized, international bodies and NGOs should improve in their funding of the programmes,

among others. If these strategies are fully adopted, it will go a long way in repositioning ANFE in Anambra state.

Recommendations

Based on the findings of the study, the following recommendations are made:

1. Government needs to provide a different budget allocation for ANFE in the state and when these funds are released, there should be proper monitoring of such funds.
2. International organizations, NGOs and individuals should assist regularly in the funding of ANFE in the state for the realisation of its objectives. This is because, no programme can be executed without funding.
3. There should be elimination of corruption from the body polity.
4. Proper accountability of funds released for ANFE in the state is important.

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The Role of Research Centers in Saudi's Universities in Supporting Creativity and Innovation: Descriptive Study

Dr. Mohamed Abdulla Mohamed

Faculty Member

Deanship of Graduate Studies and Research

Phone: (+966 3) 849-5489

P.O Box 1664

Email: - mabdulla@pmu.edu.sa

Al-Aziziyah, Eastern Province, Al-Khobar, 31952 KSA

Bimal Krishna Banik

Professor, Deanship of Research Development and

Department of Mathematics and Natural Sciences

Prince Mohammad Bin Fahd University

Al Khobar, Kingdom of Saudi Arabia

Phone (cell): +9660567304657

E-mail: bimalbanik10@gmail.com

Abstract

This research aims to present the role of research centers in supporting the creativity and innovation in Saudi's Universities. The research activities and scientific innovations of these centers are also described. This paper also explores the feasibilities of social-economic development by paying attention to create a knowledgeable society in light of implementing Saudi vision 2030.

Keywords: Research Centers, Innovation, economic development, knowledgeable society; Saudi Arabia.

Introduction

The leadership of the Kingdom of Saudi Arabia has recognized the importance of creativity and innovation. Therefore, the Institute of Innovation is established in King Abdulaziz City for Science and Technology which has contributed into the designing of the Technical innovation centers programs in Saudi's Universities for achieving the economic and social development objectives. KACST (2019), the Research Center Networking and Technical offices of ARMACO also represents the strategic focal point for innovative and research competencies in many regions around the World. Thus the "Open Innovation" feature of the research networking has aimed to utilizing the technology into the field of energy by providing an access to the best ideas to the employees and partners around the World (ARAMCO 2019) .

The research centers in all educational and research institutions are responsible for innovations registration, and finding solutions to social-economic problems of the society through applying scientific research. These are thoroughly associated to the development of the countries from social and economic viewpoints. Therefore, the importance of recent study in exploring the role of research centers in supporting the innovations and creativity of Saudi's Universities and their roles in achieving the Kingdom's vision of 2030 is highly crucial. There are many universities in the Kingdom that focus on teaching only and are not interested in scientific research. But, research is an important part of progress and it reflects social and economic development. In view of the important role of research centers in supporting creativity and innovation for achieving social-economic development, this study reports the current situation of research centers in Saudi's Universities. This type of study may prove to be helpful for advancing research facilities and productivities in Saudi Arabia. ([2019](#))

Method

This research used descriptive analytical method which was considered as the most appropriate for this study. It was based on the reality of the problem from different dimensions, analyzing their causes and factors in order to reach the necessary solutions. It utilized two methods as the followings:

- Theoretical approach: theoretical framework was determined.   In addition, previous research, studies, papers, books, articles and relevant materials in the internet websites were reviewed.

- Practical approach: It utilized scientific research tools (interviews and direct observations). It also examined the websites of research and innovations centers for analyzing and evaluating the contents to identify the current status.

Literture review

The Kingdom of Saudi Arabia had desired for establishing research centers in different fields in order to develop and facilitates conducting scientific research, directed to national priorities for social-economic development. These centers are affiliated with universities, colleges and higher institutes, also research centers affiliated to ministries and agencies, and others are independent and specialized in different fields of research.

scientific research in Saudi universities has witnessed great changes in the past few years, the rate of expansion in higher education and the opening of new universities, those universities has sought to promote the movement of scientific research, innovative research, as one of the main functions of universities, and doubled the interest of universities and scientific research, patents, and diversified sources of income and expenditure on scientific research and development in Saudi universities as a result of the great support the offering by King Abdulaziz City for Science and technology ([KAUST](#)) through the National Science, Technology and Innovation Plan ([NSTIP](#)), as well as the support that comes from the private sector represented in scientific endowed chairs, "SABIC chair " in Saudi universities is the best example, and a

network of research centers and technical offices manage by ARAMCO around the world which represent the Axes of competencies innovative and research strategy in the desirable areas of The World.

Among the efforts made by the government to support and promote scientific research and the Ministry of Education has established team work to design the indicators to measure and evaluate the reality of scientific research in the Saudi universities in order to identify sme facts about scientific research in universities, and producing research to learn the strengths and weaknesses, the ministry has followed the best international standards, and sought to be these indicators are consistent with the current reality and nature of Saudi universities, the team desined six themes included (researchers and competencies. financial support. Scientific research, rehabilitation and training. Graduate Studies. and infrastructure), also contributing to give accurate and realistic image of the research activity, thus contributing for the future plan of scientific research activity in terms of addressing deficiencies Existing shenanigans based on scientific reading realistic, as well as enhancing aspects of the Force and its support to achieve the maximum benefit from the scientific research activity. (Al-jazirah,2012)

The number of graduate students (MA & Ph.D.) increased, where the number of students enrolled in master's level of 9.768 students in 2006, bringing in the year 2009 to 19.592 students and the number of students in the doctoral level of 2.410 in 2006 to 2,565 in 2009, but that this number has decreased slightly, according to the latest statistics published by the Ministry of Education for the year 2014 - 2015 a number of 18.741 students for all graduate students, the researcher noted that the State has paid special attention to scientific research as the port to move to Knowledge Society. King Abdulaziz City has established a strategic program for the national research and development support system, to raise the kingdom's position within the map of leading countries in the field of science, technology and innovation. The aims of this program to provide financial and technical support to Saudi graduate students, to implement thier master's and doctorate research, In order to encourage outstanding them to conduct original research in different fields of science according to the latest international scientific knowledge. And to develop thier practical skills to raise the kingdom's position as a leader in the fields of science, technology and innovation. (KACUST,2020) the follwing chart shows:

Figure 1. Chart Source: https://www.kacst.edu.sa/arb/srs/Pages/Graduate-Research-Program.aspx
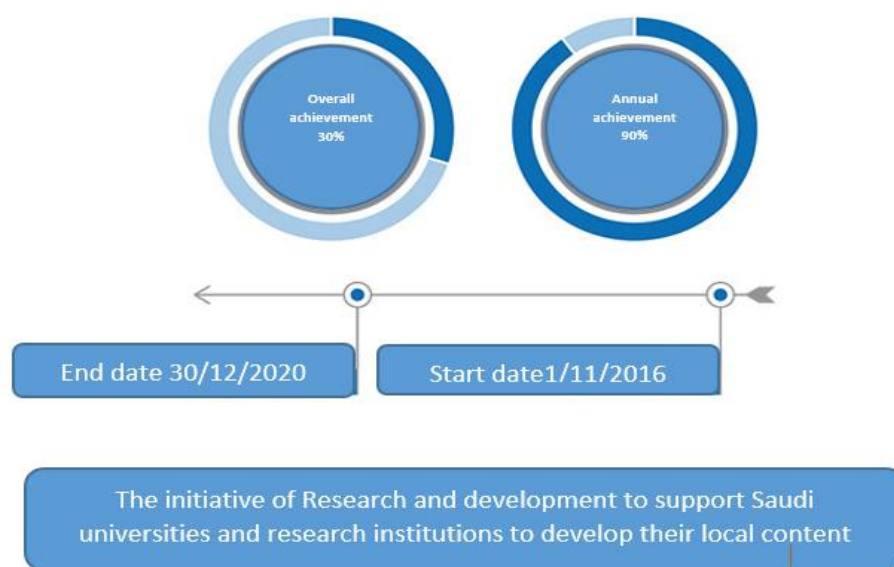
Indicators of innovation and research centers in Saudi universities:

The Saudi National Plan for Science and technology and Innovation aimed at strengthening the role of scientific research and support to innovation and creativity. The National Plan included many of the programs and projects that support the resettlement and development of techniques in the Saudi kingdom. The programs to develop the capacity of scientific research, innovation and research centers in Saudi universities was stressed. The establishment of outstanding research centers, programs for the transfer and dissemination of technology and innovation are required to realize the Saudi vision 2030. A number of Saudi universities strategic program within the national research and development support system and strategic investment of national capacities are interested in the development of postgraduate students. In the Kingdom of Saudi Arabia, many reports indicated that the great majority of research depends on the experimental research and development. These aim to innovate and benefit from the knowledge and information in the development of products that are marketable research in the field of engineering and science.

> The initiative of Research and development to support Saudi universities and research institutions to develop their local content

According to the global innovation index rankings for the year 2019, Saudi Arabia ranked 68th, while Output rank was 85 and Input rank was 49. The global innovation report indicated that there is a weakness in national income. In general, global economic growth is losing momentum compared to 2017/18. Global productivity growth has reached a record low. For many reasons, commercial battles are brewing. Economic uncertainty is high (WIPO 2019).

Tablo 1. presents the number of patents filed in the U.S. patent and trademark office.

Economy	Innovation Index (2019)		Innovation Index (2018)		Change	
Saudi Arabia	Rank	Score	Rank	Score	Rank	Score
	68	32.9	61	34.3	-7	-1.4

Table (1) Source: http://statisticstimes.com/ranking/global-innovation-index.php

The number of patents submitted in the past few years is shown here: 2014 (141 patents), 2015 (109 patents), 2016 (105 patents), 2017 (104 patents), and 2018 (122 patents) (USPTO 2018). Out of these 334 patents were granted to king Abdulaziz city for science and technology at the Saudi Patent Office. These were approved in the following fields: chemistry (177 patents), mechanical engineering (62 patents), electrical engineering (39 patents), tools (32 patents) and other fields (24 patents).

Saudi Arabia ranked 23rd in the world out of 92 countries with (664 Saudi patents) registered in 2017, of which 409 patents were registered in 2015 and 517 patented in 2016 (2019). The figure (2) shows the total number of patents filed to the Saudi Patent Office for the year 2018. There are more countries to submit patent applications to the Saudi Patent Office in accordance with the table (2).
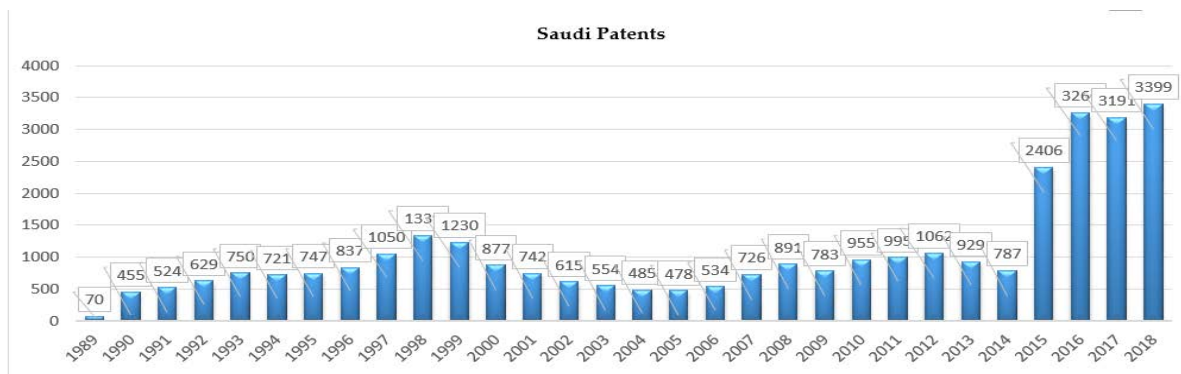
Figure 2. Chart Source: Saudi Patent Office website - applications fields annually
https://www.kacst.edu.sa/eng/IndustInnov/SPO/Pages/Statistics.aspx

R	Country	Applications
1	Saudi Arabia	345
2	United States	125
3	Japan	83
4	China	74
5	France	45

Table 2: Source: https://www.kacst.edu.sa/eng/IndustInnov/SPO/Pages/Statistics.aspx

Five countries have submitted industrial design applications to the Saudi patent Office during 2018. The diagram, figure 3 shows the number of approved patents by the Saudi Patent Office for the year 2018.
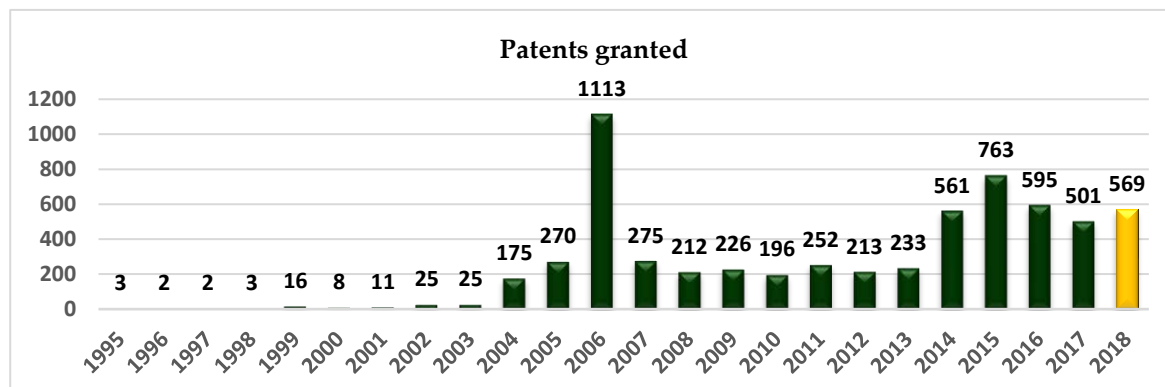
Figure 3. Chart Source: Saudi Patent Office website

The figure (4) shows the number of industrial models issued certificates with the Saudi Patent Office for the year in 2018.
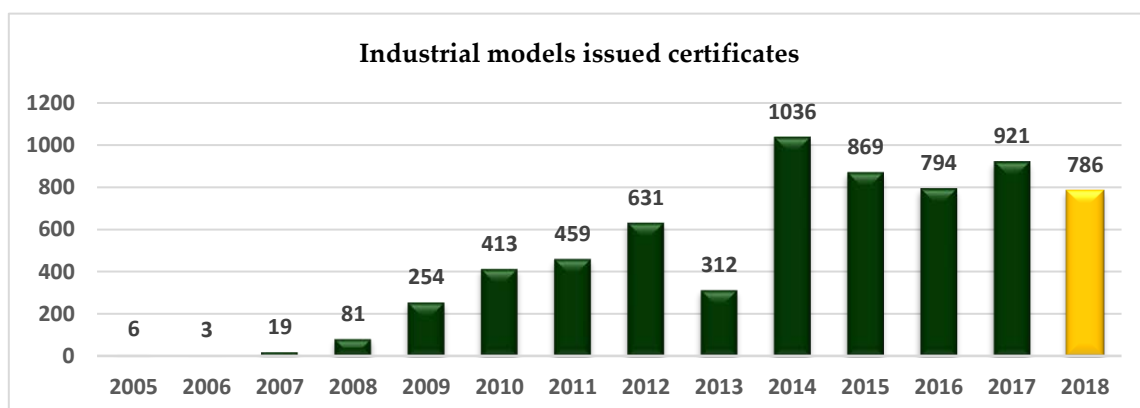
Figure 4. Chart Source: Saudi Patent Office website

The figure (5) illustrates the applications filed by universities in Saudi Arabia Saudi Patent Office. The figure (6) illustrates the patents granted to national research institutions originated from Saudi Patent Office. The figure (7) illustrates the patents submitted to the Saudi Patent Office for the years 2011 to 2015.
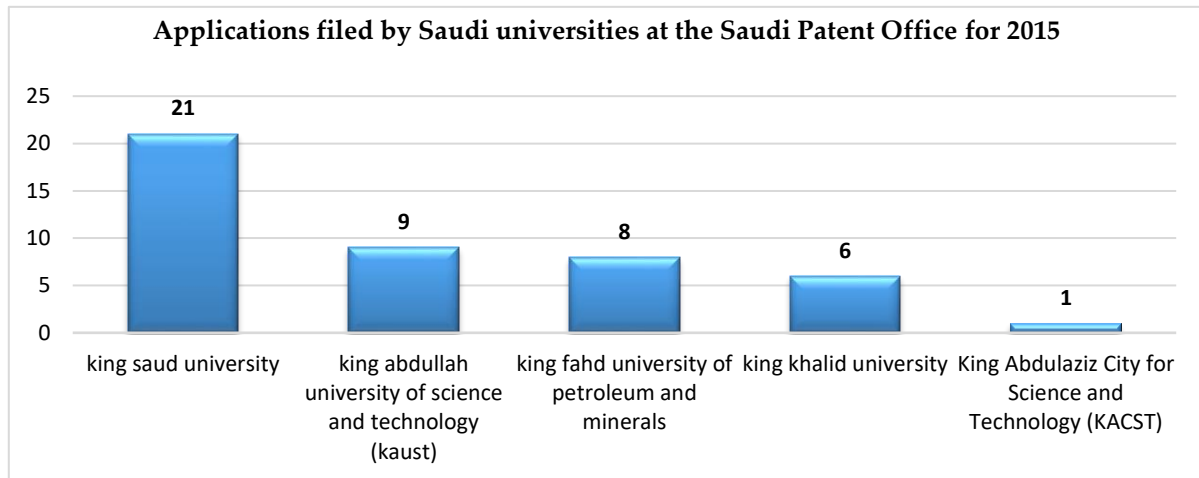
Figure 5. Chart Source: Annual Statistical Report 13436-1437 H - Saudi Patent Office
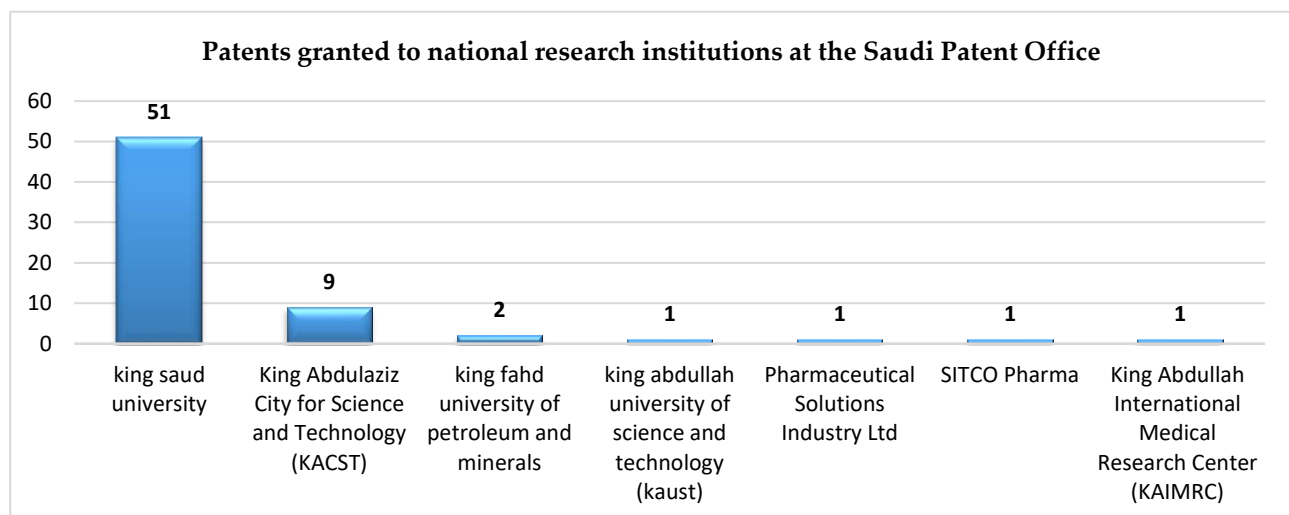
Figure 6. Chart Source: Saudi Patent Office
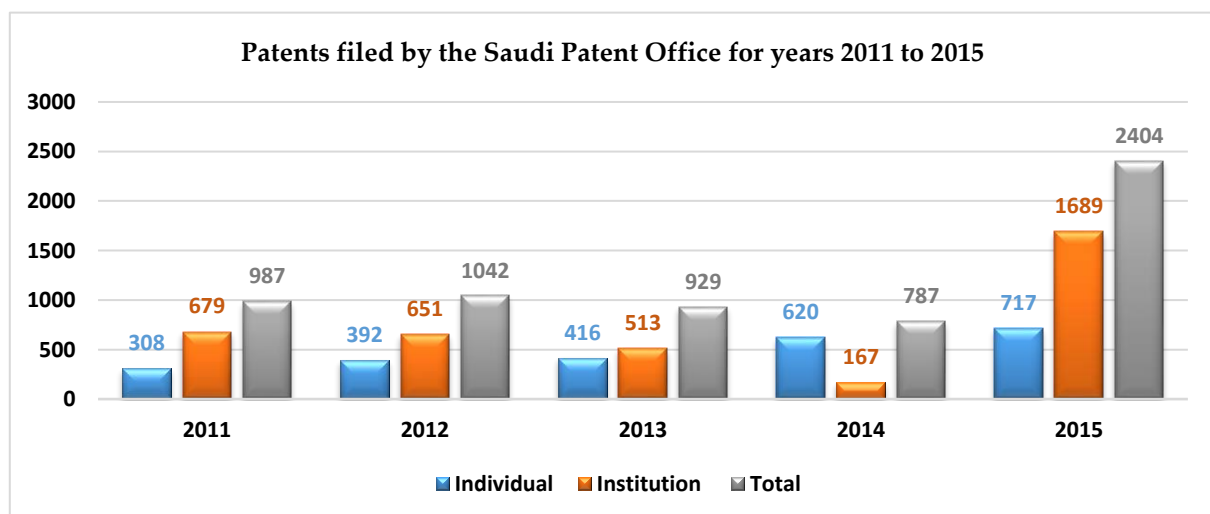
Figure 7. Chart Source: Saudi Patent Office

The comprehensive development plan witnessed many of the programs that encourage the research centers in the Saudi kingdom in the support of innovation. King Abdulaziz City for Science and technology adopts some activities for the care of the talent and innovation. Toward the goal, the city has established 7 Institutes, 4 centers and 5 national programs for research, development and innovation.   Some of the centers and units are as follows. (Abdulaziz M Al-Swailem 2014):

1. **Innovation and Industrial Development Institute**: This was established in 2013 with a view to supporting the transition to a knowledge-based economy, in line with the Saudi Vision 2030.   This Institute aims to achieve a number of objectives as follows:
   - Lead in the development of the infrastructure of technology transfer to identify intellectual property investment and support Saudi Inventors.
   - Stimulate technical innovation in the industry through the support and cooperation and effective participation with the industrial sector and the private sector.
   - Support technical innovation centers in Saudi universities and national research centers.
   - Support the establishment and development of technical projects and large commercial scalability for growth and sustainability through enhanced placement industry technical support entrepreneurial environment

2- National Center for Industrial Development: ([KACST 2019](#)) The Center was established to provide support services for projects of King Abdul Aziz City for Science and technology, The (NCID) has made great efforts to provide support services for King Abdulaziz City projects by measuring the level of technological readiness, providing basic facilities for the prototype manufacture and linking it to the public and private sectors in Saudi Arabia, eliminating all difficulties. Facing KACST researchers and interested parties, and working to introduce KACST products to the local and international market in order to increase the efficiency of the city results.

3- **Technology Innovation Centers**: This program aimed to achieve the goals of economic and social development in the Saudi kingdom through innovation and creativity. Technology and Innovation Plan in the kingdom of Saudi Arabia is funded and managed by [KACST](#). The goals of the Technology Innovation Centers are to promote Saudi universities, the local industry, and KACTS Institutions through research collaboration and technology transfer in Saudi Arabia.

4- Intellectual Property and inventors support Unit: This center was created to maintain and exercise laws and regulations for the protection of the intellectual property rights of individuals and providing the suitable environment for investment that stimulate the establishment of industries based on innovation.

5- **Saudi Patent Office**: The Office established with a view to the protection of inventions layout designs of integrated variety, plant varieties and industrial designs in the kingdom

6- **Badir program**: Is one of the King Abdul Aziz City for Science and Technology programs, which was founded in 2007, the term Badir means   (the initiative), this program is one of the most important national and creative environments in the field of innovation and support,   for the establishment and growth of business and developing projects, which was established in 2007 by King Abdulaziz City for Science and Technology, with the aim of supporting the opportunities of business projects based on technology, Developing entrepreneurship in the technical field.

The most challenges and constraints facing the research centers in Saudi universities:

The studies of research centers became the focus of Arab attention since 1952 when the Arab Research and Studies Institute of the Arab League were founded. In recent decades, Arab's interests in Research and study centers have grown in quantity and quality. The number of centers has increased significantly in the last 10 years. Despite this growth, it is still limited, compared to its counterparts in other regions of the world, with 580 research centers accounting for 7.49% of all Centres around the world (SABAQ newspaper, 2018).

Arab research and studies centers face many challenges. One of them is mainly independence. The vast majority of research centers belong to government, Saudi Arabia, like other Arab countries, suffers from a lack of research and studies centers, for many reasons addressed in this paper in some detail below: (Telal Abdulla Hussain 2015)

1. The agreements and partnerships to develop the framework for cooperation in order to create channels of communication between universities, scientific research institutes, and industrial enterprises.

2. Saudi Arabia has supported the research institutions, King Abdulaziz City for Science and Technology, which conducts applied scientific research. This institution provides scientific advice and plays a key role in the Saudi vision 2030, through the national transformation program. They also develop the necessary strategies in the fields of research, support research programs and scientific projects for applied purposes, work to develop mechanisms to convert the research outputs and develop industrial products. (KACST)

3. Most of the Saudi universities did not provide a service to the community in particular and to the Kingdom in general, despite the presence of endowed chairs in universities. But their roles were very limited due to a number of problems that do not enable them to achieve their roles. In fact, some of them suffered from adequate funding and others suffered from the lack of a clear plan. Advertising and propaganda were also involved. (2019)

4. Although the research centers in Saudi universities have adopted important studies and researches, some of those departments responsible for monitoring the research performance in the universities do not function properly, which turns the performance of these research institutions to be low and weak.

5. The research centers in the Saudi universities face a lot of financial and administrative constraints which lead to the recommendations that research may not be implemented. So the researchers should work for marketing their research results.

Role of Saudi universities research center in supporting the creativity and innovation:

Saudi Arabia has demonstrated great importance to the national development plans to achieve substantial progress in research. It is realized that this progress should be measured by the number of published research papers in scientific international journals as well as patents approved. Universities with enriched scientific research capabilities are ranked internationally. The quantity and quality of research outputs are judged by the Saudi universities and King Abdul Aziz City for Science and technology and some governmental bodies or semi-governmental organizations and departments. These support Saudi community-related studies, issues and interests, particularly in relation to the implementation of the Saudi Vision 2030.

According to the Saudi Economic Journal, statistics were cited by 5 Saudi universities and 54 research centers to study economic, social, medical and technological issues. The following are the best research centers in Saudi universities for ([2018](#)):

- **Institution of Consulting Research and Studies - Umm Al-Qura University,**

  The institution offers research, development services, studies and consultation to the public and private sectors, through the members of the faculty of the university and the potential sources available to the various colleges and institutes. The institution aims to develop studies and advisory services and provide them to Saudi community, and contribute to research and development efforts. These are aimed to Saudi economic and social development, to develop an integrated system at Umm Al-Qura University, to develop it for education and vocational training for the public, private and community sector. The Center also operates in the following areas: Communication Engineering, Electrical Engineering, Mechanical Engineering, Architecture and Planning and computer in addition to the basic sciences. There are 200 full-time researchers and faculty members in this center. ([2019](#))

- **King Fahd Center for Medical Research - King Abdulaziz University**:

  King Fahd Center for Medical Research is the first research center in the Kingdom to provide cooperative services with all health facilities and health colleges in Saudi Arabia. It is worth mentioning that the center enhances its presence and excellence in the field of advanced medical research that deals with Saudi society as well as facilitate academic communication in all aspects of health and social according to the priorities and concerns of the society. The center has completed a number of distinguished medical research centers, as well as the development of policies and plans for scientific research and higher studies in the university. This center consists of (16) Research Units which include 70 full-time researchers. ([2019](#))

- **Alfaisal Centre for Research & Consultancy Studies - King Faisal University:**

  The Center is to promote research cooperation and channeling research, educational training and contract projects as well as consulting studies between external organizations, and the faculty members of Alfaisal University. They find ways to strengthen and diversify the sources of the national economy through industrial investment and guide them to serve the objectives of economic and social development in the Saudi Kingdom. The Institute carries out several activities and provides many services in the areas of consulting, research, scientific studies as well as training courses, and aspires to promote partnerships and investment opportunities that allow the transfer and localization of technologies, knowledge and expertise to the local and national community. They attempt to create experts in King Faisal University and try to distribute the resources for the needs of external organizations and institutions. ([2019](#))

- **The Research Center of the Faculty of Applied Medical Sciences, King Saud University**

  The center cooperates with a number of governmental bodies to determine the planning, implementation and evaluation of research activities. They have a provision for advisory services in the field of research and development to governmental and non-governmental organizations. They contribute effectively to the health development in Saudi Arabia as well as to develop and

facilitate the development programs of the College of Applied Medical Sciences and related bodies on the health of the community. (2016)

- **Research Center of the Faculty of Engineering - King Saud University**:
  The Center submitted many projects in the various fields of engineering and applied sciences. The faculty members conduct research in collaboration with external parties and build a practical application to serve development in the kingdom. This research is financed by the King Abdul Aziz City for Science and technology or some other sectors outside the university.

- **Al-Qassim University Research Centers:**
  Al-Qassim University currently has 53 colleges, 12 deans and 5 research centers, which are one of the best research centers in Saudi universities. The deanship of Research has been able to support a number of programs and research projects. The University has adopted development projects within the framework of the university's strategic plan for the period 2009 to 2019 to shape the future of the university, and to achieve partnership with the community. The deanship of research offers endowed chairs that aim to achieve the consistency between the university and research possibilities.   This provides financial support to encourage research and field studies in addition to consulting that helps in many of the Social and developmental problems. The deanship of research also provides its services and advice to government and private sectors. The Deanship includes a number of 500 full-time faculty members and researchers. (2019)

Role of SABIC endowed chairs in supporting the creativity and innovation:

Saudi Basic Industries Corporation (SABIC) "endowed chair" in Saudi universities is a partnership between SABIC Company and Saudi universities to provide annual grants that serve the purposes and objectives of the research, science, technology, and   innovation in Saudi Arabia.   The company is seeking, through this partnership to benefit from the experts working in Saudi universities, research centers and other advanced research centers inside and outside the Saudi Kingdom. The main idea to continue developing their industries and promoting their integration, and to increasing the quality of the products and services provided by the SABIC, as well as for building long-term relationships with its clients. SABIC's relations with Saudi universities through many topics, including providing grants to universities to conduct scientific research in areas relevant to the SABIC activities, and support the participation of Faculty members in local and international conferences and forums are well established. It should be noted that SABIC has signed (12) joint research agreements with Saudi universities, and the company has financed three Endowed Chairs in three universities as following: (SABIC 2019)

- University of King Saud in research polymers
- King Abdulaziz University in research catalysts
- King Fahd University of Petroleum and Minerals and corrosion materials

With annual financial support for each endowed chair and renewal possibility create distinctive research centers. This attracts experts from inside and outside the Saudi kingdom. Therefore, development of the applied programs in cooperation between "SABIC" and Saudi Universiies can be possible.

Role of ARAMCO in supporting the creativity and innovation:

Research and development efforts focus in Saudi Aramco on several areas, such as exploration, production, refining, processing, marketing and sustainability create significant competitive advantage for ARAMCO work and assistance. This helps to grow new businesses, as part of the efforts to Aramco in research and development. Aramco also established the Global Research Network, which consists of three research centers in the Kingdom and eight research centers and offices of foreign technology. All of these are working for the development of technologies to address energy challenges at the global level and to contribute to the development of vital and effective techniques in the Saudi kingdom. (ARAMCO 2019)

Aramco seeks to establish research center at King Abdullah University of Science and technology to be a nucleus of the integrated cooperation between Aramco and the Saudi universities. In order to take advantage of the international network of academic institutions associated with the Saudi Universities, The Aramco has sought to find technical solutions to reduce greenhouse gas emissions and increase sustainable supplies of energy, and also has contributed to the company in cooperation with local and international technological centers of excellence in promoting research capacity within the kingdom with Saudi universities and research institutes to support its new techniques in the fields of exploration and production, refining, processing and marketing.   The company has also sponsored research partnerships and cooperation between academia and industry through cooperation with leading energy services companies in the compounds research and innovation. (KAUST 2016)

Results

The Ministry of Education has launched a series of initiatives to achieve the goals set by The Saudi Vision 2030, and the National Transformation Program for Public and Higher Education. In addition to strengthening the ecosystem of high institutions, assets and activities dedicated to scientific research and development in Saudi Arabia. Based on the Saudi government's approach to contribute to support sustainable development in society to build knowledge economics a society, some Saudi universities have been interested in supporting Entrepreneurship and the development of its curriculum in line with local and international trends and in accordance with international academic standards. In addition, the establishment of specialized centers in universities concerned with entrepreneurship has direct contact with support providers such as The Tasleef Bank, Riyada Institute and other related centers. One of the experiences of Saudi universities in this regard led by several universities such as King Abdullah University of Science and Technology (KAUST), where academic departments and research centers support the research objectives of the University by bringing faculty, researchers and graduate students from Various disciplines together, to benefit from the interconnection between science and engineering to develop a multidisciplinary approach to addressing fundamental and targeted problems. The University also provides laboratories and facilities equipped with the latest research devices operated by more than 100 scientists and experts engineers, to support the research community. Another experience at Um al-Qura University through workshops and summer courses, and the benefits from the experience of the global leading centers in Britain and Japan, as well as the experience of King Saud University by introducing entrepreneurship courses into the student curriculum.

Discussion *

Education and Scientific research is witnessing a qualitative shift and is receiving a lot of attention from the government, education leaders and decision makers in the Saudi Arabia, this positive impact is clearly demonstrated through the financial budgets that have been allocated to scientific research from the government budget in recent years, and also from support to the scholarship program and the support of government and private universities.

Saudi Arabia has taken a great deal of interest in the localization of technology, and has made great strides in the field of education and the formation of Saudi cadres capable of localization of technology, so that Saudi faculty and researchers make up a large majority in Saudi universities, and scientific research centers have increased in Both the public and private sectors have increased steadily, most notably King Abdulaziz City for Science and Technology, Aramco, SABIC, The General Organization for Technical and Vocational Training, as well as many other academic and university institutions.

Conclusion *

The role of research centers in Saudi universities is very limited as it implements researches for graduate students and faculty members. The universities have not addressed the needs of Saudi society adequately. Therefore, Saudi universities should take responsibility for building the creativity and innovation in order to implement the Saudi Vision 2030. The development of the Saudi society and its support with new knowledge is very important because Saudi Arabia at this stage needs creative productivity. There is no doubt that outstanding education is the backbone of the creativity and innovation projects. Certainly, the university will be able to foster creativity through appropriate education.

There are efforts to link the research in Saudi universities to the social and economic development in the Kingdom. But the level of research output does not meet the aspirations of the Saudi society. Also most technology comes from companies that have produced progressive thinking. Therefore, research centers in Saudi universities must cooperate with them so that they can be linked to skilled persons.

Acknowledgements **

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Quantitative and Qualitative Approach of Scientific Paper Popularity by Naïve Bayes Classifier

Tobias Ribeiro Sombra, Rose Marie Santini, Emerson Cordeiro Morais, Walmir Oliveira Couto, Alex de Jesus Zissou, Pedro Silvestre da Silva Campos, Paulo Cerqueira dos Santos Junior, Glauber Tadaiesky Marques, Otavio Andre Chase, José Felipe Souza de Almeida

Brazilian Institute of Information, Science and Technology (IBICT) - Federal University of Rio de Janeiro (UFRJ), Brazil

ABSTRACT

Usually, scientific research begins with the collection of data in which online social media tools can be some of the most rewarding and informative resources. The extensive measure of accessible information pulls in users from undergraduate students to postdoc. The search for scientific themes has popularized due to the availability of abundant publications that resides in scientific social networks such as Mendeley, ResearchGate etc. Articles are published on these media inform of text for knowledge dissemination, scientific support, research, updates etc, and are frequently uploaded after its publication in a proceedings or journal. In this sense, data collected from database often contains high noise and its analysis can be treated as a characterization undertaking as it groups the introduction of a content into either good or bad. In this text, we present quantitative and qualitative analysis of papers popularity in Mendeley repository by using naive Bayes Classifier.

Keywords: Scientific Social Networks; Mendeley; Naïve Bayes; Machine Learning

1. INTRODUCTION

Machine learning presents several concepts that are similar to each other (Shalev-Shwartz and Ben-David, 2014). As an example, Rocha et al. (2008), who conceptualizes machine learning as the ability of a computer program to learn through classifiers. Among them, it is possible to highlight the Neural Networks, Bayesian Networks, among others, each carrying a specific paradigm and definitions. In addition, Faceli et. al. (2011), says that machine learning is the ability of computational tools to create hypotheses or functions on their own that can solve a certain problem, through experience during automatic learning. Likewise, Mitchell (1997) states that Machine Learning are computational algorithms that aim to automatically improve with experience.

According to Rocha et al. (2008), supervised learning can be exemplified through the presence of a teacher, that is, each example presented in the data set contains a correct answer that would be the exit class. In this case, each example must contain its input attributes and the corresponding output classes. Conduta and Magrin (2010) categorize the output classes into two types: if the classes have discrete values,

the problem is categorized as classification; if the classes have continuous values, they are categorized as regression.

Another concept related to error measures for classification problems is the Confusion Matrix (Rocha et al., 2008), which is based on mapping the examples contained in the training to verify how many were predicted. It consists of a table with distributed values, representing the total of examples trained by a classifier, and a higher concentration of values is expected on its diagonal, that is, where it will always present the negative-negative and positive-positive relationship to identify the values expected. These values are examples that have been correctly classified by a machine learning algorithm. As a consequence, the Percentage of Examples Correctly Classified (PECC), counts the number of examples for which the predicted value for the class coincides with the real value, i.e., diagonal values of the matrix. PECC is usually normalized in terms of percentage, dividing by the total number of examples.

Bayes' theorem may be used in any situation where needs to calculate conditional probabilities after collecting data and is considered one of the simplest yet complete for data classification (Rocha *et al.*, 2008). When applied in the form of an algorithm, the probability calculations assumes that the presence of a particular feature in a class are obtained through the co-occurrence frequencies for each attribute of the training data set. As a result, the algorithm concludes the classification based on the likelihood concept, which is obtained by multiplying the relative frequencies of each attribute present in the test example, associating each output class described in the database.

The naive Bayes classifier has been widely used in the scientific community and, as examples, are the works of Carvajal et al. (2015), Xu (2018) and Li et al. (2020). The first uses this algorithm to classify, predict and represent associations between pathogen reduction and operational conditions, a need that arose due to the interest in optimizing risk management during biological treatment processes. The second uses the textual classification algorithm, in order to categorize and provide conceptual visualization of the document collection. The third uses the algorithm as a way to protect data privacy due to the ability to group probability information.

This article is based on the continuity of a formulation presented by Sombra et al. (2020), but within the context of qualitative analysis. Thus, the work consists of three stages, which are: data collection and selection, pre-processing and mining. The first step aims to obtain data on the Mendeley platform by developing an application based on the Mendeley API (https://dev.mendeley.com). The second stage aims to treat the collected data, in order to eliminate existing noise. In this case, treatments were carried out to remove repeated documents. The third step, so-called mining, consists of treating the documents to be executed in the naive Bayes algorithm. The algorithm presents a model based on the UCI Machine Learning Repository database (https://archive.ics.uci.edu/ml/index.php), which is a repository of Machine Learning databases developed by the University of California Irvine that presents standards for data set composition. Another important factor to be mentioned is the work organization, which was divided into subcategories. In this sense, Proceedings, Open_Proceedings, Open_Journal and Journal that present the names five output classes, three output classes and two output classes, as subcategories.

2. QUANTITATIVE APPROACH

Based on the Mendeley API, at no less than 16,091,264 documents were collected using the words proceedings and journal as query words. Subsequently, the final subset was divided, as follows: 1,696,118 for Proceedings, 3,416 for Open_Proceedings, 815,794 for Open_Journal and 13,575,936 for Journal.

In order for the data to be adapted, the discretization process was carried out, which consists of converting the attributes of the documents to nominals, since the naive Bayes algorithm presents the supervised paradigm. The discretization process aims to establish ranges of values according to the attributes and assign a name to each range. The calculation used basically works as a rule of three, being a ratio between the value to be discretized and the highest value in the database. Table 1 shows the frequency distribution for the category Open_Proceedings in the subcategory five output classes.

. Table 1. Distribution of discretization for the category Open_Proceedings in the subcategory five output classes

Output Classes	Discretizations (%)	Discretizations (Amount)	Total of Documents	Average Frequency of Popularity
Not_Popular	0% a 1.6%	0 to 1.04	179	1
Little_Popular	>1.6% to 4%	>1.04 to 2.6	77	2
Popular	>4% to 7%	>2.6 to 4.55	60	3.36
Very_Popular	>7% to 12%	>4.55 to 6.5	22	5.54
Extremely_Popular	>12% to 100%	>6.5 to 65	21	17.9

Table 1 shows the average frequency of popularity between the number of readers for each output class and the total number of documents. These values represent the averages corresponding to the concentration of most of the reader counter for each class of output. The discretization column (%) was obtained by means of exhaustive tests in the database until finding an adjustment capable of allowing the distribution balance or a decreasing distribution. Thus, the output class Not_Popular corresponds to the largest number of documents, followed by Little_Popular as the second largest amount, and so on.

Table 2 and Table 3 show the distributions for the Open_Proceedings category in the subcategories three output and two output classes, respectively.

Table 2. Distribution of discretization for the Open_Proceedings category in the subcategory three output classes

Output Classes	Discretization (%)	Discretization (Amount)	Total of Documents	Average Frequency of Popularity
Not_Popular	0% to 1.6%	0 to 1.04	179	1
Popular	>1.6% to 6%	>1.04 to 3.09	115	2.33
Extremely_Popular	>6% to 100%	>3.09 to 65	65	9.01

Table 3. Distribution of discretization for the Open_Proceedings category in the subcategory two output classes.

Output Classes	Discretization (%)	Discretization (Amount)	Total of Documents	Average Frequency of Popularity
Not_Popular	0% to 4%	0 to 2.6	253	1.3
Extremely_Popular	>4% to 100%	>2.6 to 65	103	6.79

Using the same procedure, Table 4, Table 5 and the Table 6 show the distributions for the Proceedings category in the subcategories five, three and two output classes.

Table 4. Distribution of discretization for the Proceedings category in the subcategory five output classes

Output Classes	Discretization (%)	Discretization (Amount)	Total of Documents	Average Frequency of Popularity
Not_Popular	0% to 0.5%	0 to 10.38	51,795	3.49
Little_Popular	>0.5% to 2%	>10.38 to 41.54	13,647	20.29
Popular	>2% to 5%	>41.54 to 103,.85	328	63.55
Very_Popular	>5% to 8%	>103.85 to 166.16	840	129.19
Extremely_Popular	>8% to 100%	>166.16 to 2,077	605	307.77

Table 5. Distribution of discretization for the Proceedings category in the subcategory three output classes

Output Classes	Discretization (%)	Discretization (Amount)	Total of Documents	Average Frequency of Popularity
Not_Popular	0% to 0.5%	0 to 10,.38	51,795	3.49
Popular	>0.5% to 2%	>10.38 to 41.54	13,647	20.29
Extremely_Popular	>2% to 100%	>4.54 to 2,077	5,173	102.77

Table 6. Distribution of discretization for the Proceedings category in the subcategory two output classes

Output Classes	Discretization (%)	Discretization (Amount)	Total of Documents	Average Frequency of Popularity
Not_Popular	0% to 0.5%	0 to 10..38	51,795	3.49
Extremely_Popular	>0.5% to 100%	>10.38 to 2,077	18,820	42.96

In continuation, Table 7, Table 8 and Table 9 show the distributions for the Open_Journal category in subcategories five, three and two classes of output.

Table 7. Distribution of discretization for the Open_Journal category in the subcategory five output classes

Output Classes	Discretization (%)	Discretization (Amount)	Total of Documents	Average Frequency of Popularity
Not_Popular	0% to 0.035%	0 to 3.2	60,211	1.82
Little_Popular	>0.035% to 0.08%	>3.2 to 7.4	40,069	5.30
Popular	>0.08% to 0.15%	>7.4 to 13.9	28,263	10.11
Very_Popular	>0.15% a 0.3%	>13.9 to 27.9	23,033	18.97
Extremely_Popular	>0.3% a 100%	>27.9 to 9,326	14,184	59.51

Table 8. Distribution of discretization for the Open_Journal category in the subcategory three output classes

Output Classes	Discretization (%)	Discretization (Amount)	Total of Documents	Average Frequency of Popularity
Not_Popular	0% to 0.06%	0 to 5.59	83,448	2.55
Popular	>0.08% to 0.3%	>5.59 to 27.9	68,128	12.20
Extremely_Popular	>0.3% to 100%	>27.9 to 9,326	14,184	59.51

Table 9. Distribution of discretization for the Open_Journal category in the subcategory two output classes

Output Classes	Discretization (%)	Discretization (Amount)	Total of Documents	Average Frequency of Popularity
Not_Popular	0% to 0,1%	0 to 9.3	112,316	3.77
Extremely_Popular	>0.1% to 100%	>9.3 to 9,326	54,134	27.82

At least, Table 10, Table 11 and Table 12 show the distributions for the Journal category in subcategories five, three and two classes of output.

Table 10. Distribution of discretization for the Journal category in the subcategory five output classes

Output Classes	Discretization (%)	Discretization (Amount)	Total of Documents	Average Frequency of Popularity
Not_Popular	0% to 0.17%	0 to 16,9	1,516,506	2.21
Little_Popular	>0,17% to 0.5%	>16.9 to 49.79	960,451	30.97
Popular	>0.5% to 0,9%	>49.79 to 89.60	433,574	55.82
Very_Popular	>0.9% to 2%	>89.60 to 199.12	328,187	108.53
Extremely_Popular	>2% to 100%	>199.12 to 9,956	112,695	207.18

Table 11. Distribution of discretization for the Journal category in the subcategory three output classes

Output Classes	Discretization (%)	Discretization (Amount)	Total of Documents	Average Frequency of Popularity
Not_Popular	0% to 0.25%	0 to 24..89	1,702,893	2.98
Popular	>0.25% to 0.8%	>24.89 to 1991.2	1,015,640	30.74
Extremely_Popular	>0.8% to 100%	>1991.2 to 9,956	832,880	1993.7

Table 12. Distribution of discretization for the Journal category in the subcategory two output classes

Output Classes	Discretization (%)	Discretization (Amount)	Total of Documents	Average Frequency of Popularity
Not_Popular	0% to 0.5%	0 to 49.78	2,286,075	2.98
Extremely_Popular	>0.5% to 100%	>49.78 to 9,956	1,065,338	55.40

The tables presented show that although the distribution of the output classes are not balanced, they were ordered from the highest to the lowest according to the class of least popularity to the most popular. In this sense, the data configured in this way, reflect the best reality on the databases, in which most documents do not have as many readers. Consequently, the class Not_Popular in all distributions kept in discretization, presented a greater number of documents. In fact, the percentage distribution helped to improve all output classes, since if it were an equal distribution, this class would have the vast majority of documents, at the risk of the other classes presenting very little or even no value. All percentage ranges presented in the tables were obtained based on exhaustive tests until a range was found that keeps the data balanced or with a decreasing order of magnitude of distribution. Therefore, the Not_Popular class obtains more documents than the Little_Popular class, which in turn has more documents than the Popular class, and so on.

3. QUALITATIVE APPROACH

From the discretization process, the transformation of numerical to nominal attributes allowed the recognition of patterns by the naive Bayes algorithm. All processes of discretization, pre-adaptation and final adaptation were done automatically by means of algorithms that were developed for this purpose. Therefore, the results obtained are based on the continuity to the work of Sombra *et. al.* (2020), in which the qualitative analysis of the same problem was carried out.

The quantitative analysis showed that the subcategory two classes of output, presented better result for having higher PECC than the other subcategories. In this analysis, the output classes on the popularity of the documents consider the quantities of accesses. In short, Table 13 presents a brief summary of the quantitative results in order to explain the qualitative analysis later.

Table 13. Test examples classification in the naive Bayes algorithm for each subcategory

Five Output Classes						
-	Not_Popular	Little_Popular	Popular	Very_Popular	Extremely_Popular	PECC
Open_Proceedins	3	1	-	1	-	53%
Proceedings	3	1	-	1	-	74%
Open_Journal	1	1	2	-	1	44%
Journal	1	1	1	2	-	47%
Three Output Classes						
-	Not_Popular	-	Popular	-	Extremely_Popular	PECC
Open_Proceedins	3	-	-	-	-	54%
Proceedings	3	-	-	-	-	75%
Open_Journal	2	-	1	-	-	64%
Journal	1	-	1	-	1	60,5%
Two Output Classes						

-	Not_Popular	-	-	-	Extremely_Popular	PECC
Open_Proceedins	1	-	-	-	1	73%
Proceedings	-	-	-	-	2	77%
Open_Journal	1	-	-	-	1	76%
Journal	1	-	-	-	1	77%
TOTAL	20	4	5	4	7	-

Table 13 shows that the subcategory two output classes produced a better PECC result, in relation to the others. Another interesting detail is that most of the examples were classified as Not_Popular and followed by Extremely_Popular as runner-up. Besides, there was already expected when considering the subcategories three output classes and two output classes present a lower number of classes. If we disregard the classes which do not appear for all subcategories, there are at least 20 examples for Not_Popular and 8 for Extremely_Popular. This last result was also expected, considering the distribution of discretization previously presented, in this text.

To evaluate the attributes related to the Not_Popular and Extremely_Popular classification test examples, it is necessary to understand what these attributes are and how they were categorized. Table 14 presents all the attributes which can be contained in the test examples related to this type of metric.

Table 14. Attributes and possible characteristics for classification test examples

Attributes	Characteristics
Title	very_bad, bad, good, very_good, excellent
Type	Dependent on database requirements
Source	Dependent on database requirements
Year	Until 1999: classic _article From 2000 to 2007: review From 2008 to 2011: citation From 2012 to 2015: state_of_art From 2016 to 2017: current
Keywords	very_bad, bad, good, very_good, excellent
Authors	very_bad, bad, good, very_good, excellent
Month	Full name of the corresponding month of the document.
Abstract	very_bad, bad, good, very_good, excellent
Reader Count	very_popular, little_popular, popular, very_popular, extremely_popular

The attributes described in Table 14 play an important role in generating results to this type of evaluation process. It is worth mentioning that the Reader_Count attribute is the number of readers for each document and which defines the output classes of the database. In general, they were chosen due to the assumption of helpers as indicators, in order to identify the popularity of an article. The possible

characteristics were thought of as a strategy, so that the naive Bayes algorithm has the ability to identify and learn from the data, therefore, they will be used after the entire data processing process. In this sense, it should be noted that the Title, Keywords, Authors, Abstract and Reader_Count attributes were defined based on the discretization performed previously. Thus, the Reader Count attribute is the output class of the naive Bayes algorithm and the underline names assigned to the possible characteristics were defined only as a means for the algorithm to understand and classify the examples. The Month attributes of publication in the database, are ordered from lowest to highest recurrence. Moreover, the Year attribute is validated until 2017, as it was when the data collection had been completed. Type and Source attributes depend on the database, since Mendeley presents several types of documents, as well as places where they were published. Table 15 shows the number of attributes found for the Not_Popular class.

Attributes	Result							
Title	very_bad	8	bad	4	excellent	5	good	3	-
Type	Journal	17	Conference_ Proceedings	2	Generic	1	-		-
Year	classic_article	10	citation	4	state_of_art	2	review	2	current	2
Keywords	very_bad	17	excellent	3	-		-		-
Authors	very_bad	18	bad	1	good	1	-		-
Abstract	very_bad	12	bad	3	excellent	4	good	1	-

Table 15. Quantitative of attributes found in the test examples for the Not Popular class

Table 15 shows the very_bad characteristic for the frequencies of Title, Keywords, Authors and Abstract, which may be one of the justifications for the classification as Not_Popular. This result indicates that the attributes mentioned above have a small score in relation to the database, which is indicated by the aforementioned characteristic. The Type, predominantly in Journal, only indicates that the majority of classified documents are hosted in scientific journals. The Year, predominantly in classic_article, shows that classified documents were until to the 1999 period, which may indicate that articles do not reach popularity status over time. The questions regarding these attributes can be further enriched after analyzing the test examples at extremely_popular, shown in Table 16.

Table 16. Quantitative of attributes found for the test examples in the extremely_popular class

Attributes	Result						
Title	very_bad	5	excellent	2	-		-
Type	Journal	6	Generic	1	-		-
Year	classic_article	2	citation	2	review		1
Keywords	very_bad	6	excellent	1	-		-
Authors	very_bad	7	-	-	-		-
Abstract	very_bad	5	excellent	2	-		-

Table 16 shows the very_bad characteristic for the frequencies of Title, Keywords, Authors and Abstract, as reported for the Not_Popular class. This suggests that the attributes mentioned may not directly influence the popularity of papers. However, Type remained high in Journal, indicating the preference of researchers when publishing articles in scientific journals. The Year brought a balance between classic_article and review, showing that some documents considered popular by the Naive Bayes algorithm were published until 1999 and the interval between 2008 to 2011.

Other tests were done, considering the Source and Month attributes, for the Not_Popular class. In short, two characteristics in Source appeared evidenced, when the terms proceedings_in_indian_academy_of_sciences_chemical_sciences were used, with frequency 5 and proceedings_in_national_academy_of_sciences_usa, with 4 test examples. In the case of the Month attribute, March was the one that most appeared with 4 examples, followed by April and December tied at 3. The use of the Source and Month attributes were made to identify where documents are most frequently published and what are the months of the year with the highest concentration of publications, respectively. However, the data obtained are still not considered sufficient to make a more specific conclusion on these attributes, requiring further research. The Extremely_Popular class for the Source proceedings_in_national_academy_of_sciences_usa appeared with 2 classified test examples and in Month, November and January, which have been tied in 2 examples for each.

5. CONCLUSION

Qualitative and quantitative evaluation of a data set are very useful when approaching common problems in pattern recognition situations from the viewpoint of Naive Bayes classifier. Based on the scientific social networks Mendeley platform, this work presented the continuity of the results of a previous work, which deals with qualitative analysis with a focus on the popularity metric for technical-scientific publications. Therefore, we present two corresponding situations on the same problem: the percentage discretization model taking into account the PECC and the frequency of access to the attributes which determine the classes related to the metrics of popularity for papers. In this sense, the correlation between qualitative and quantitative analyze allows the assessment of the characteristics of a data set in a way which naive Bayes classifier is suitable for this type of approach. In summary, the optimal selection of particular

pattern classes for identification may thus be approached initially at the level of data qualitative analysis before embarking upon more complex issues of quantitative evaluation.

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Scientific Production and Intellectual Property: Analysis of the Correlations between Evaluation and Valuation of Patents in the Transfer of Technologies in Public Research Institutions

Robson Almeida Borges de Freitas (Corresponding author)

Intellectual Property Science Program - PPGPI, Federal University of Sergipe – UFS, Aracajú – SE, Brazil.

Federal Institute of Education, Science and Technology of Piauí – IFPI, Teresina - PI, Brazil.

Telephone: +55(89)99403-8725 E-mail: robson.freitas@ifpi.edu.br

Antonio Martins de Oliveira Júnior

Intellectual Property Science Program - PPGPI, Federal University of Sergipe – UFS, Aracajú – SE, Brazil.

Humbérila da Costa e Silva Melo

Federal Institute of Education, Science and Technology of Piauí – IFPI, Teresina - PI, Brazil.

Abstract

In Brazil, Public Research Institutions (PRI) are agents that promote innovation and technological production. The role of these institutions in social and regional development is to provide scientific and technological production and make it available for productive arrangements. This study aims to relate the evaluation and valuation of patents with the processes of Technology Transfer in Public Research Institutions in Brazil. To justify the execution of the study, it is observed that it is necessary to improve the use of technologies created in PRI so that society can take advantage of the advances promoted in scientific research, and so that the distance between industry and academia is minimized. We researched 30 Public Research Institutions, in five variables collected on the platform of INPI (National Institute of Industrial Property), ESPACENET (European Patent Office) and BDTD (Brazilian Digital Library of Theses and Dissertations). In possession of the data, the Shapiro-Wilk test and the Spearman correlation coefficient were used used to analyze them. The R software was used to apply the statistical methods. For data discussion, the reports of FORMICT (Information Form on Intellectual Property Policy of Scientific and Technological Institutions) were analyzed to guide the arguments. The data did not show normality and have moderate and strong correlations, the significance of the correlations is strong or very strong. It is believed that the patent evaluation and valuation processes have space for improvement and thus can enhance the Transfer of Technologies of PRI.

Keywords: Patents; Technology Transfer; Patent Evaluation; Patent Valuation; Public Research Institutions;

1. Introduction

In Brazil, Public Research Institutions (PRI) are agents that promote innovation and technological production. The role of these institutions in social and regional development is to provide scientific and technological production and make it available for productive arrangements, in a feedback process involving government, companies and Public Research Institutions (SEGATTO-MENDES; SBRAGIA, 2002). In this line, it is observed that the process of partnerships is essential to raise funds for technological development and to finance investments in new scientific research. The connections between PRI and companies are under discussion and under development in Brazil, so it is necessary to raise awareness of this importance for local and regional development (MÜLLER; STRAUHS, 2019).

The Technology Transfer process (TT) is a growing topic in the academic environment. As argued, the partnerships between Public Research Institutions and companies are important and are effective based on Technology Transfer contracts. TT is defined by Lima (2004) as the way to acquire and use technologies generated by third parties. In the literature there are obstacles in the TT process in Brazil, in which discussions about profit and knowledge are placed on the agenda (CONDE, 2003; ANDREASSI, 2006).

Among the PRI, the participation of universities in innovation processes and Technology Transfer stands out. Universities have the role of encouraging the creation process, emphasizing that the Technology Transfer processes promote the social reach of what is developed in the research environments (UNGUREANU; POP; UNGUREANU, 2016). It is noteworthy that with TT inventors can obtain gains from the commercial exploitation of technologies, in addition to benefiting the ecosystem to which it is inserted (SOARES, 2018). However, it is observed that as PRI produce patents, strategies are needed for them to profit.

This study aims to relate the evaluation and valuation of patents with the processes of technology transfer in Public Research Institutions in Brazil. To justify the execution of the study, it is observed that it is necessary to improve the analyse of technologies created in PRI so that society can take advantage of the advances promoted in scientific research, and so that the distance between industry and academia is minimized.

The aim is to suggest improvements the processes for evaluating and valuing patents to increase the effectiveness of technology transfers. The discussion covered in this article is based on the rate of use of technologies in commercial terms and on scientific production on intellectual property, patents, patent evaluation and patent valuation, with observation of the technology transfer phenomenon. According to Prado (2018), there is a structural process to obtain TT results (Figure 1).

SCIENTIFIC PRODUCTION → PATENT EVALUATION → PATENT VALUATION → TECHNOLOGY TRADING → TECHNOLOGY TRANSFER

Figure 1. Summary Technology Transfer Management Model
Source: Adapted from PRADO (2018)

2. Theoretical foundation

In 2020, according to data from the Ministry of Education, Brazil has more than 661 Federal Institutes of Education, Science and Technology, and about 69 Federal Public Universities. These institutions are a sample of the research and development potential that the country has, considering the existence of other Public Research Institutions. This potential should be monitored and evaluated, in this reasoning, the Information Form on the Intellectual Property Policy of Scientific and Technological Institutions (FORMICT) has the purpose of presenting numbers that guide and record these actions. FORMICT, linked to the Ministry of Science and Technology of Brazil, provides the numbers of Technology Transfers carried out by the PRI that participated in the research, and in 2018 it reached an amount of R $ 1,054,747,338.11 in TT.

To put it in context, INOVA-UNICAMP, the Center for Technological Innovation at the University of Campinas (UNICAMP), presents in data collected in May 2020, that with 131 current licensing contracts, the Institution raised R $ 1,607,722.00 in terms of financial gains. INOVA-UNICAMP, through its website, reports the number of 815 daughter companies, 31,343 jobs generated in the daughter companies and revenues of more than R $ 7.9 billion in these companies.

The approach of the TT process depends on the assessment and valuation of technologies, in short, the combination of these forms of analysis of intangible assets are ways to overcome bureaucratic barriers. In this sense, Abreu Júnior (2019) proposes a model for the Technological Innovation Centers (NIT) to expand TT. The author mentions the creation of support foundations with its own legal nature, non-profit to facilitate bureaucratic procedures. Livesey (2014), in a survey with 33 NIT (Technological Innovation Centers), reports that TT is not commonly used in universities as a strategy for harnessing technological potential, and that funding is not adequate for the development of projects.

The use of indicators in TT is beneficial for monitoring results and promoting improvements. It is observed that simple and complex indicators can promote a better understanding of the production and use of technologies (CHAPPLE et al., 2005; VINIG, LIPS, 2015; BUENO, TORKOMIAN, 2018; MARQUES, 2018). The monitoring of these indicators can indicate the generation of value in scientific production, attributing gains to society. The indicators show positive and negative factors in the development and maintenance of technologies. In this sense, it is highlighted that the search for indicators for the evaluation of patents and technology transfers can contribute to the understanding of the successes and mistakes made in scientific and technological development.

In terms of patent evaluation, it is highlighted that the models, in a more general view, can be divided into three categories: models of accounting assets; models with cash flow discount techniques and market-related valuation models (MARTINEZ, 1999; FAMÁ, 2003). There are several models of technology assessment that relate to different purposes of assessments, that is, the models depend on which types of technologies will be applied.

As an example of models found in scientific publications, we have the model proposed in the article "Forecasting of emerging therapeutic monoclonal antibodies patents based on a decision model", the study reports on the creation of a score to classify patents for therapeutic monoclonal antibodies that have potential in biotechnology, with the aid of hierarchical analysis (PEREIRA, CG et al, 2019).

That said, it is observed that the negotiation of technologies depends on a facilitating ecosystem and it is up to the owner of these patents to carry out evaluative and valuative studies. The purpose of these potentiality studies is to amplify the obtaining of revenue, or even to avoid losses in the exploration (FREITAS, 2019). In this sense, evaluation of a technology can establish indicators of research potentiality.

In terms of patent valuation, it is observed that it must be preceded by evaluative aspects (SANTOS; SANTIAGO, 2008a). The valuation seeks adequate values so that the technologies give the expected return, analyzing it in terms of commercialization and investment risk (SANTOS; SANTIAGO, 2008b). Hagelin (2002) highlights factors of approach to the valuation of a patent, they are: 1) Assess the existence of a market for technology; 2) Analyze similar transactions in the market; 3) Analyze prices of similar technologies; 4) Has independence between the assignor and the assignee. In addition, the technology assessment and valuation processes promote the potentialization of patents, in addition to solidifying the negotiation arguments.

3. Methodology

Documentary research was used in open access databases with a quantitative approach. Public Research Institutions (PRI) were analyzed in the following categories: 1 - Number of publications of Theses and Dissertations; 2 - Number of Theses and Dissertations dealing with Intellectual Property or Patents; 3 - No. of Theses and Dissertations with Approach to Patent Evaluation or Valuation; 4 - Number of patents deposited; 5 - Number of Technology Transfers made. Each item received a nickname for identification as a variable (Table 1). The sample was selected using the annual report of the National Institute of Intellectual Property - INPI, selecting PRI with a significant number of patent registrations.

Table 1. Identification of the study variables

QUESTION	VARIABLE
1 - Number of publications of Theses and Dissertations	QTD
2 - Number of Theses and Dissertations dealing with Intellectual Property or Patents	QPIPAT
3 – Number. of Theses and Dissertations with Approach to Patent Evaluation or Valuation	QAVAVAL
4 – Number. of patents filed	QPAT
5 – Number of Technology Transfers made	QTTPAR

Source: Elaborated by the authors (2020)

Thirty (30) Public Research Institutions (PRI) were selected, as shown in Table 2. In the sample criteria, we sought PRI from different regions of Brazil that were among the 30 PRI that most deposited in the years 2016, 2017 and 2018 and that had more than 1000 publications of Theses and Dissertations. The Brazilian Digital Library of Theses and Dissertations - BDTD was used to collect the number of publications of Theses and Dissertations, since it has 118 institutions registered in its database, with approximately 639,025

thousand documents. PRI that did not have data registered, sought the data in the institution's repository. Filters were applied to select the data of interest, selecting the total numbers of each PRI, and later, applying the following filters with Boolean logic: 1- (All fields: Intellectual Property OR Patent *); 2- (All fields: (valuation OR evaluation) AND patent *).

Table 2. Public Research Institutions selected for the study

PUBLIC RESEARCH INSTITUTIONS	BRAZILIAN REGION	AMOUNT
Universidade Federal de Goiás	Midwest	
Universidade de Brasília	Midwest	3 (10%)
Universidade Federal de Mato Grosso	Midwest	
Universidade Federal da Bahia	Northeast	
Universidade Federal de Pernambuco	Northeast	
Universidade Federal do Piauí	Northeast	
Universidade Federal de Sergipe	Northeast	
Universidade Federal do Rio Grande do Norte	Northeast	
Universidade Federal da Paraíba	Northeast	10 (33,3%)
Universidade Estadual do Ceará	Northeast	
Universidade Federal Rural De Pernambuco	Northeast	
Universidade Federal de Campina Grande	Northeast	
Universidade Federal do Maranhão	Northeast	
Universidade Federal do Pará	North	
Universidade Federal do Tocantins	North	3 (10%)
Universidade Federal do Amazonas	North	
Universidade Estadual de Campinas	Southeast	
Universidade de São Paulo	Southeast	
Universidade Federal de Minas Gerais	Southeast	
Universidade Estadual Paulista	Southeast	
Universidade Federal de Alfenas	Southeast	8 (26,7%)
Universidade Federal de Juiz de Fora	Southeast	
Universidade Federal de Ouro Preto	Southeast	
Universidade do Estado do Rio de Janeiro	Southeast	
Universidade Federal de Santa Catarina	South	
Universidade Federal do Rio Grande do Sul	South	
Universidade Federal de São Carlos	South	
Fundação Oswaldo Cruz	South	6 (20%)
Universidade Federal de Viçosa	South	
Universidade Tecnológica Federal do Paraná	South	
TOTAL		**30 (100%)**

Source: Elaborated by the authors (2020)

To obtain the number of PRI patents, the INPI database was used. In terms of TT, the data made available by the Innovation Centers of each PRI was observed, however, when the information was of restricted knowledge, the INPI bases were used to search for Technology Transfer (TT) and the databases from ESPACENET (European Patent Office) to investigate PRI partnerships with companies. Thus, the number of TT considered in the first order was informed by the Innovation Centers, and in second order, the patents developed in association with companies. The data found at the INPI in the TT databases were disregarded because they did not present values close to those reported by the Innovation Centers.

With the data in hand, the Shapiro-Wilk normality test was performed to observe the sample's distribution characteristics. Shapiro and Wilk (1965) originally tests the normality of samples smaller than 50. The test is defined by:

$$W = \frac{(\sum_{i=1}^{n} a_i x_i)^2}{\sum_{i=1}^{n}(x_i - \bar{x})^2}$$

Royston (1995) provided a study using the AS R94 algorithm for the test to be applied to samples with $3 \leqslant n \leqslant 5000$. The calculation of the p-value depends on the sample size (Shapiro & Francia, 1972). R software was used for statistical calculations. The tested hypotheses were: H0 = Normal Distribution and H1 = Other Distribution are adopted.

Spearman's correlation coefficient was used to understand the possible relationships between the 5 variables studied. Spearman's correlation coefficient measures the relationships between variables with a trend scale ranging from -1 to +1. A positive relationship shows that the data increases or decreases together, and a negative relationship, that the data progresses in opposite directions (ROQUE, 2003).

Siegel (1975) reports that Spearman's correlation coefficient is a non-parametric measure defined by:

$$r_s = 1 - \frac{6 \sum_{i-1}^{n} d_i^2}{n(n^2 - 1)}$$

In Spearman's correlation coefficient, for samples with observations greater than 10, significance can be estimated with the p-value (SIEGEL, 1975). To describe the degree of correlation between the variables, the scale described in FOWLER; COHEN and JARVIS (2013) was used, according table 3.

Table 3. Spearman's correlation coefficient values

Value of coeficiente (positive or negative)	Meaning
0.00 to 0.19	very weak correlation
0.20 to 0.39	weak correlation
0.40 to 0.69	moderate correlation
0.70 to 0.89	strong correlation
0.90 to 1.00	very strong correlation

Source: FOWLER; COHEN and JARVIS (2013)

In Spearman's correlation test, H0 = No significant correlation is assumed and H1 = There is correlation. The p-value is used to estimate the probability of this correlation being random, as shown in table 4, the p-value to estimate significance in rejecting H0, that is, the more the p-value is close to 0, the more significant

it is the correlation.

Table 4. Significance values for correlation probability

P-value	P-value %	Evidence for rejecting H$_0$
> 0.1	>10%	Very weak
0.1 - 0.05	10%-5%	Weak
0.05 - 0.01	5%-1%	Strong
< 0.01	<1%	Very strong

Source: FOWLER; COHEN and JARVIS (2013)

To discuss the results found, the FORMICT reports (Intellectual Property Policy of Scientific, Technological and Innovation Institutions in Brazil) for the years 2016, 2017 and 2018 were analyzed. The report presents the consolidated data provided by the Scientific, Technological and of Innovation (ICT) to the Ministry of Science, Technology, Innovations and Communications (MCTIC) on the Intellectual Property Policy of institutions in Brazil. It focused on data from Public Research Institutions. Figure 2 presents a summary of the methodology.
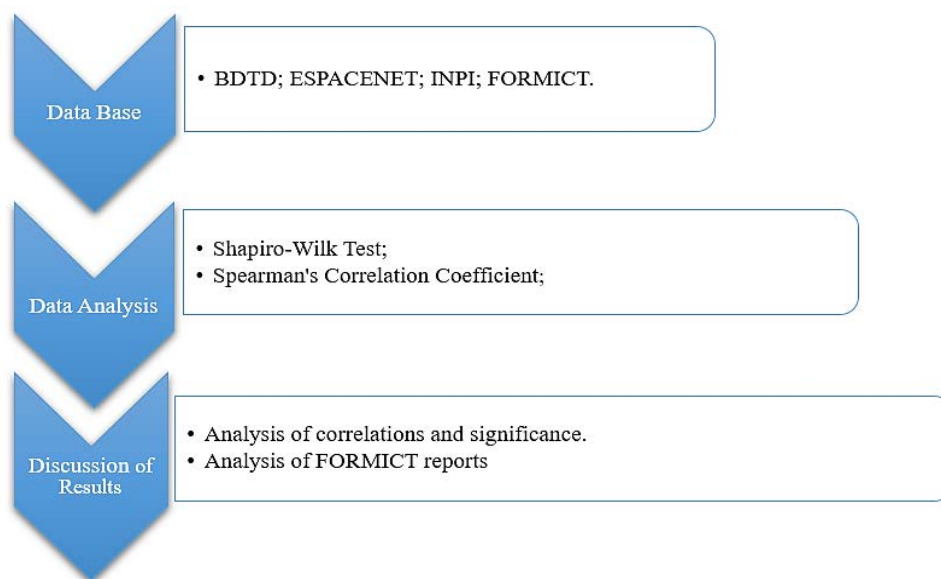
Figure 2. Summary of methodological steps
Source: Elaborated by the authors (2020)

4. Results and Analysis

The data, in a brief descriptive analysis, reflect the economic, social and geographical differences in Brazil. Some institutions have numbers of publications of theses and dissertations far above the average, while others have numbers up to 80 times lower. The number of patents and technology transfer follow visible variations. Table 5 describes the data statistically.

Table 5. Descriptive data analysis

	Mean	SD	Median	Min	Max
QTD	15198.37	18863.7	7299.0	1046	88662
QPIPAT	53.87	56.5	33.5	1	265
QAVAVAL	7.45	8.8	5.0	0	40
QPAT	323.5	354.6	228.0	14	1403
QTTPAR	23.57	45.48	6.5	0	197

Source: Elaborated by the authors (2020)

To test the compliance of the data in a normal distribution, the Shapiro-Wilk test was applied in software R. Figure 3 shows the scatter plots around the mean and the p-value of the Shapiro-Wilk test. α = 0.05 was adopted to establish statistical significance for normal distribution. As shown in Figure 3, the p-value is less than the value of α, rejecting H0 and assuming that the data do not have a normal distribution for all variables. It should be noted that the Outliers were included because they are important for the study.
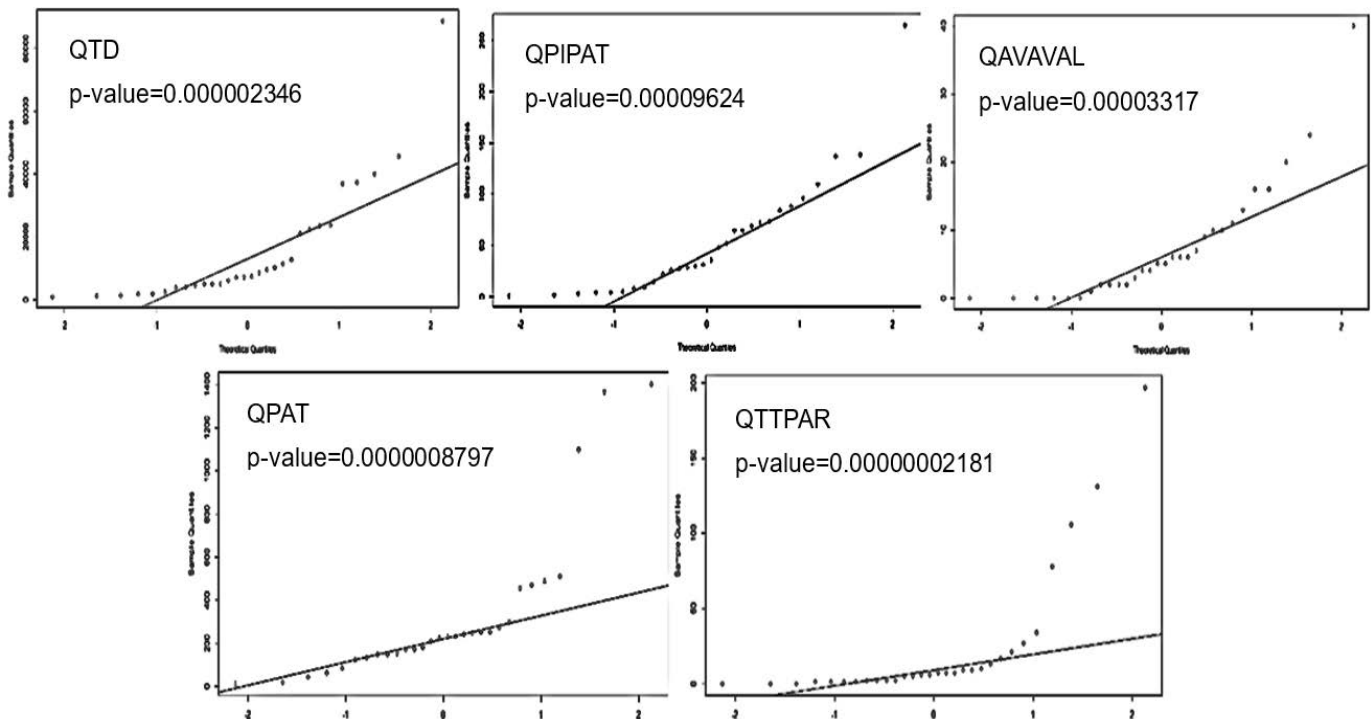
Figure 3. Graphs of the Shapiro-Wilk test and p-value of the variables

Source: Elaborated by the authors with survey data (2020)

With the convention of a different distribution than normal, Spearman's correlation coefficient was chosen to analyze the relationships between variables. With the application of the method, a graphical correlation matrix was generated to illustrate the results obtained (Figure 4). The figure shows the variables studied and the coefficient values that can range from -1 to +1. The greater the relationship between the variables, more the number tend to blue. And the more it tends to the negative value of the correlation (-1), the more the color approaches red. The white color means neutrality (0).
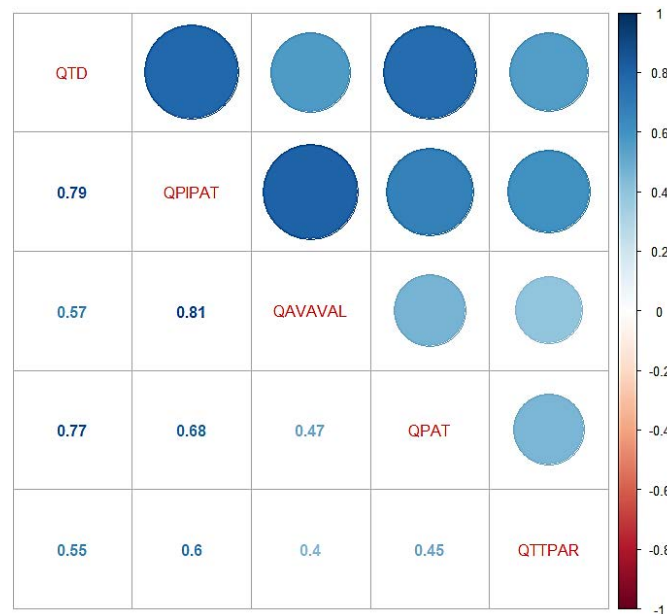
Figure 4. Correlation matrix of the studied variables
Source: Elaborated by the authors with survey data (2020)

The correlation coefficients found are moderate to strong. Strong correlation results are presented between the variables QTD - QPIPAT, QTD - QPAT and QPIPAT - QAVAVAL. In other words, the more scientific knowledge is produced, the more it is necessary to know about Intellectual Property, and the more it is necessary to protect in the form of a patent. It is noted, in a strong relationship, that the more you study about Intellectual Property and patents, the more it is necessary to study how to evaluate and value these technologies.

The results show moderate correlations for most variables. The moderate correlations are: QTD - QAVAVAL, QTD - QTTPAR, QPIPAT - QPAT, QPIPAT - QTTPAR, QAVAVAL - QPAT, QAVAVAL - QTTPAR and QPAT - QTTPAR. It is noted that with the increase in scientific production, moderately, there is an increase in the work on the evaluation and valuation of patents, and an increase in the amount of Technology Transfer (TT). In continuity, when analyzing the scientific production related to Intellectual Property and patents, the number of patents and TT is moderately increased.

The results referring to scientific production on the evaluation and valuation of patents show that the greater the production, the greater the quantity of patents and Technology Transfer, in a moderate way. Finally, the number of patents moderately influences TT. Table 6 summarizes the degrees of correlation.

Table 6. Degrees of correlation between variables

Correlation	Meaning
QTD - QPIPAT; QTD - QPAT; QPIPAT - QAVAVAL.	STRONG CORRELATION
QTD - QAVAVAL; QTD - QTTPAR; QPIPAT - QPAT; QPIPAT - QTTPAR; QAVAVAL - QPAT; QAVAVAL - QTTPAR; QPAT - QTTPAR.	MODERATE CORRELATION

Source: Elaborated by the authors (2020)

The results regarding the significance of the correlations were classified as strong and very strong, therefore, the correlations found by means of Spearman's correlation coefficient have statistical significance and can be considered relevant for the study. Figure 5 presents the histograms of the variables, the bivariate dispersion graphs, the correlation coefficient and the indicators of significance (p-value).
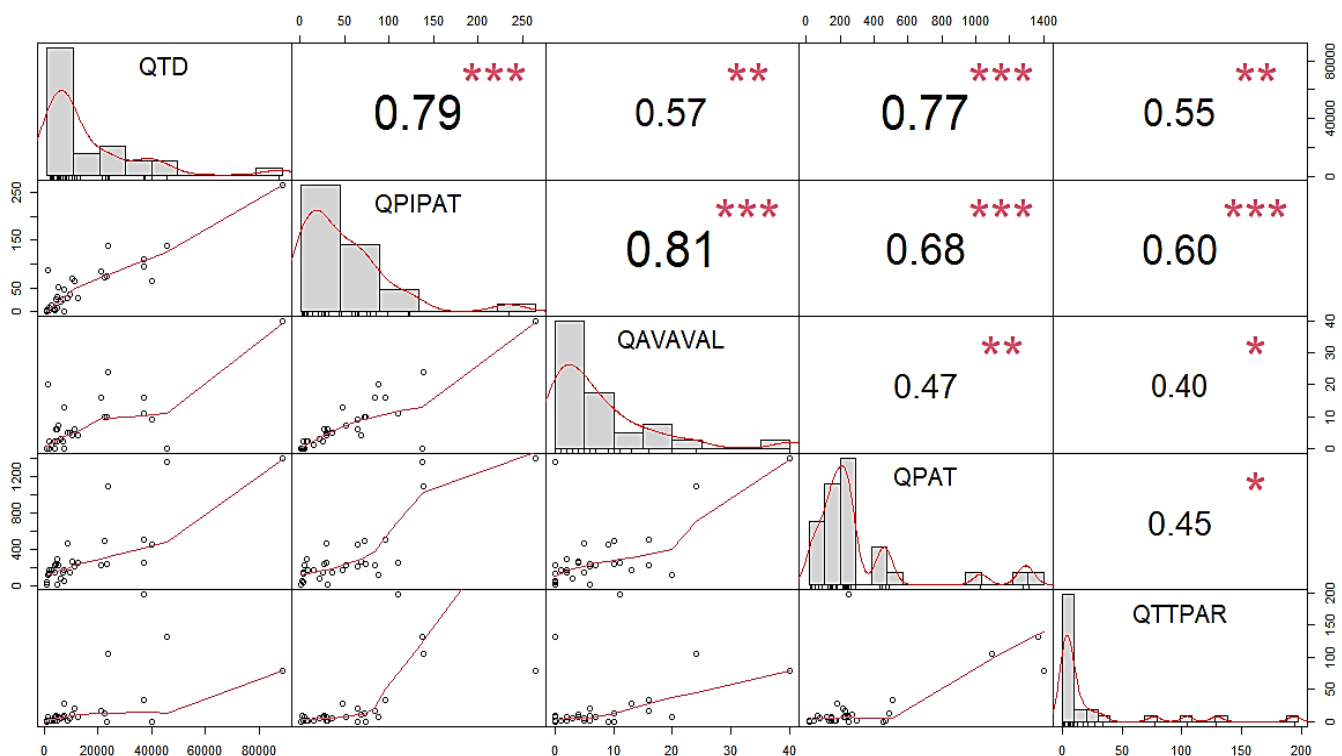
Figure 5. Histograms, bivariate dispersion, Spearman correlation coefficient and significance of the correlation

Source: Elaborated by the authors (2020)

*** Extremely Significant (Very Strong, p <0.001) ** Very Significant (Very Strong, 0.001 <p <0.01) * Significant (Strong, 0.01 <p <0.05)

The correlations with the publications of Theses and Dissertations are significant in the studied variables, with emphasis on the production of studies on Intellectual Property and on the production of patents. The variable Number of publications related to Intellectual Property or patents correlates with extreme significance with all the variables studied, showing that Intellectual Property can represent a link between the variables. The variable of Number of publications on patent evaluation or patent valuation is extremely significant with the production on Intellectual Property or patents, and in decreasing order of meaningfulness, with the number of theses and dissertations, the number of patents and the number of technology transfers.

Patents have an extremely significant correlation with scientific publications in the researched institutions. As patents are produced, interest, in decreasing order, in evaluation and valuation and technology transfer increases. When it comes to Technology Transfer (TT), as institutions study Intellectual Property and Patents, this variable increases, and to a lesser extent, institutions seek or perform TT, increase their studies on patent evaluation and valuation, as well how they increase their technological portfolio. Table 7 summarizes the significance of the correlations.

Table 7. Degrees of meaningfulness between variables

Correlation	Meaningfulness
QTD - QPIPAT; QTD - QPAT; QPIPAT - QAVAVAL; QPIPAT - QPAT; QPIPAT - QTTPAR;	VERY STRONG
QTD - QAVAVAL; QTD - QTTPAR; QAVAVAL - QPAT; QAVAVAL - QTTPAR; QPAT - QTTPAR.	STRONG

Source: Elaborated by the authors (2020)

4.1 Discussion of Results

This section addresses a discussion of the results obtained. There are institutions with a high number of publications and patents, however, a low number of publications on evaluation and valuation and Technology Transfer, and some institutions have a high number of patents and, however, have a low number of theses and dissertations and Transfer of Technologies.

Due to this specific difference in each institution, it chose to analyze the normality of the data and the use of the chosen methods. Through these choices, it is possible to analyze, in general, the correlations and the possible influences between the variables and thus suggest improvements in the processes of evaluation, valuation and Technology Transfer. Although an abnormality was found in the distribution of data, significant relationships can be observed on the analyzed data. For ethical reasons, the data found is not

exposed, and as they are of great value, a new article is needed to present PRI efficiency rates instead of the data.

In order to elucidate the data and strengthen the argument of the need to evaluate and value technologies with more dense means, some data collected from the FORMICT report (Intellectual Property Policy of Scientific, Technological and Innovation Institutions in Brazil) of the years 2016 to 2018 was analysed. Table 8 presents data on the number of institutions surveyed and which of these report having TT.

Table 8. Degrees of meaningfulness between variables

Year	Sample of RPI	Number of Public Institutions with TT	% of Institutions with TT
2016	193	42	22%
2017	212	39	18%
2018	209	47	22%
		Average	20,7%

Source: Elaborated by the authors with FORMICT data (2020)

From the data observed in the report, there is an average of 20.7% of PRI between the years that report having performed TT processes. Taking into account that it is a sample survey and that the number of IPP in Brazil is much higher, it leads to believe that this TT process should be improved. It is observed in the data found in the research, that some institutions have greater weight in terms of efficiency in the process of using patents. An example in the data found is the case of the Federal University of Santa Catarina, which when compared to the number of patents with the amount of TT, PRI has a utilization of 78% of its technologies in the form of TT.

From a financial perspective, although the TT numbers are low, the values from these technologies are considerable. It is believed that the management models used in the technological portfolios have technologies that generate significant dividends for PRI. It is noteworthy that for a good advantage of a technology, the processes of creation, development and economic exploitation must be linked to the evaluation and valuation processes of these technologies, as exposed in the results of the correlation between the variables. With this, the PRI can generate contracts with well-founded negotiations, choosing to commercialize the technologies exclusively, without exclusivity, or other form of agreement. Figure 6 shows the evolution of gains from the exploitation of technologies by PRI.
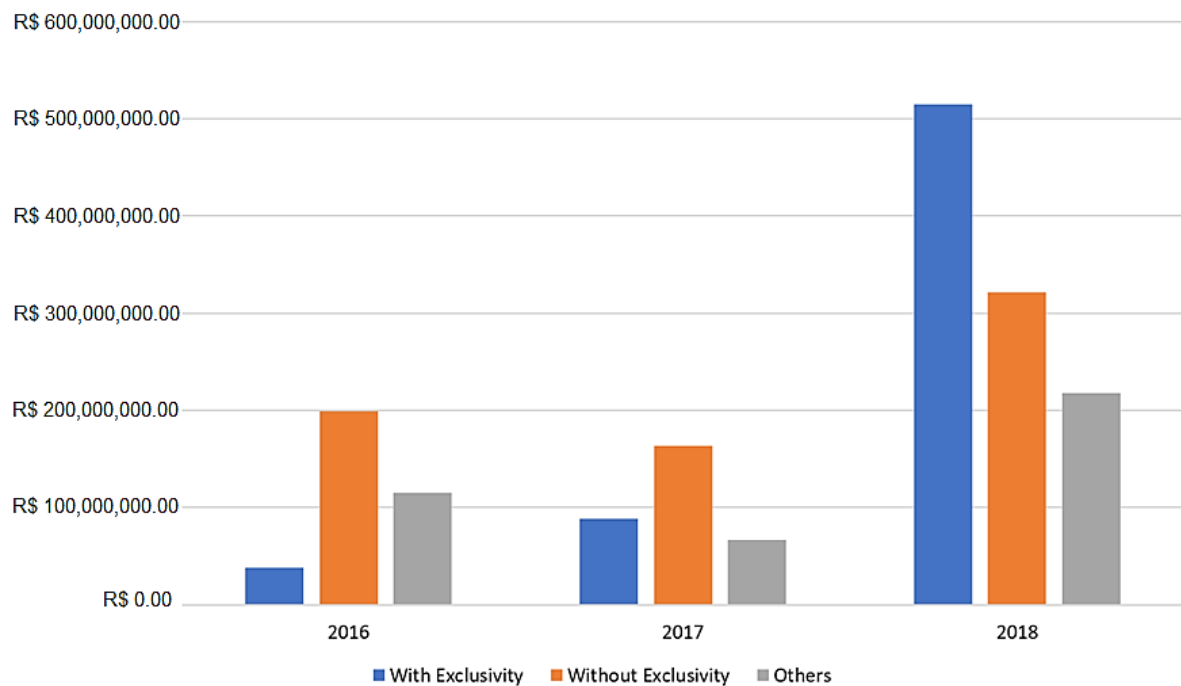
Figure 6. Evolution of gains with TT by PRI from 2016 to 2018

Source: Elaborated by the authors with FORMICT data (2020)

With the visualization of the data, between the years 2016 and 2018 there was an increase in the gains of PRI that managed to commercialize their technologies. The values reflect that with efficient processes, expressive results can be obtained. In a comparison with the data obtained with the relationships between the studied variables, it is observed that the Technology Transfer and Patent Evaluation and Valuation processes are crucial to enhance the exploitation results of the technologies, and in a greater result, achieve social arrangements such as products and services.

The correlations found in this study do not imply causality, that is, it does not mean that the variables can cause the others, or cause a Technology Transfer (TT) phenomenon. What is indicated is that, statistically, the variables have a relationship and that they must be discussed and implemented by the PRI managers so that they can evaluate the effectiveness of the actions carried out by them.

5. Final considerations

Based on the researched sample and the results obtained, it is concluded that the correlations between scientific production of theses and dissertations, production on Intellectual Property or patents, production on evaluation and valuation of patents, production of patents itself and the realization of Transfer of Technologies are moderate to strong. The significance of these correlations, as approached statistically, ranges from strong to very strong, that is, it can be concluded that there is relevance in the approach observed at work. It should be noted that productions on Intellectual Property are a key point for the creation of patents and technology transfers (TT), in which the more one understands about the process, the chances of creating partnerships that return gains are increased.

The creation of patents becomes a way to enhance the capillarity of PRI in productive arrangements,

however, it points to the processes of evaluation and valuation of patents as facilitating mechanisms for the process of transferring these technologies. It is considered that it is necessary to expand scientific production aimed at the evaluation and valuation of patents to improve the processes of creating patents with market potential, since the moderate correlations are concentrated in the relationships between these variables.

As stated in the paper, citing the case of INOVA-UNICAMP, it is observed that the gains for the University are in the millions, while the value generated by companies from technological production, are in the Billions. These values are extraordinary at the level of Brazil, however, we emphasize that with the improvement of assessment, valuation and Technology Transfer processes, these gains can be leveraged for PRI, and thus can generate the investment feedback process.

It is suggested that researchers evaluate the innovation processes of their institutions and may suggest adjustments, including the scientific knowledge already published on the subject. Observing the specificities of the institutions and their regional and economic context is also a necessity to accurately diagnose the details of PRI.

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The importance of community action in the process of implementing an educational institution and its impact on extension activities.

Tânia Márcia de Freitas (Corresponding author)
PPGA, Universidade Municipal de São Caetano do Sul,
São Caetano do Sul, Brasil.
Fone:+55(64)99641-5484
tania.ifgoiano@hotmail.com

Abstract

The Federal Institutes of Education (IFs) are intended to collaborate with regional innovation systems, encouraging the production of knowledge and innovative technologies and activities constituting a promising strategy for Brazilian regional development. One way to measure whether the institute's purpose is being fulfilled is through outreach activities with the community concerning local and regional economic and social advancement. Therefore, the objective of this study was to analyze the process of implementing an IF, as well as its impact on the community. Methodologically, here we present documentary research carried out on the process of community participation in IF implementation, as well as interviews conducted to ascertain the perspective of this determining actor regarding the return to society and extension actions. We conclude that engaging the local population in the choice of city was fundamental, causing other cities in the region to join efforts to capture the institute, just as it generated a positive impact in the entire region by providing an opportunity for qualification, which before was carried out at a distance, causing the success of the young population or even a lack of public training for financial reasons. As for the extension actions, the institute analyzed performs these according to region, filling any existing gaps by its creation.

Keywords: Federal Institutes of Education (IFs); Education Professional; Regional development; Extension actions

1. Introduction

Law nº 11,892 (December 29, 2008) can be considered a major instrument in the expansion process by creating the Federal Network for Professional, Scientific, and Technological Education as part of the federal education system linked to the Ministry of Education. The junction authorities of education as well as converting and Technical Schools and Centers Federals Technological Education were established by this legislation with the legal nature of authority and holding administrative, patrimonial, financial, educational, pedagogical, and disciplinary positions. At first, the conceptual perspectives of the Federal Institutes were organized on a territorial basis defined by region (FERNANDES, 2015).

The Creation Law has nine items that delimit the purposes and characteristics of these entities, from the levels and modalities of the offer of professional education to the promotion of the production and transfer of social technologies aimed at the environment, including the development of educational and investigative studies on entrepreneurship, cooperatives, and others; consolidation of local productive, social and cultural arrangements; teacher training in science education; and development of a scientific and technological extension and dissemination program and the stimulus (BRASIL, 2008).

According to MEC/SE TEC (2014), 140 units of technical schools were built in Brazil from 1990 to 2002. Subsequently, between 2003 and 2010, another 214 new units were delivered after the launch of the Network Expansion Plan Federal Professional Education. The choice of cities for new units considered three dimensions established by the federal government for the expansion of the network: social, geographic, and development. In general, the social dimension aimed at universal services to territories; the geographical dimension aimed at internalizing the public offer of professional education and serving municipalities not served by federal schools; and the development dimension aimed to serve municipalities that already had productive arrangements.

In 2017, the National Regional Development Policy completed officially 10 years of its institutionalization, held by Decree n° 6047, 22 February 2007. This emergency was a milestone in the resumption of the regional development issue and, through this plan, its actions correlated with an effort to strengthen the expansion of federal institutes of education.

In 2018, the Federal Network consists of 38 institutes of education, science, and technology, the Federal Technological University of Paraná (UTFPR), two federal technological education centers (Cefet), 23 technical schools linked to federal universities, College Pedro II, and their respective campuses.

It is a determining role of the Federal Institutes to act in line with local productive, social, and cultural arrangements (BRASIL, 2008). What is in underway affirms a one conception of Education Vocational and Technological as potentiating the individual in the development of their capacity to generate knowledge starting from a practice integrated to reality instead of another one that takes EPT only as a way of instrumentalizing the being human being.

1.1 Federal Institutes of Education, Science, and Technology and local development through extension projects

The IF's purposes related to regional development are evidenced by impact, how to train and qualify citizens aiming professional performance in the various sectors of the economy, with emphasis on local, regional and national socio-economic development, as well as developing education professional and technological. Develop professional and technological education as an educational and investigative process for generating and adapting technical and technological solutions to social demands and regional peculiarities. Guide its training offer to the benefit of the consolidation and strengthening of local productive, social and cultural arrangements, identified based on in the mapping of the potential for socio-

economic and cultural development within the scope of the Federal Institute.

Thus, according to MEC (2018), the legal advance of extension in the recent national education laws was not accompanied by practice in the education systems, especially in the sense of explicitly contemplating the subject of extension in a regimental manner.. As a result, the spread of multiple extensionist concepts and practices was unleashed for different types of higher education institutions in the country, creating a regulatory gap for the extension that led, in 2012, to the Institutions Extension Pro-Rectors Forum of Higher Education Publics publishing referential text entitled National Policy for University Extension. In this document, among other subjects, the objectives of university extension were listed as a set of 15 objectives including those agreed upon in the National University Extension Plan, 1991 as well as new ones deemed necessary to overcome other challenges that have been established over time, as well as to take advantage of new opportunities (MEC, 2018).

From the section of the MEC (2018, p. 13) referencing compliance with Law nº 13,005/2014, which approved the National Education Plan - PNE 2014-2024, "the extension activities must comprise, at least, 10% of the total curricular and student workload of the undergraduate courses," thus becoming an "action integrated to the curricular matrix and the organization of the research, so that it constitutes a single interdisciplinary, educational, cultural, scientific, technological process, the extension" (MEC, 2018, p. 14), according to guidelines that structure its conception and practice. University extension guidelines are aimed at promoting transformative interactions between higher education institutions and other sectors of society through the production and application of knowledge.

As noted in the Opinion section of the MEC (2018), extension activities are interventions that directly involve communities external to higher education institutions and that are linked to the education of the student and supported by clearly defined guidelines and principles, inserted in   courses'   political pedagogical projects through programs, courses and workshops, events and service provision, which can be complemented by institutional rules specific to higher education but not exclusively. Therefore, according to the MEC (2018), it is desirable to include "programs of a governmental nature, which meet municipal, state, district, and national policies" (MEC, 2018, p. 14).

Benetti, Sousa, and Souza (2015) in a theoretical explanation of the accreditation of university extension in undergraduate courses rescue the FORPROEX approach and present a set of attributes that characterize this action - interdisciplinary educational, cultural, scientific process and political, involving students, teachers, and administrative staff, which, therefore, would enable the bilateral or collective transformation of the university and other social actors.

The extension curriculum, or extension (curriculum) accreditation, a strategy provided in the National Education Plan (PNE), was regulated by Resolution nº 7 MEC/CNE/CES, of December 18, 2018, which establishes the Guidelines for the Extension in Brazilian Higher Education and regulates the provisions of Goal 12.7 of Law nº 13.005/2014. Just as it is present in Goal 12.7 of the National Education Plan (PNE) - which ensures 10% of curricular credits for extension projects - and provides definitions for the policies of

extension of Brazilian higher education. For example, evaluation parameters for extension actions are determined, in addition to principles and norms for extension in all higher education in the country.

Among other things, the Resolution: (1) establishes that "extension activities must comprise, at least, 10% of the total student curriculum load of undergraduate courses, which must be part of the matrix course curriculum"; and (2) instructs INEP to consider, for authorization and recognition of courses, (i) compliance with the 10% minimum workload dedicated to extension, (ii) the articulation between extension activities, teaching, and research, (iii) the teachers responsible for guiding extension activities in undergraduate courses.

The 10% of extension activities must be calculated based on the total workload of the course, thus, as it is not related to the workload of each discipline, as some of them have mixed workload - theoretical and extension. That is, the quantitative aspect is carried out after the sum of the curricular components, including subjects, complementary activities, internships, course completion work, etc.

The extension activities can thus, according to each strategy in the institutional educational planning, be accomplished in several ways, among them: (a) extension actions incorporated into the courses, i.e., incorporated into disciplines, which will be dedicated to part of the entire workload for such activities; (b) registered extension actions configured in projects, courses or events) that must be certified and validated; (c) composition of anterior items, that is, mixing hours to be met in such and such disciplines and the rest in shares registered in other aspects, and essential condition that these activities play a formative role for the student and involved the community outside the educational institution, involving the teacher responsible for certifying that the activities performed by the student fulfilled the proposed role. The main element that differs from the extension of complementary activities (the practice of disciplines, field classes, technical visits, scientific or cultural, scientific research, etc.). This is included in implementing the external public institution. For the latter, although they may play a formative role, the student can participate as a listener and in actions that do not involve the external community.

Higher education institutions have until December 14, 2021 to comply with the rules and reserve 10% of the workload for extension activities.

1.2 The Federal Institute of Education Goiano and the Campus Iporá

The institutions that are included in the IF Goiano were given by the implementation of Technical Courses in Agriculture, based on LDB 5692/71. With subsequent reforms in Vocational Education implemented since the LDB of 1996 (Law nº 9394/96) and its regulations, these Teaching Units were boosted, with public funding from government programs, with emphasis on the Professional Education Expansion Program (PDI 2009/2013).

Per its creation law, the institute started to design and develop curricular programs based on regional demands while adhering to local productive arrangements, regional development plans, and social

movements (PDI 2009/2013).

For this study, an analysis of the locations of the IF Goiano campuses showed the potential of the Iporá campus, because its installation was prompted by demand from local actors, in addition to being classified as a small town with a population of 31,274 people, MHDI of 0.743 according to the 2010 IBGE Census, and 2016 GDP of R $18,040.93 per capita.

Determining the choice was the nature of the insertion of the Iporá Campus. Table 1 shows the process of installing the campuses that make up the IF Goiano.

Table 1. IF Goiano and the nature of the insertion of its Campi

Campi IF Goiano	City/GO	Nature of insertion
CAMPUS CAMPOS BELOS	Belos Campos	Government-induced
CATALAN ADVANCED CAMPUS	Catalan	Government- induced
CAMPUS CERES	Ceres	Government-induced
CRYSTALLINE CAMPUS	Crystalline	Government-induced
ADVANCED HYDROLANDIA CAMPUS	Hydroland	Government-induced
IPAMERI ADVANCED CAMPUS	Ipameri	Localized/regionalized demand
IPORÁ CAMPUS	Iporá	To send localized/regionalized
MORRINHOS CAMPUS	Morrinhos	Government-induced
CAMPUS POSSE	Possession	Government-induced
RIO VERDE CAMPUS	Green River	Government-induced
TRINITY CAMPUS	Trinity	Government-induced
CAMPUS URUTAÍ	Urutaí	Government- induced
INNOVATION POLO	Innovation	Government-induced

Source: Compiled by author.

In this sense, the municipality of Iporá is a typical case for studying a research problem outlined.

The city of Iporá is located in the interior of the State of Goiás, in the Midwest Region of the country, in the western region of the state, in the homonymous microregion and Mesoregion of the Central Goiano. The distance between Iporá and the capital and Estadual, Goiânia, is 230 kilometers by the GO-060 highway. Its population, as previously presented, is equivalent to 31,563 inhabitants (IBGE, 2019).

The city's economy was already based on agriculture, livestock and strong trade, as the concentration of

formal jobs in the Iporá Microregion, according to 2011 data, was, in decreasing order: Public Administration (36.05%), Trade (18.61%) and Services (16.18%) (OLIVEIRA JR, 2014).

On the border between the municipalities of Iporá and Arenópolis, on the Caiapó River, the first small hydroelectric plant was built under the Incentive Program for Alternative Electricity Sources of the federal government of Brazil: the Small Mosquitão Hydroelectric Power Plant.

By State Law nº 249, of November 19, 1948, it was elevated to the category of municipality, installing on January 1, 1949, separated from the Municipality of Goiás and by State Law of nº 700, of November 14, 1952, was elevated to the region.

In accordance with the Institute Mauro Borges, the microregion of Iporá is comprised of 10 municipalities, totaling 59,086 inhabitants. Of this population, 79.8% live in urban areas and 20.2% in rural areas and most of these residents are in the municipality of Iporá (IBGE, 2019).

According to data of the census IBGE (2010), updated in partnership with the state agencies statistics, the monthly income of formal workers in 2017 was a 2,2 minimum wages, presenting 18.5% since the percentage of the population with monthly nominal income per capita up to half the minimum wage in 2010 was 33.3%.

The rate of schooling of 6 the 14 years of age, also in 2010 was at 98.4%. 2017 data showed that the Basic Education Development Index (IDEB) of the initial years of elementary school (Public Network) was 6.9 and of the final years of elementary school (Public Network) was 5.7.

In 2008, the federal government restructured the Federal Network for Professional and Technological Education, resulting in the Federal Institutes. That same year, the construction of the Iporá Campus of IF Goiano began. But this beginning of its activities started in August 2010. (IF Goias, 2016).

2. Methods

For the analysis, an analysis a collection of printed material was carried out in the city, which had a record of its history, as well as the implementation of the Federal Institute of Education Goiano, as well as 27 interviews with a semi-structured script for investigation with the actors: representatives of the local media, unions, current public management, and the time of implementation of the educational institution, managers and the institution's staff present, as well as those in charge at the time of this study. The audience included representatives of IF Goiano and Campus Iporá (managers IF Goiano, managers Campus Iporá, coordinators/representatives for projects/research-extension activities of Campus Iporá and teachers, students, and graduates); a representative of the agricultural sector, a business association representative, representatives of the union of rural workers and other, representatives of other class associations a representative of the executive power, representative of the legislature, the law enforcement agent/security

segment of the representative of educational institutions, and representative of community associations, development agencies, other representations.

From this perspective, the external documents - printed and virtual - and internal to the Federal Institute are included in the methodological procedures of empirical research. From the external perspective, a search for journal material among printed and virtual media (websites) and official documents (e.g., minutes of the Economic Development Council) will be carried out. From an internal perspective, the Institutional Development Plans of the IF Goiano (PDI), contracts, and ordinances of the Extension, Research, and Rectorate Provinces, available since the implementation of the Iporá Campus, have been observed. As the study in question will involve empirical data, triangulation applies as this approach aims to minimize the "gap between the theoretical foundation and the research practice" (GOMES, 2004, p. 69). The analysis by triangulation of methods is used to verify the proposed theme.

This research utilizes suggestions Marcondes and Brisola (2013) based on Gomes (2010) that interpretation is divided into three processes: 1) phenomenal and technical valorization of the information collected, 2) analyzing context and triangulating the data, and 3) the apex of interpretation.

According to Gomes et al. (2010), this process aims "to the theoretical reconstruction of reality." Therefore, the analysis procedures require a) in-depth reading of the collected material; and b) appropriation of the content to obtain an overview of the set as well as the specificities evidenced in the partial set of data collected, that is, in the semi-directed interviews and selected documents.

So, they were used as methodological procedure semi-directed interviews with one intentional group of actors-c have, as well as secondary data for environmental context before and after the installation of the IF Campus Iporá. Furthermore, were used data and documents officers and the media, as more one initiative to insert the view of the IF Campus Iporá community, under a selected theoretical orientation and focused on references to local development and the discussion about the movements of the extension activities.

3. Conclusion

Located in the municipality of Iporá, the Iporá Campus was placed in the central-west region of Goiás. It is 1030 km² in area, has an altitude of 584 meters, and is 222 km from Goiânia, the state capital.

Access for the members of this institution (teachers, students, and administrative staff) and the community was easily accomplished due to the junction between BR 060 and GO 060. Because this region is considered a commercial, educational, and health hub, with a diversified service provision sector, the road infrastructure allows access to more than 40 municipalities in Goiás within a radius of 200 km.

The campus has two functional units: the administrative headquarters and its dependencies and four spaces for professional training, in addition to the school farm, which is located 2 km from the administrative

headquarters.

The Iporá Campus was inaugurated on February 1, 2010, but the first academic activities, of technical courses in agriculture and information technology, only started in August 2010. In 2011, the following courses began: Technician in Informatics Integrated to High School, Technician in Secretarial, Technician in Chemistry, and Degree in Chemistry.

In the center-west of Goiás, the traditional economic activities are mostly preserved, which centers around beef and dairy cattle, in addition to low-tech agriculture, typical of family farming. Due to this characteristic, in 2012, two more courses were offered: Technology in Agribusiness and Technology in Agriculture Integrated into High School. In 2013, distance education courses were also offered, allowing for the consolidation of the expansion of the Campus and the verticalization of teaching. In the same year, more advanced-level courses were created: Technology in Analysis and Systems Development and in 2014 the Agronomy course.

Table 2 shows the courses offered at Campus Iporá, diagnosed in the PDI from 2014 to 2018.

Table 2. Courses offered at the Iporá Campus

COURSE	MODALITY	LEVEL	SHIFT	STUDENTS 2018
Agronomy	bachelor degree	University graduate	Integral	132
Chemistry graduation	Graduation	University graduate	Night	47
Technology in Systems Analysis and Development	Technological	University graduate	Night	85
Technology Agrone gócio	Technological	University graduate	Night	99
Qualification in Administration Assistant	PROEJA	Medium	Night	16
Agriculture and Livestock technician	Concomitant/Subsequent	Medium	Evening	13
Secretarial Technician	Concomitant/Subsequent	Medium	Night	36
Agricultural Technician	Integrated	Medium	Integral	70
Systems Development Technician	Integrated	Medium	Integral	51
Chemistry Technician	Integrated	Medium	Integral	64
Science and Mathematics Teaching	Specialization	Postgraduate studies	Night	-
Teaching Humanities	especialização	Postgraduate studies	Integral	---

Source: PDI- IF Goiano 2014-2018

The process of implementing a teaching unit of the Federal Institute of Education nature, despite the Phase II expansion mentioned above, was envisioned as a singularity in the case of Campus Iporá.

This fact that stood out and made this unit chosen for study, according to internal historical reports, the implementation of the Iporá unit of the Federal Education Network only occurred through the intense mobilization of the population of the municipality, demonstrating the local demand/regionalized mobilization of the local community, using public policies to its benefit.

This base uniqueness is the city's clamor for the educational institution. This was revealed through reports from those who participated in the process. The interviews delved into how this process occurred, and with the binding of reports, combined with recorded historical facts (e.g., the minutes from the public hearing held on December 18, 2006, at the Plenary of the City Council of Iporá at 7:30 pm) proved this fact to be true. This document contains a register of those present, representing all segments of the city. It states, "CEFET is the guarantee of access to good quality education and above all free."
The terminology CEFET refers to the Federal Center for Technological Education and was renamed after the reformulation, as the Federal Education Institute.

This document also includes the presence of the CEFET representative from Rio Verde, the closest city to this type of educational institution, and that, in principle, the implementation in Iporá would be an extension of the first. He considered the city of Iporá as a pole and a reference for the others, that's why it was chosen.

The Rio Verde representative stressed the importance of implementation in Iporá. Other participants in management positions mentioned that studies carried out by the working group that prepared, at the time, the master plan for the city of Iporá, confirmed that the city was considered a central hub and that with the advent of the improved education segment, it could expand even more. Reports still occur regarding the need to offer education in that region, since the city experienced an evasion of young people to carry out studies.

The mobilization of the city to attract the institute caused a movement to abandon political "party lines" and come together for a single goal. Political forces joined to create better living conditions for the population, as leaders of different parties were present and, despite ideological differences, all agreed and cooperated for the good of both the population of Iporá and the region, which would come with the advent of the educational institution. Some cities gave up entering the dispute and started to support and commit to Iporá.

An interview about this study, it was reported about the community's engagement to have the institute, such as the donation of land, as also, recorded in the minutes of the public hearing, was affirmed by the highest authority in the municipality: the mayor.

The chief of staff at the time, interviewed in this study, was also part of a commission created to acquire equipment (e.g., chairs and computers), visited several cities around Iporá to raise funds by signing a terms of commitment agreement (a document that was part of the institute's fundraising process to be placed in the application dossier).

One of the interviewees present during the implementation process stated that it was due to the great mobilization efforts from the local community, which initially was an expansion of the Rio Verde Campus, as a demand from the West Goiano, mostly small producers and also councilors, deputies, and mayors of the region.

Another interviewee pointed out that IF Goiano was the expansion of Rio Verde into the western region of the state that was in need, and that the city of Iporá would become another pole and reference for its neighboring cities. This reasoning was echoed by another interviewee, as he considered it to be a growth opportunity for the region with a multiplying effect of qualified labor for the new generation.

The city's vocation in the agricultural sector has already shown itself in the public audience where a certain fruit-growing project did not develop due to the lack of trained technicians. The citizens realized that knowledge and economics could change the current state of stagnation.

In the process of its installation, according to the minute registration document, the CEFET representative mentioned the importance of a study in the region to inform which courses ought to be implemented; that is, the local context and its potential directly influence what could be offered, thus enabling greater applicability of the study institution.

During their interviews, the teachers and other actors in the local community confirmed the agricultural characteristics of the region.

Some teachers reported that some small producers forwarded their demands to the IF Goiano Campus Iporá to attend the institute or the search occurs by students who are children of rural producers to explore what they learned in class and potential applications to their home environment.

Thus, according to the purpose set out by law regarding the actions that these institutions must exercise, stimulate, and support, during the educational process, activities that lead to the generation of work, income, and the emancipation of the citizen from the perspective of local and regional socio-economic development that's what IFGoiano from the Iporá campus represents.. One of the interviewees stated that "The institute's appeal is to serve small producers, as it is a small city here."

Thus, since its inception, the campus has sought to respond to demands for professional training and to disseminate scientific and technological information to support productive arrangements not only in Iporá but in the entire West Region of Goiás, which has low indicators of economic and social development relative to the rest of the state per the rules governing institute creation (BRASIL, 2008).

The results measured concerning extension activities, that is, service provision, project, or other instruments, in which the institute is talking to the community, as one of its actors were carried out to analyze the Extension Project Report, he found. Around 50% of the 62 extension projects in execution from the second half of 2017 until December 2019 had an agricultural theme.

Projects such as the recovery of gullies in rural areas implemented from 01/04/2019 to 30/11/2019, contemplated by Notice nº10/2018, were carried out in rural properties at the request of a producer who sought IF Goiano, demonstrating the content quality with the region, since this type of erosion is considered very common in the region, as well as the theme focused on agriculture.

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The Use of Internet and Social Networks as Methodological Tools in The School Environment

Fabiano Battemarco da Silva Martins1, Queli Cristiane dos Santos Souza2, Marcio Antônio de Oliveira3, Marcelo de Jesus Rodrigues da Nóbrega4, Flavio Maldonado Bentes5, Hildson Rodrigues de Queiroz6

1Master in Agricultural and Environmental (UFRRJ), School Management Specialist (FAVENI), Professor at UNIGAMA and Santa Úrsula University, Rio de Janeiro, Brazil. E-mail: fabianobattemarco@gmail.com.

2School Management Specialist (FAVENI), Life Skills Pedagogue, Rio de Janeiro, Brazil. E-mail: queli.ss@hotmail.com

3Educational Technology Specialist (UCAM), Professor at Faetec, Rio de Janeiro, Brazil. E-mail: profmarcioantonio@gmail.com

4Post-Doctor in Civil Engineering (UERJ), Doctor in Engineering (PUC-Rio), Master in Technology (CEFET/RJ). Professor at UNIGAMA, CEFET-RJ and Santa Úrsula University, Rio de Janeiro, Brazil. E-mail: engmarcelocefet@terra.com.br

5Doctor in Mechanical Engineering (UFRJ), Master in Mechanical Engineering (UnB). Senior Researcher (FUNDACENTRO), Rio de Janeiro, Brazil. E-mail: flavio.bentes@fundacentro.gov.br.

6Master in Mechanical Engineering (UFF), Specialist in Petroleum and Natural Gas Engineering (Universidade PETROBRAS), Professor at UNISUAM, Petroleum Engineer (PETROBRAS), Rio de Janeiro, Brazil. E-mail: hildsonqueiroz@yahoo.com.br

Abstract

This work addresses the integration of the Internet and Social Networks to the teaching-learning processes in the school environment, using the computer as an intermediate tool between student and teacher. The use of these technologies is transforming human relationships in all their dimensions: economic, social, and educational. The cognitive development of these students is being mediated by these technological resources, where these new information and communication technologies will expand their potential. The objective of this study was to understand the importance of using the internet and social networks in the teaching-learning process in the school environment as a methodological resource and to what extent it is favorable to the student's intellectual development.

Keywords: School environment. Integration. Transformation.

1. Introduction

This work addresses the integration of the Internet and Social Networks to the teaching-learning processes in the school environment, using the computer as an intermediate tool between student and teacher. The use of these new technologies is transforming human relationships in all their dimensions:

economic, social, and educational.

According to Porto (2006), the use of the internet and social networks at school highlights challenges and problems related to spaces and times that the use of new and conventional technologies causes in the practices that occur in the school's daily life.

In order to understand and overcome them, it is essential to recognize the potential of these available technological tools and the reality in which the school is inserted, identifying the characteristics of the pedagogical work carried out in it, of its faculty and students, of its internal community and external (BARBOSA, 2004). Understanding this, favors the incorporation of different discourses existing at school in pedagogical practice and other school activities in situations where they can bring significant contributions. Social networks are used according to the educational purposes and the most appropriate strategies to provide the student with learning. One learns to deal with diversity, scope, and speed of access to information, as well as with new possibilities for communication and interaction, which provides new ways of learning, teaching and producing knowledge, which is incomplete, provisional and complex. (PORTO, 2006)

According to Duarte et. al (2008) the cognitive development of these students is being mediated by these resources, where these new information and communication technologies will expand their potential.

The objective of this research was to understand the importance of using the internet and social networks in the teaching-learning process in the school environment as a methodological resource and to what extent it is favorable to the student's intellectual development.

2. The use of the internet and social networks in teaching

2.1 The use of social networks in the 21st century

The use of social networks and especially the internet has been expanding and becoming a landmark of the 21st century. With the globalization these new technologies started to be inserted in our daily life, mainly in schools and with that the information and knowledge arrive with more intensity and speed, making the cognitive development of children and young people expand more and more potential for assimilation of school content. (PORTO, 2006)

Information is made available through increasingly innovative social networks, making new ways of thinking, acting, living, and learning arise using these technologies. (DUARTE et. Al., 2008)

To ensure that the implementation of technologies is efficient, Maturana (2001) mentions:

> "Undoubtedly, the interconnectivity achieved through the internet is much greater than what we lived a hundred or fifty years ago through the telegraph, radio or telephone. However, we still do with the internet nothing less than what we want in the domain of the options it offers, and if our desires do not change, nothing really changes, because we continue to live through the same configuration of actions (to thrill) that we usually live."

Pozo (2008) points out that "for the proper use of technology in education, the training of education professionals is necessary, so that they can instruct students in how to use these tools for educational learning."

Given the above, it is necessary to study and familiarize the entire school community with these technological tools, not as spectators, but as collaborators of the process and being aware that social networks, together with the internet and the computer came to assist as well as chalk and blackboard. (BRITO & PURIFICATION, 2006)

According to Moran (2005), everything we do to innovate in education today will be little, he shows that the more social networks and technologies, the greater the importance of trained, competent and creative professionals so that they have the chance to generate students with the same characteristics, after all we are living in the 21st century where the use of logic prevails and the lack of knowledge of young people who were born in this globalized and totally competitive world, where vast knowledge in different subjects is no longer admitted.

That is why it is of great value that the child be inserted into the virtual world at an early age, as in this phase he sees the computer as a diversion and with that (playful view) his curiosity is explored to enter the reality experienced in everyday life.

2.1.1 The computer age in the Brazilian educational system

The computer age in the Brazilian educational system began in the 1980s and 1990s, with an initiative from the Ministry of Education (MEC). The objectives of this information technology in education is to cause changes in students making them more and more able to interact with this technology and in this way, to be able to walk each day towards intellectual progress. For this to happen, some projects were created for the Inclusion of Educational Technology in the country. (LUCENA, 2003).

MEC sponsored a project called EDUCOM (EDUCATION WITH COMPUTERS), which was destined to the development of research and methodologies on the use of the computer as a pedagogical resource. Then it implanted in each State the Center for Informatics in Education (CIED), followed by the FORMAR project which, as the name says, trained and specialized teachers for the use of informatics in education, enabling the operation of these centers.

Currently, the National Program for Informatics in Education (PROINFO), from the Department of Distance Education of MEC, is introducing Information and Communication Technologies (ICT) in schools.

Brito & Purificação (2006) created a more complete graphic with all the political actions of educational informatics in Brazil, according to table 1.

Table 1 - Political actions of educational informatics in Brazil.

Year	Actions
1979	The Special Secretariat for Informatics (SEI) made a proposal for the educational, agricultural, health and industrial sectors, with a view to enabling the computational resources of its activities.
1980	The Special Secretariat for Informatics (SEI) created a Special Education Commission

	to collect subsidies, aiming to generate norms and guidelines for the area of information technology in education.
1981	I National Seminar on Informatics in Education (SEI, MEC, CNPq) - Brasília. Recommendations: Educational IT activities should be guided by cultural, socio-political and pedagogical values of the Brazilian reality; the technical and economic aspects must be considered not in terms of market pressures, but of socio-educational benefits; one should not consider the use of computational resources as a new panacea to face education problems; there should be the creation of experimental pilot projects with limited implementation, aiming at conducting research on the use of information technology in the educational process.
1982	II National Seminar on Educational Informatics (Salvador), with the participation of researchers in the fields of education, sociology, informatics, and psychology. Recommendations: The study centers must be linked to universities, with an interdisciplinary character, giving priority to high school education, while involving other teaching groups; computers must function as an auxiliary means in the educational process, and must submit to the purposes of education and not determine them; its use should not be restricted to any teaching area; priority should be given to teacher training in terms of theoretical aspects, participation in research and experimentation, in addition to involvement with computer technology and, finally, the technology to be used must be of national origin.
1983	Creation of the Special Commission for Informatics in Education (CEIE), linked to SEI, National Steel Company (CSN) and the Presidency of the Republic. This committee included 49 members of MEC, SEI, National Research Council (CNPq), Financier of Studies and Projects (FINEP) and Embratel, whose mission was to develop discussions and implement actions to take computers to Brazilian public schools.
1983	Creation of the Educom - Computer Education project. It was the first official and concrete action to take computers to public schools. Five pilot centers were created, responsible for the development of research and the dissemination of the use of computers in the teaching-learning process.
1984	Officialization of the study centers of the Educom project, which was composed of the following institutions: UFPE (Federal University of Pernambuco), UFRJ (Federal University of Rio de Janeiro), UFMG (Federal University of Minas Gerais, UFRGS (Federal University of Rio Grande do Sul and Unicamp (State University of Campinas). The financial resources for this project came from FINEP, Funtevê and CNPq.
1986 and 1987	Creation of the Informatics Advisory Committee for Education of 1st and 2nd Degrees (Caie/Seps) subordinated to MEC, to define the directions of the national educational information policy from the Educom Project. Its main actions were: holding national educational software contests; writing a policy document defined by them; implementation of Educational Informatics Centers (CIEs) to serve approximately 100,000 users, in partnership with the State and Municipal

	Education Departments; definition and organization of CIEs' teacher training courses and evaluation and reorientation of the Educom Project.
1987	Elaboration of the Immediate Action Program in Informatics in Education, which had, as one of its main actions, the creation of two projects: Projeto Formar, which aimed at training human resources, and the CIED Project, which aimed at implementing Computer and Education Centers. In addition to these two actions, the needs of the education systems related to information technology in primary and secondary education were raised, the Educational Informatics Policy was prepared for the period from 1987 to 1989 and, finally, the production of educational software was stimulated. The CIED Project was developed in three lines: CIEs - Centers of Informatics in Higher Education, CIED - Centers of Informatics in Education of 1st and 2nd Degrees and Special; CIET - Informatics Centers in Technical Education.
1997 to the present	Creation of Proinfo, a project that aimed at the formation of NTEs (Educational Technology Centers) in all states of the country. These NTEs will be composed of teachers who must even undergo postgraduate training in educational computing, so that they can exercise the role of multipliers of this policy. All states will receive computers according to the population of students enrolled in schools with more than 150 students.

Source: Brito & Purificação (2006)

These political actions in Brazil were carried out by different people who participated in the programs, among them, teachers, technicians, and administrators from the knowledge of different institutions in the country. (BRITO & PURIFICATION, 2006) For this reason, Chaves points out:

> "... the public authorities have a significant share of responsibility in the task of creating conditions that will contribute to the nation's cultural and technological autonomy, thus eventually reducing the distance that separates the country from the more developed nations. (CHAVES, 1987)."

2.1.2 The importance of the internet and social networks in teaching-learning

The Desktop Computer, better known as Desktop, was once considered a sophisticated equipment and a "consumer dream" for many people. Nowadays, not only him, but Notebooks, Tablets and Cell Phones are part of our reality and everyday life together with the internet and social networks being present in several aspects as well as in work, leisure, and education. (SAVIANI, 2001).

Believing that education is a right for everyone, this theme arose to reflect the importance of new technologies in schools. However, when talking about new technologies, it is necessary to explain that it is not a fad, nor a new educational trend, but an essential process in the students' lives. (MORAN, 2005) With the exploitation of social networks in education, the field of study and research of students has improved. And through them (social networks), both teachers and students can exchange experiences and content with information on different areas of knowledge, that is, "the main element becomes the rational

organization of the means" (SAVIANI, 2001).

Amid the complexity of learning and teaching, it is necessary to search for new teaching methodologies, and social networks bring possibilities that generate different means of teaching.

Many scholars have drawn attention to social networks and the importance of the internet in education, just as Moran (2005) points out that the internet is a great support network for education, an indispensable anchor for the vessel.

Lucena points out,

> "The insertion of ICTs in education, with an emphasis on the computer connected to the Internet, becomes essential, since students already explore in their daily lives the innumerable possibilities made available by new technologies and all that they represent in terms of potentials for production and dissemination of knowledge, as well as other facilities related to life/work." (LUCENA, 2003)."

Social networks are multimedia systems because they are interactive, and thus, facilitating the exchange of knowledge between all school communities. With these new networks, the user, in this case the student, is no longer a passive receiver, deciding what information they want to receive; since the teaching-learning process becomes not only by the teacher, but also by other means. (CORTELAZZO & GARCIA, 1998)

According to Bicudo (1999), communication and interactivity processes are always considered as advantageous in educational processes assisted by the computer, that is, that use this medium for this. The ease of access to social networks through the Internet, changed the profile of the student who started to demand another form of knowledge transmission and not in an archaic way. The teacher as a mediator uses these new technologies together with the didactic material (books or handouts) in favor of education, speaking the same language as the student, who in turn develops skills such as attitudes and values assimilating the contents and improving socialization with the world , where it always lives in evolution and constant change. To better illustrate Cortelazzo & Garcia (1998), they set up Table 2 containing the comparison between a situation in traditional education and another in teaching with new technologies.

Table 2 - Comparison between traditional and technological education.

	Traditional Education	**Technological education**
Teacher	An expert	A facilitator
Student	One received passive	An active contributor
Educational emphasis	Memorization of facts	Critical thinking
Evaluation	What was repeated	Interpretation
Teaching method	Repetition	Interaction
Access to knowledge	Limited to content	boundless

Source: Cortelazzo & Garcia (1998)

According to Gadotti:

> "Access as digital communication and information networks is important for the functioning and development of any social institution, especially for education that is directly directed at human formation ..." (GADOTTI, 2000).

The use of the internet, along with social networks, as a research tool is fantastic. Museums can be visited, as well as there are a multitude of libraries, books, articles, magazines, documents, all available to be used in the best possible way. In addition, the education process can extract cultural and social elements, identifying problems to be solved via the internet through these sources of ideas. (GADOTTI, 2000)

In addition to these alternatives, there is also the possibility of learning to use Internet tools and social networks as a means of exporting your knowledge, no page building process for example. When designing as pages, articulation occurs in different forms of language, using a logical and spatial organization or that may not occur if you use the technology resource.

For Perrenoud (1999), how competences are built without seeds, without conflict with real obstacles, in a design process or problem solutions.

Complementing Perrenoud's thought, Almeida explains:

> "(...) the project shows an activity that robs with disciplinary barriers, becomes permeable as its borders and moves towards an interdisciplinary proposal to understand and transform reality for the benefit of personal, group and global quality of life." (ALMEIDA, 1999).

2.1.3 The social networks most used by the school community

The constant use of social networks and new technologies can also be called cyberculture. It is through it that a current worldview is linked with digital communication. (KENSKI, 2007)

Currently the social networks most used by young people on the internet are Facebook, Instagram, and Twitter. Youtube is a digital medium. However, it can be considered a Social Network because there are chatters called: "live chat" and "comments". Live chats, as the name implies, users (students) can comment during the broadcast and Comments for post-post use. (BRITO et. Al., 2013)

WhatsApp can also be considered a Social Network, as there are relationship groups. According to Kenski (2007) "the technologies are as old as the human species". And it has been invading our lives over the years, expanding all our senses, and thus bringing a certain "technological comfort".

To Brito & Purificação (2006), one can exemplify how these new resources allow to encourage and help students in learning: Electronic Lists teach students to surf the Internet through electronic mails also known as e-mails, and with this each will be able to create their personal list of virtual connections; chats better known as online chat, allow the exchange of information, research and communication between those seeking to learn. The most used are: WhatsApp, Facebook Messenger, Skype, Google Hangouts and

Telegram, Facebook can be used to publicize events at school, through the application "My Calendar" or "Events"; on YouTube, it can be used to assemble a virtual collection of school work or a specific class, through videos that can be used for a critical analysis of the materials presented. These materials end up becoming a reference for the school community, as the same stored on this social media can be shared worldwide. References are found in the National Curriculum Parameters - PCNs cited by Brito & Purificação (2006) where the ICTs are:

> "Technological resources that allow the transit of information, which can be the different means of communication (print journalism, radio and television), books, computers, among others." (BRITO & PURIFICATION, 2006).

In teaching through the computer, information is the main part in its processes of storage, representation, acquisition and how this transmission of knowledge is done. Computer is undoubtedly the most used technology in the educational field, and the one that has generated more studies regarding its use; as well as handling the equipment where it requires thinking about the implications for the teaching-learning process of the subjects involved.

3. Conclusion

It is concluded that the new networks together with the internet are tools of aid in the teaching-learning process and that they are being used properly, generating a meaningful learning obtaining an increase of the students' creativity and motivation, that is, making become interactive and more dynamic. Social networks, internet and new technologies, provide us with an education with more quality and dynamism in the teaching process when used in an organized and responsible way, which can benefit a lot, as well as train more critical, sociable and autonomous apprentices capable of intervening in your own reality. In this sense, it is understood that the use of these new methodological learning resources favors the reconstructive questioning of both students and teachers. As a future work, we intend to carry out a research involving the school community, to know what advances in teaching and learning have been achieved in the use of technological tools for school content.

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Meta-analysis: hydroxychloroquine therapy approach with or without azithromycin against covid-19

Josilene Nascimento do Lago

Nursing Academic. University of Amazon (UNAMA),
Belém, Pará, Brazil.

Cosmo de Sousa Costa

Medical Academic. Federal University of Pará (UFPA),
Altamira, Pará, Brazil.

Larissa Emily de Carvalho Moraes

Nursing Academic. University of Amazon (UNAMA),
Belém, Pará, Brazil.

Raissa Ribeiro da Silva

Nursing Academic. University of Amazon (UNAMA),
Belém, Pará, Brazil.

Gleiciane Moraes Gonçalves

Nursing Academic. University of Amazon (UNAMA),
Belém, Pará, Brazil.

Thainar Stefanie Barbosa de Oliveira

Nursing Academic. University of Amazon (UNAMA),
Belém, Pará, Brazil.

Tatiane Roseli Alves Castro

Nursing Academic. Federal University of Viçosa (UFV),
Viçosa, Minas Gerais, Brazil.

Thalles Ricardo Melo de Souza

Medical Academic. State University of Pará (UEPA),
Belém, Pará, Brazil.

Christian Pacheco de Almeida

Physiotherapy Academic. State University of Pará (UEPA),
Belém, Pará, Brazil.

Lorena Victória de Souza Ferreira

Nursing Academic. Paulista University (UNIP),

Belém, Pará, Brazil.

Alex Jean Ferreira da Silva

Nursing Academic. University of Amazon (UNAMA),

Ananindeua, Pará, Brazil.

Widson Davi Vaz de Matos

Resident Nurse, Oncology Nursing Residency Program, Federal University of Pará (UFPA),

Belém, Pará, Brazil.

Renan Rocha Granato

Physician in vascular surgery and adjunct professor of Medical Academy of Federal University of Pará (UFPA), Altamira, Pará, Brazil.

Ademir Ferreira da Silva Júnior

Post doctor in Safety of patient and associated Professor in Academy of Medicine of Federal University of Pará (UFPA), Altamira, Pará, Brazil.

Abstract

Objective: identify and analyse the evidences about the use of hydroxychloroquine with or without azithromycin in covid-19. Methods: This is a systematic review with meta-analysis using posted articles in December 2019 until May 2020. The research was formulated by a question structured using PICO strategy, in these data bases: BVS, PUBMED, MEDLINE, LILACS, BDENF e SCIELO. Results and discussion: Resulted in 9 articles founded by the PRISMA, approaching 4182 patients. PICO strategy selected and analysed 5 articles projected in Forest plots. Resulting in tree clinical trials (RR: 1.15; IC95%, 0.76 a 1.73), which did not found big differences in the outcome in the groups of patients who used HCQ with or without AZT, comparing with the control group. Two studies analysed the number of deaths/intubations in comparative group, experimental group and control (RR:1.86; IC: 95%, 1.54 a 2.26) resulting in more chance of death /intubation in patients who used HCQ. Conclusion: It was found that is not possible to prove the efficacy of these drugs, due to the limited number of randomized and controlled clinical trials. Therefore, the encourage of scientific production about the HCQ and AZT against Covid-19 is more than necessary

Keywords: Azithromycin; Covid-19; Hydroxychloroquine; SARS-CoV-2.

1. Introduction

In the last 20 years, the human coronavirus (CoVh) is responsible for virulent epidemic which cause respiratory and enteric diseases, causing a Severe Acute Respiratory Syndrome (SARS). The CoVh is

classified with a prevalent agent etiologic in the acute respiratory infections (IRAs), it should be the principal cause of this respiratory disease or can predispose people to have secondary infections caused by bacteria (LANA et al., 2020).

In 2003, the epidemic of SARS started in Hong Kong China, with lethality near to 10% of them habitants. In 2012, the Middle East Respiratory Syndrome (MERS) emerged in Saudi Arabia, making a mortality level something about of 35% of them population. In December 2019, was detected in Wuhan, China the first behaiour of the new CoVh, denominated SARS-CoV-2, which cause the new disease knowledge like Covid-19 (JUURLINK, 2020). The structure of virus and gene receptor response by the cell link are similar to SARS-CoV. However, SARS-CoV-2 use the receptor of the Angiotensin converting enzyme (ACE2), to try to enter in cell, although the reservoir of SARS-CoV-2 is localized in animals, your stay is still unknown for a long time. furthermore, studies shows the genomic of SARS-CoV-2, revelling the high phylogenetic distance in those CoVh, identified in respiratory human disease, because they shared respectively 50 and 79% of identify with SARS-CoV and MERS-CoV (BESSIÈRE et al., 2020).

The clinical manifestations of Covid-19 in 80% of them, are classified in low cases, generally characterized by fever, dry caught, tiredness. In several cases, 5% of them, the patient will have progressive dyspnoea, pulmonary bleeding, lymphopenia, it's important to say that we still don´t know every signs and symptoms of covid-19, knowing that's a new pathology. The severe phases, associated with disease of the low respiratory tract, generally are seeing in people with risk factors, like: cardiopathy, pneumopathy and others chronic conditions like diabetes, obesity and asthma (STRABELLI; UIP, 2020). The laboratory diagnostic is giving using the exam: Reverse-Transcriptase Polymerase Chain Reaction (RT-PCR), that's the gold-pattern for definitive diagnostic of this pathology, with the positive results. However, the absence of a good treatment against the infection caused by coronavirus 2 (SARS-CoV-2) and Severe Acute Respiratory Syndrome predispose the research for drugs known for their effectiveness in others medical conditions (ZHAI et al., 2020).

In this contest, articles shows that the reuse of medicines can find approved drugs which can be used for treatments in diseases with unknown ethology. One of the highlighted drugs is Hydroxychloroquine (HCQ), which showed antivirals properties and immunomodulatory effect. Furthermore, the HCQ is used in control of autoimmune pathologies, like rheumatoid arthritis and systemic lupus erythematosus. In addition, another therapeutic agent used is Azithromycin (AZT) is also defended because this classification as an antibiotic with antiviral activity. Moreover, the typical posology of these drugs is: 5 days using HCQ (400–600mg) and AZT (500mg) in diary doses, that makes a cumulative effect like the administration of 48 hours in patients with chloroquine sensibility (JUURLINK, 2020).

The quickly expansion of the pandemic caused by the new virus of the SARS-CoV-2, recalled a lot of research's around the world, searching for answers for a possible solution for the management of this disease. However, although the advance in researches for treatments, science still haven't found an effective drug against covid-19 (PACHECO et al., 2020). Therefore, every action of a study need a legitimacy recognize about them approaches, mitigating the damage, high transmissibility and complications during the hospitalization in unities of intensive therapy care. In others words, a treatment which provide the reduce the viral charge and promote the clinical cure of the patients in the onset of this disease, may help to limit the transmission of the virus in question. The present research had like focus identify and analyse

the use of HCQ with or without AZT in the fight against Covid-19, using a systematic review with meta-analysis.

2. Method

This study is a systematic review with meta-analysis, tried to identify judiciously the studies which rated the efficacy of HCQ with or without AZT, in patients with the diagnostic of covid-19. The inclusion criteria of the articles was made by two steps, like that: the first one was structured by the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA), who is based in evidences for reports in systematic reviews and meta-analysis. In the second step, used the strategy of patient, intervention, comparing, outcome (PICO), with the purpose to check the internal value of each study (SADIGURSKY et al., 2019). In the first step, was used PRISMA, with these criteria: 1) qualitative studies, quantitative, clinical trial, season cases studies, technical reports, exploratory studies made by physicians; 2) studies using adults patients (more than 18 years) who received HCQ with or without AZT; 3) studies with control group which did not receive HCQ e AZT; 4) studies write in Portuguese or English; 5) was included randomized and not randomized clinical trials; 6) cohort studies; 6) studies posted in data base in December 2019 until May 2020.

The second step was based in PICO strategy, to try to check the internal value of these studies. The including criteria was defined, according the description inside the Table 1. The bibliography research was made during January to May de 2020, in Virtual library in Health (BVS), with these data base: PUBMED, MEDLINE, LILACS, BDENF e SCIELO. For the construction of this review, was used terms of research to identify the disease COVID-19 or the agent SARS-CoV-2, after was addicted to research these descriptors: COVID-19, SARS-CoV-2, HCQ and AZT, where was defined using the platform of descriptors in Science of Health (DECS).

Table.1: Table caption above the table.

Definition	Description
Indicators	Founded articles selected by the title and resume according the PRISMA.
Researches	Cohort studies, clinical control group and randomized and non-randomized studies.
Patients or problem	Adults with more than 18 years, without highest age limit, diagnosed with Covid-19.
Intervention	Analyse the posology of HCQ with or without AZT in therapeutic treatment against Covid-19.
Coltroll and effectiviness	Evalue the therapeutic results of HCQ and AZT according the measuring of RT-PCR and the numbers of deaths/intubation comparing with the experimental group and control.
Outcome	Analyse the therapeutic answers of HCQ with or without AZT, through the negativity of RT-PCR.

Source**:** PICO Strategy, SADIGURSKY et al., 2019. Adapted by the authors, 2020.

The exclude criteria was composed by the wrong description and when the clinical outcome were not reported by the author. Serial cases, posted experiences, narrative reviews, and systematic reviews weren't considered. Moreover, were exclude as well posts with application made in surgical clinics and obstetric, paediatric and new-born. In addition, reviews with tests made by professionals associated to pharmacologic industry was exclude.

3. Results

The bibliography search results in 7.232 posts, after the selection, 60 articles was founded and selected by the title and resume. After that, with a deeper read and use of PRISMA and PICO strategy, was considered 9 available articles for this systematic review. The figure 1 shows a flux gram and the selected researches, with the researches shared in groups.
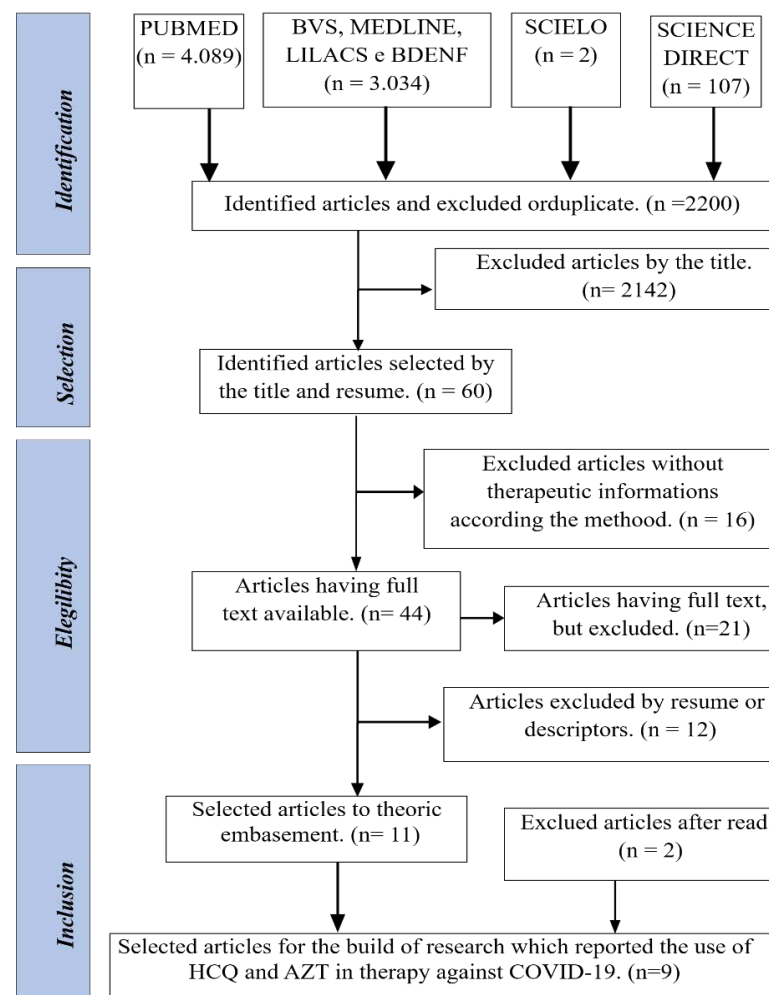
Figure 1: Stages of the procedures of the systematic review, elaborated by the authors.

Later, create a table to describe the studies found with the following characteristics: authors, identification of the research, method, study objective, number of patients or hospital beds, posology of

drugs, results of researches and conclusions about the effectiveness of the following medicines: HCQ and AZT for treatment of Covid-19. According the Table 2

Table.2: Description of the articles included in the review about the use of hydroxychloroquine with or without azithromycin.

Author	Identification of research	Method	Objective of research	Number of patients or hospital beds.	Posology of drugs	Drug percentual of effectiviness	Conclusions
ANDREANI et al., 2020.	In vitro testing of combined hydroxychloroquine and azithromycin on SARS-CoV-2 shows synergistic effect.	That's a clinical trial using in vitro system which consist the use of cells culture.	Shows that the combination of HCQ e AZT have a synergic effect in vitro no SARS-CoV-2.	Not relacioned.	The tested drugs concentration was expressed in micromoles per liter (μM), was 1, 2 or 5 μM for HCQ associated with a 5 or 10 μM for AZT.	The combination using AZT and HCQ made a high inhibition in viral replication for the wells having HCQ in 5 μM in combination with AZT in 10 and 5 μM with relative viral inhibition of 97,5% and 99,1%, respectively.	This research shows that the combination using HCQ and AZT have a strong synergic effect in vitro against SARS-CoV-2 in compatible dosage founded in human lung.
CHEN et al., 2020.	A pilot study using hydroxychloroquine in the treatment of common cases of (Covid-19).	Open label trial.	Check the safety and effectiveness of HCQ in treatment of the patients with SARS-CoV-2 (Covid-19).	The patients was randomized 1: 1 in the HCQ group + usual treatment (n=15) and control group (n=15) only usual treatment.	Was use a dosage of HCQ 400mg/ per day for 5 days (n = 15), usual treatment (n = 15).	after 7 days of treatment: Group using HCQ + usual treatment was without viral detection in nasopharyngeal swab in 86,7% (n=13/15) *versus* 93,3% (n=14/15) control	There was no high difference in virus negativation using swab of nasopharynges comparing with group using usual treatment.

						group (p > 0.05).
1- GAUTRET et al., 2020.	Hydroxychloroquine and azithromycin as a treatment of Covid-19: results of an open-label non-randomized clinical trial.	It was a clinical randomized trial quantitative, during 6 days.	Check the HCQ and AZT effectiveness in the viral charge of SARS-CoV-2.	36 patients; 20 patients treated with HCQ, 6 of them was received AZT and 16 of the control group).	20 patients received 200 mg of orally sulphate of HCQ, during 10 days, three times in diary doses 6 of them received the association with a AZT in the dosage of 500 mg in day 1, after 250 mg per day, for 4 days.	The patients with the association of HCQ plus AZT had the virology cure in 100% in the sixth day, comparing with 70% of the patients treated only with HCQ and 12,5% of control group.	Showed that the treatment with HCQ plus AZT had effectiveness in reduction of the viral charge about Covid-19 disease.
2- GAUTRET et al., 2020.	Clinical and microbiological effect of a combination of hydroxychloroquine and azithromycin in 80 Covid-19 patients with at least a six-day follow up: A pilot observational study.	That's a cohort research without control, and comparation, using patients treated with the combination: HCQ and AZT. For 3 days or more.	Check with urgency a treatment to use in patients with Covid-19 and reduce the viral transport.	Total of 80 patients with Covid-19.	Received 200 mg of orally HCQ, 3 diary doses for 10 days, with AZT (500 mg) in the first day, after (250 mg of AZT) per day for 4 days.	After the sixth day of treatment, 83% of PCRs was negatives in positive tested patients. In the 8° day 93% the hospitalized ones showed a decrease in the number of infective. After the 5° day of the onset of admission, the virus cultures	Therefore, the combination of HCQ and AZT against Covid-19, showed a potential reduce in the onset. Moreover, this therapy showed a redution in infectiveness.

						tested as negative in 97,5% of patients.
GELERIS et al., 2020.	Observational Study of Hydroxychloroquine in Hospitalized Patients with Covid-19.	This is a randomized clinical trial research made in Hospital of Columbia University Irving Medical Centre, localized in the north of Manhattan, during the hospitalization in march 7 until April 25 of 2020.	Check up the using of HCQ in respiratory insufficiency in a big medical centre which helps a substantial number of patients with Covid-19 in New York City.	1446 patients were checked, 70 had intubation, they dead and was excluded of the research, having 1376 patients in total.	The dosage suggested was one dose of HCQ 600 mg twice in 1/D, after that 400 mg per day during more 4/D. AZT 500 mg was given in 1/D, after that 250 mg per day for more 4/D combination using with HCQ was a optional therapeutic	In the 1376 of patients Admitted in hospital with Covid-19. The patients who received HCQ with or without combination had intubation or came to death 232/811 (28,6%), and who didn't use these drugs 84/565 (14.9%).	This observational study about HCQ showed that there is no high association about using HCQ and evolution to intubation or death. Therefore, more controlled randomized researches are necessary, because that's the best way to prove the benefits in a therapy.
MILLION et al., 2020.	Early treatment of 1061 Covid-19 patients with hydroxychloroquine and azithromycin, Marseille, France.	That's a randomized clinical trial, in cohort, the average age was 43,6 years and 46,4% of the patients was men.	Check the safety and effectiveness in the use of HCQ and AZT in Covid-19.	This research was made with 1061 patients with Covid-19 during 9 days.	200 mg HCQ three times per day + AZT (500 mg day 1 after 250 mg per day for more 4 days).	The virology cure was seen in 91,7% of patients in 10 days. The result was unsatisfactory in 46 patients (4,3%).	The precocious use of HCQ + AZT is safe and effective against Covid-19.
MOLINA et al., 2020.	No evidence of rapid antiviral clearance or clinical benefit with the combination of	Observational, prospective study realized in France during 10	Evaluate the viral mitigating or clinical benefit about using	Sampling had 11 persons made by 7 men and 4 woman's. 8	HCQ (200mg per each 8/8 hours and AZT 500mg in	This research showed that 80% (n=8/10) was still	There was no evidence of antiviral activity about using HCQ plus AZT.

	hydroxychloroquine and azithromycin in patients with severe COVID-19 infection.	days.	HCQ and AZT in critical patients with COVID-19.	of them had several comorbidities. During 5 days 1 patient died.	D1, after that 250mg in the 2-5 day).	tested positive in viral charge using swab nasopharyngeal after 5 and 6 days after the onset of treatment.	Moreover, others biggest clinical trials had not proved the effective or damage in the use of these drugs.
ROSENBERG et al., 2020.	Association of Treatment with Hydroxychloroquine or Azithromycin with In-Hospital Mortality in Patients With Covid-19 in New York State.	Multicentre cohort retrospective study using patients in a aleatory sampling about all admitted patients with Covid-19 confirmed by labs in 25 hospitals in New York City.	Describe the association of using HCQ, with or without AZT, and the clinical results in hospitalized patients diagnosed with de Covid-19.	Sampling using 7914 patients having Covid-19. A total of 2362 registers was selected randomly and 1438 was included in the analysis of medical treatment.	The dosage of HCQ was made in 3 steps, with 200mg, 400mg, 600mg. In addiction the dosage of AZT was given in 200mg, 400mg e 500mg.	The study showed that the mortality level was 20,3%. In the experimental group using HCQ + AZT was 25,7%, 19,9% with isolated HCQ, 10,0% with the association using AZT. In the control group was 12,7%.	The treatment using HCQ and AZT made no high difference in the levels of hospital mortality. However, this founds should be limited by the observational draw.
TANG et al., 2020.	Hydroxychloroquine in patients with mainly mild to moderate coronavirus disease 2019: open label, randomized controlled trial.	That's a multicentre opened randomized clinical trial about the use of HCQ in patients admitted in hospitals having Covid-19.	Check the effective and safety about the use of HCQ associated with the usual. Comparing with the usual treatment.	150 patients admitted in hospital having covid-19. 75 patients received HCQ plus usual treatment and 75 only using the usual one.	Started dose of 1200mg/per day still the thirty day. After that, using the maintenance dose of 800mg/per day of HCQ during two or three weeks.	The probability of negative conversion of SARS-CoV-2 in these patients who used usual treatment plus HCQ, was 85,4% in 28 days. Similar than who used only the usual one (81,3%) with perceptual difference of pattern in 4,1%.	The use of HCQ in the usual treatment did not change the probability of negativation in results of SARS-CoV-2 comparing with group using only usual treatment.

Source: HCQ (hydroxychloroquine), AZT (azithromycin), D (day), MG (milligram), SADIGURSKY et al., 2019. With adaption in the authors, 2020.

4. Discussion

After the evaluation, it's possible to identify three non-randomized clinical trials, three randomized trials, one multicentre clinical trial, one experimental clinical trial in vitro and one cohort study. Of The 9 studies, only eight had approach with humans, a total of 4182 patients. In this way, the selected articles was chose and organized by alphabetic order for discussion.

To evaluate the result of in vitro evidences, the research made by Andreani et al., (2020), used the HCQ isolate or associated with AZT, resulting in a high reduce in viral replication of SARS-CoV-2, showing synergic effects. Therefore, in this controlled clinical trial using wells having HCQ (5μM), in association with AZT (10 and 5 μM) cause viral relative reduction of 97,5% and 99,1% in the viral replication. Although can be possible to have this dosage in compatible levels founded in lung tissue, this research translates the difficult situation about reproducing clinically, because the high possibility to have adverse effects in these dosages. Moreover, the results founded in works using in vitro projects in pharmacology opened space to search more answers in clinical trials controlled in vivo.

In addition, in a Chinese randomized clinical trial, Chen et al., (2020), which tried to check the safety about using HCQ in moderate cases showed their results and have not showed high difference in the detection of viral charge using nasopharyngeal and oral swab, in the group using HCQ with usual treatment, evaluated during 28 days. In this way, the results without viral detection using HCQ plus usual treatment was 86,7% (n=13/15) versus 93,3% (n=14/15) about control group (usual treatment) (p > 0.05). So, for the authors, science needs more studies to found better outcomes about the use of HCQ against Covid-19.

In this context, the study realized by the French Gautret et al., (2020), presented some clinical trials about the use of HCQ with AZT. One of them had an important reduction in the viral charge after 6 days of treatment comparing with control group (n=16). A total of 36 persons was analysed (100%), 55% of them (n=20) just used only HCQ e 17% (n=6) or the combination addiction with AZT, resting for the control group 44% (n=16) of persons. After the analyse, in the sixth day after the started of treatment 100% of the patients having the combination of HCQ and AZT, was cured virologically, comparing with 57,1% of patients using only HCQ e and inside control group the cure level was 12,5%. However, another researched posted by Gautret et al., (2020), reproduced the same results seeing before, but with a biggest sampling of cases (80 patients), non-comparative e non-randomized, used doses with 200 mg of orally HCQ (three times per day for ten days), addicting the AZT (500 mg in D1, after 250 mg per day during four days). This article did not show against indications about using these drugs, did not putted critical situations and addicted a cephalosporin of third generation in therapy.

In this way, researches made by de Gautret et al., (2020) reinforced that after the sixth day of treatment, a the virological cure was seen in 83% of PCRs and negative in patients in the 8° day of admission (93%). However, was a decrease in the number of infective patients after the 3° day of the onset of admission, proved using viral cultures using respiratory specimen, where was negatives in 97,5% of the cases in the

5-day no. Therefore, the both studies bring relevant data about effectiveness of these medicines using precociously, however, showed with limitations, not only because the low number of patients analysed, but also the absence of a better strict in the randomization presents.

Another different article produced in France founded the same conclusion, showed by Gautret et al., (2020). Approach using 1061 patients, the author Million et al., (2020) concluded that the precocious use of HCQ and AZT against SARS-CoV-2 is safe and effective, having low levels mortality. An Observational and retrospective study was realized, which saw the virology cure in 973 patients in 10 days (91,7%); by the other side, a bad clinical result happened in 46 patients (4,3%), with 8 deaths (74-95 years). So, the association of HCQ plus AZT used precociously, is related with an interesting reduce of viral charge with a good clinical result, preventing possible complications, also should be considered in this sampling, that something about 95% of the patients have not reported complications, classified like low cases in the admission.

This trials gained prominence around the world like possible drugs in the treatment against SARS-CoV-2. After that, others studies was developed to try to reproduce the clinical results founded before. In a prospective study, made in France, the authors Molina et al., (2020), used the same   posology used by the study of Gautret et al., (2020) to analyse these drugs in patients in several cases, having comorbidities, to prove as well the effectiveness of this study in the reduce of viral charge. However, the results of these authors, founded different results comparing with the production of Gautret et al., (2020), In these ones, there was no evidence of clinical success in the association use of HCQ e AZT to several patients infected by this virus, because 80% (n=8) of the patients still had positive results for SARS-CoV-2 after 5-6 days of treating, against drastically with the results showed by Gautret et al., (2020) which had a significantly reduce in viral charge after sixth day of treatment.

The study of Geleris et al., (2020), exposed a total of 1446 patients, after the hospital admission, was excluded from analyse 70 patients who were intubated, dead or had hospital discharge after 24 hours of admission. Were included 1376 patients in analyse, 811 (58,9%) received HCQ (600 mg twice in first day, after 400 mg per day during 5 days), the controlled group was 565 (41,1%) who have not received HCQ. During something about 22 days, patients treated with HCQ was hardly sick in the started than others who have not received HCQ). Having like first outcome the respiratory insufficiency in 346 patients (25,1%); a total of 180 patients was intubated, 66 of them dead after, and 166 dead without intubation. In this analyse non adjusted, the patients who used HCQ had more chance to face complications during the admission comparing with the patients who have not used HCQ (risk level, 2,37; IC95%, 1,84 a 3,02).

Moreover, this research analysed the principal multivariate with pondering of reverse probability, exposing that there was not association about using HCQ and intubation and death (risk reason: 1,04; IC95%, 0,82 a 1,32) and emphasized that the association with AZT also haven't increase in the final compose (level of risk 1,03; IC95%, 0,81 a 1,31). The last analyse was made in April 25, totalizing 232 deaths and 114 still were hospitalized (only 24 wasn't have intubation). So, the observational article tried to exam the association about using HCQ and respiratory insufficiency, although this huge research, is notorious the incoherence about the data organization about deaths and intubation, predisposing questions about this theme. As well, the authors mentioned the limitations about this study, including low data's for some variants.

In this same context, the same results also happen in other research scene, according to Rosenberg et al., (2020) realized in United States of America. The studded group of the cohort multicentre study was guide for a aleatory sampling about every cases of patients admitted with suspect of da Covid-19 and conformed by labs 25 hospitals. Article showed that 88,2% of patients with Covid-19 was from the metropolitan area of New York, which approached 1438 hospitalized patients. 735 (51,1%) of these patients received HCQ + AZT, 271 (18,8%) received HCQ isolated, 211 (14,7%) received AZT isolated e 221 (15,4%) have not received any drug. The dosages of HCQ occurred in 3 steps: first with 200mg, after 400mg and 600mg. The dosages of AZT were: 200mg, 400mg e 500mg. The hospital mortality was 20,3% (IC 95%, 18,2% -22,4%). The probability of death in patients using HCQ + AZT was 189/735 (25,7% [IC95%, 22,3% -28,9%]), HCQ isolated, 54/271 (19,9% [IC95%, 15,2% -24,7%]). AZT isolated, 21/211 (10,0% [IC 95%, 5,9% -14,0%]) and none drug 28/221 (12,7% [IC 95%, 8,3% -17,1%]).

Furthermore, the approach of the research of Rosenberg et al. (2020), posted the proportional risk models of Cox adjusted, comparing to patients who have not received any drug, there was not   high differences in mortality of the patients who received HCQ + AZT (HR, 1,35 [IC 95%, 0,76-2,40]), HCQ isolated (HR, 1,08 [95 % IC, 0,63-1,85]) or AZT alone (HR, 0,56 [IC 95%, 0,26-1,21). In the hospitalized patients in New York city having Covid-19, the therapy with HCQ with or without AZT, comparing to the group who haven't use these drugs, there is no difference in association about mortality.

Another open-multicentre trial with randomized clinical approach, used 150 persons diagnosed with Covid-19, most of them are classified in low and moderate persistent cases, c Tang et al., (2020), this trial search the probability about negative conversion of SARS-CoV-2 using extraction and amplifying the total RNA in RT-PCR removed by the patients seeing for 28 days, sharing them in 2 groups: one group with HCQ and usual treatment and the other with control group, using only usual treatment. Therefore, the outcomes of these studies about HCQ showed a negativation at virus SARS-Cov-2 in 85,4%, evidencing a probability similar than a viral elimination, comparing to the usual treatment 81,3%. As well, more gastric and enteric effects was reported inside the group using HCQ, comparing to control. No geral, tais estudos não apoiam o uso do fármaco HCQ em pacientes de leve a moderado com covid-19.

In these 9 articles, 4 were excluded because the absence of comparison with control groups. PICO strategy selected retrospectives cohort researches, clinical controlled trials and randomized and non-randomized. 5 articles were included in this meta-analyse, 3 of them for the experimental group and for control one, 2 for evaluate the number of deaths/intubated. These data's was putted, analysed and projected by the forest plots with informatics software called Rstudio to help them, using these packs: Openxlsx, meta e Office 2016. The graphycs is showing in the figures 2 and 3.
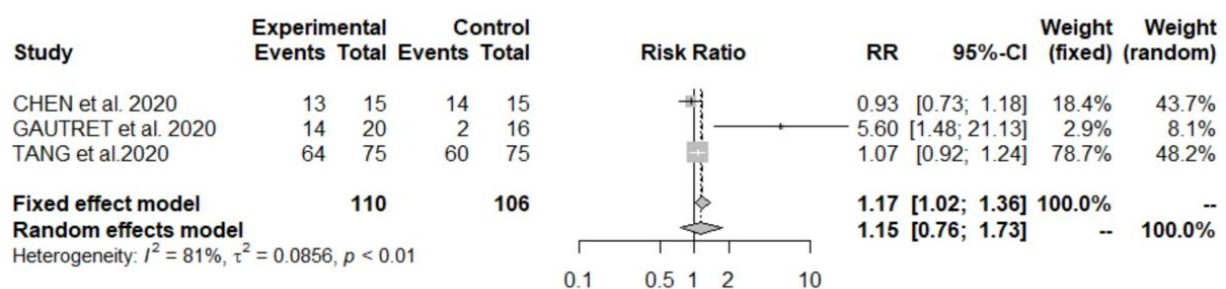
Figure 2: Authors, 2020. Graphic of forest plots which compare the use HCQ with or without AZT with

control group gainst Covid-19.

The meta-analysis of 3 clinical trials (RR: 1.15; IC95%, 0.76 a 1.73), did not found high differences when evaluated in a common outcome about negativation of PCR in patients using HCQ with or without AZT, comparing to control group who haven't used the therapy, a total of 216 persons in the research.
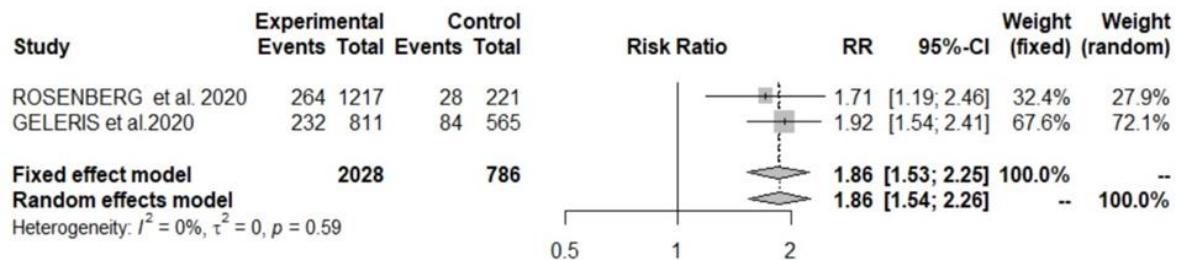
Figure 3: Source: Authors, 2020. Graphic of forest plots which compare the number of deaths about using HCQ with or without AZT, with control group who have not used the medicines.

Figure 3, shows a meta-analysis referent two articles, approaching 2814 patients, where checked up the number of deaths or people who needs to be intubated, in comparative groups: the experimental use of HCQ and control. Therefore, although this research shows a weak result (RR:1.86; IC: 95%, 1.54 a 2.26) should be considered a higher chance to death or intubation in patients who had HCQ in the therapy.

4. Conclusion

According with results, there is no highest difference about using HCQ with or without AZT about the final outcomes which evaluated the relationship with the control group. In this way, it's not possible to prove the effectiveness of these drugs in the fight against SARS-CoV-2, not only for the poor number of controlled clinical trials, but also for the limited sampling, evaluated without scientific rigor. Therefore, the necessity to improve the scientific production used to qualify the real power about using HCQ with or without AZT against covid-19 is more than necessary.

Acknowledgements

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White uniform's meanings for nursing teachers

Clara Felício Barreto Zatyrko, Régia Cristina Oliveira, Eunice Almeida da Silva
Brazil

Abstract

The uniform can be understood as a symbol which represents the individual's occupation in society and in the institution where he works. Nursing, since its early days, is a profession which demands the wearing of a uniform. Nursing schools, traditionally, are in charge of indicating the wearing of uniform, informing this clothing's symbolic importance for the profession. The present paper aims at analyzing the uniform's meanings revealed by nursing teachers at a high school and nursing technician course, in a school located in the North Zone of São Paulo, Brazil. This qualitative research with semi structured interviews and participant observation with nursing teachers. The results showed that there are meanings that update traditional values related to the profession, the feminine gender, professional identity and the association between uniform and painful experiences.

1. Introduction

As Sarti[1] states, "Although translated and subjectively apprehended, the meaning of every human experience is always historically and culturally elaborated, and is transmitted through socialization, initiated at birth and renewed throughout life". In this perspective here adopted, the senses attributed to all lived experiences are considered to have roots in the culture in which the individual is inserted. These socially elaborated senses also include the perception of the objects that surround them, many of which with outstanding symbolic importance.

In this text seeks to focus on the meanings built on one of these specific objects, the nursing uniform. It is about the apprehension of these meanings expressed by nurses and nursing teachers at a technical school of secondary level, in the city of São Paulo, Brazil. This text is discussed the professionals' perception of the uniform, which also express their relationship with the practice and experience in this area of expertise.

According to Benjamin's[2] discussion, "the way in which human visual perception is organized, the medium in which it occurs, is not only conditioned naturally, but also historically".

At work, wearing a uniform reveals the professional identity of a particular group within the society to which it belongs. In general, according to Adam and Herzlich[3], "the 'professionals' are distinguished from other jobs by a high level of theoretical and specialized training and a 'service orientation' for the population that corresponds to idea of 'vocation'". The nurse's uniform is indicative of his education, this vocation and his orientation for serving the population.

It can also indicate status, the indication of a function related to the health area, especially medicine, hierarchically more valued in Western society [3][4]. As developed by Adam and Herzlich[3], "Medicine has gained full authority over the disease and has acquired a monopoly on its treatment". Inserted in a field of

power relations, [5] nursing and other health professions work in a field of tension that differences related to gender [6], professional category and position matter. Concerning specifically professional category and position, the uniform shows hierarchical differences, also influencing the behavior of the agents who wear it. This is quite evident in the health field, according to its operating logic.

A logic that is underpinned by technical-scientific principles and a biomedical rationality.[4] In reference to the health field, the training of professional nurses is also guided by this logic, by reference to actions that are supported by 'technical-scientific security'. This logic, then, guides health practices and is seen by health professionals as being "natural" to the profession. This results from a professional training process and, through it, the incorporation of certain practices and values.

The training of nursing professionals' comprehension, which includes the wearing of white uniforms and the naturalization of practices within the health field, is helped, in this article, by some key concepts, with emphasis on the one of *habitus*, social field [7,8] and professional identity [9].

The *habitus* indicates behavior in a given circumstance; it can be understood as a set of perceptions, dispositions, to feeling, to doing, and acting in a certain way, in a given circumstance. Thus, becoming a teaching nurse is incorporating, throughout training and work experience, a specific professional *habitus*.

This *habitus* is acquired through social interaction and, at the same time, are the classifier and organizer of this interaction. The nurse's uniform is understood as a 'piece' that makes up the professional *habitus*, being part of the symbolic representation of the nursing profession.

Although this garment has a double unifying and fitting purpose, the individual attributes different meanings to work uniforms, that result from his relationships and lived experiences, the social web of which crossings and overlapping are part. The representations attributed by nursing teachers to the uniform at the aforementioned technical school bring revealing elements about the profession, teaching and practice, personal and professional experiences, also marked by tensions, biographical reorganizations and contradictions.

2. Materials and methods

This article results from a qualitative research, developed in a public high school and technical school, located in the North of the city of São Paulo-Brazil. The research techniques consisted of interviews based on a semi-structured script and on participant observation of teachers working in the classroom. For the proper conduction of participant observation, the disciplines that dealt more directly with the "pain" theme were chosen, that is, those whose approach of the syllabus to be taught involved pain, among which stand out "Medical-Surgical Clinic", "Urgency and Emergency" and "Intensive Care Unit".

From a universe of 23 teachers who were part of the teaching staff of the technical course in nursing, 12 teaching nurses were interviewed. The inclusion criterion was the verification of a period of at least three years of assistance. The reason for this criterion was to focus on professionals who had experience, in working time, as a teaching and assisting nurse.

It is present below the profile of the interviewed professionals: to age, sex and professional training. The group of teachers interviewed was composed of 12 subjects, 11 women and one man. As for the age group, there was a variation from 26 to 62 years. Most professionals are between 31 and 50 years old and

the rest belong to the age group of 26 to 30 years old. In relation to training, from twelve nurses interviewed, one holds a Master in Public Health and eleven nurses hold a specialization in Teaching and a second specialization, namely: ICU, Urgency and Emergency, Mental Health / Psychiatry, Orthopedics and Oncology.

The research has been submitted to the Research Ethics Committee of the School of Arts, Sciences and Humanities (SASH) of the University of São Paulo, approved under protocol No. 2823856. All the research subjects were instructed on the objectives of the study and on the voluntary and confidential character of their participation. Their agreement was registered with the signing of the Free and Informed Consent Form.

The field research, which included interviews and participant observation at the referred state high school and technical nursing school, located in the northern zone in the city of São Paulo, Brazil, took place over a period of six consecutive months, from April to December, 2017. The data were analyzed and interpreted in the light of the theoretical framework of this work.

3. Discussion

3.1 The uniform meanings by the first nursing schools

The nursing uniform composed an image that has become eternalized worldwide. As described by Peres and Padilha[10], the nurse's image is marked, in addition to other characteristics, by the clothing dressed during the nursing practice, which has been immortalized in global iconography, allowing us to identify the wearing of accessories such as the apron, the veil and the cap.

In Brazil, the authors point out that the nurse's religious image, associated with the institution, was established in the 19th century, "with emphasis on the Sisters of Charity of São Vicente de Paulo"[10].

The effective entry of a professional nursing model into Brazilian society, competing with the religious model, occurred with the creation of the Anna Nery School (EAN) in 1923, when the National Department of Public Health (DNSP) invested in the establishment of the Anglo-American model of nursing teams to support the development of the recently implemented Health Reform. (....) In the first half of the 20th century, the uniform determined by the EAN started to characterize the nurse model constituted according to the Anglo-American standard, later known as the Anna Nery standard[10].

Santos[11], discussing the influence of the American model on nursing education, between 1928 and 1938, highlights that in the students' socialization process, rigid moral values "(...)were intentionally inculcated, guided by the principles of hierarchy and discipline, aiming at bringing about a radical change in the habitus of candidates for the new profession."[11]

Nursing schools have always been in charge of imposing the wearing of uniforms on their students, as well as informing the symbolic importance of this clothing for the profession. Peres and Padilha[10] discuss this aspect, highlighting that with the organization of the EAN, the wearing of uniforms was implemented by North American nurses as one of the strategies to maintain institutional discipline, which made it possible to identify the students in their different stages of the course, as well as the nurses / teachers according to their area of expertise, differentiating them from other nursing workers and characterizing the female nurse of high intellectual and moral standard, who also stood out for her specific clothing[10].

The wearing of uniforms in nursing education, despite done in a specific way by an existing category

in that profession, predicts a training based on respect and a status based on scientific technical knowledge, also relating to the professional's ability to provide treatment and cure. At the same time, its wearing reveals tensions, among which the high responsibility the uniform also expresses.

3.2 Uniform versus identity (re)construction: some assumptions

Seeking to analyze the white uniform's meaning for teachers at a high school and nursing technician course, we propose to apprehend the perspective of these professionals on the uniform, in this profession. For so, we use the analytical category of social representation because it is the one that best meets the perspectives apprehension. "Social representations are dynamic sets, their characteristic is the production of behaviors and relationships with the environment, it is a relationship that modifies both and not a reproduction of those behaviors or those relationships, nor a reaction to a given stimulus."[12] Social representations "are modalities of knowledge used for communication and understanding of the social context."[13]

The reports collected from the interviewees reveal ambiguities in the representations on the white uniform. There is an expression of positive meanings that show pride for the profession, at the same time that elements which reveal pain and anguish are brought about by their memories and lived experiences as nursing professionals. The professional identity is built in that same duality, in difficult experiences considered painful and full of anguish, and in reconfigurations of oneself, in identity reconfiguration, as shown by some statements that highlight the bet on teaching exercise at the expense of patient care, which diversifies, not without tension, the construction of identities related to nursing work.

The current diversification of identities is discussed by Dubar[9]. The individual participation in different social fields and the diversity of positions that the individual can occupy in them make the differentiation of identities grow even more. Currently, the author assesses, there is a strong differentiation of identities at the expense of the development of a unique type of individuality. This differentiation occurs according to multiple possible combinations between different logics of activities, "forms of power and cultural levels". The consistency of these combinations must be given by each individual, which is done not without tension.

The author claims that the modern world, in its capitalist context, imposes to the individual the requirement that each one make his own choices, and then there is a conversion of identities previously inherited according to a community orientation to identity differentiations, the result of voluntary choices of individuals in a variety of fields in life. At the same time relationships and identifications tend to be unstable, in contrast to the security and stability of community identifications. Once in crisis, uncertain and unstable, the identifications will be centered on an individual construction work for oneself. These constructions concern both professional and personal life, given, for example, by new family compositions and lifestyles.[9]

In this process, individuals are constituting themselves, in the relationship with others, selecting "certain roles more than others"[9] in a process of identity transformation that is related to the revision and reinterpretation of their biography.

This is particularly important for nursing teachers, especially for those than define their identities, previously focused on care work, and see themselves now as teachers, seeking to disconnect themselves

from the activity previously performed and which relies on the uniform, whose wearing is mandatory, the materialization of a painful memory they wish to erase. The uniform is a reminiscence of experienced situations nowadays seen as painful; it reminds us of an identity which is reconfigured, as well as its subjectivity is reconfigured in the exercise of its work and of the relationships developed through it.

The uniform is one of the markers of professional identity. Through it, the individual highlights his belonging to the occupied category, which is important for his professional identification process. At the same time, this identity is also built by the experiences lived wearing this uniform. Conceived as an important object of the nurse's professional identity, the uniform also carries both the profession's historical marks, as well as each of the professionals' experiences along their trajectory. Its image is inserted in a system of meanings constituted both by the formation and by the experience of each professional, this one also constituted by the social representations about the profession.

In order to ponder the meanings attributed to the uniform by the teaching nurses, we rely on Benjamin[2] and his considerations about objects. As the author points out, objects "are inserted in a system of meanings that must be seen as elements articulated with each other in the field of human activities, that is, as systems pervaded by the dimensions of the 'unthinkable' and the 'invisible' that support it."[2]

3.3 Uniform and professional identity

Among some interviewees, the speeches about the uniform show its importance as a symbol of professional identity, both in teaching and in care practice: *"When I wear my work clothes, it is in fact when I feel like a nurse, it is as if that outfit incorporated the nurse who exists within myself, awakening a way of speaking and doing the things that are typical of this profession"* (X).

The relationship between clothing and professional identity in nursing is discussed by Dubar [9]. According to the author, the nursing uniform is, for the nursing profession, a symbol which contributes to the process of conceiving the institutional, social and professional identity of the class. This symbolism and its representation begin in the professional training, shaping it over the individual's years of work. The uniform impregnates the professional's attitude in each of his acts, which are guided, in the work environment, by a set of premises related to the profession. The uniform's white color holds important historical meanings, including hygiene and purity, which are constantly updated in professional practice. The following statement brings out this idea, showing the importance of the uniform, in this case, the white coat and the badge, in professional practice: *"In order to teach or even answer this interview, I need to put on the white coat and the badge, without them I don't feel like a teacher."* (Y).

Clothing reveals attributes and characteristics of the person wearing it (...). Clothes have their own language and communicate about the sex, age and social class of those who wear them and can also provide important information regarding the person's work, origin, personality, tastes and mood at that time.[14]

When referring to a profession, the uniform is part of the professional *habitus*. *Habitus* is defined by Bourdieu[7] as the system of unconscious dispositions, as a geometric place of objective determinisms and of a determination of the objective future and subjective hopes, tends to produce practices, and in this way, careers objectively adjusted to objective structures.

The wearing of the uniform and the badge are part of a practice in the field of nursing, a common

practice among its agents who incorporate it in such a way that its wearing immediately identifies them with their profession. Thus, the practice defined, among other provisions, by the wearing of the uniform and the badge, constitutes a *habitus*. This pattern of behavior, the wearing of the uniform to teach nursing classes, shows ways of being in the profession of an entire group that occupies the same position in the field. Thus, for a group of nursing teachers, wearing a uniform is part of an internalized practice that defines a way of being.

Some other statements also show the uniform's importance in the how these professionals work in nursing. The wearing of the uniform is a practice that is part of the incorporation of the professional *habitus*. In this case, work clothes embody the *habitus*; it is related to working, just as work is related to the uniform. It is as if the uniform's fabric reconfigured both body and identity, becoming part of the individual who wears it while exercising the profession. As another interviewee says: "when I wear my work clothes, it is in fact when I feel like a nurse", showing the correspondence between the uniform and the profession.

The uniform's white color is also an important element of meaning and professional identity Silva.[14] refers to this aspect considering the importance of the white color's symbolic meaning. As the author states, the symbolic meaning of the white color has been constructed and reconstructed throughout history. In ancient civilizations, the white color was related to divinity and wisdom. Later, other meanings were added to this color, such as: hygiene, clarity, energy exchange and retention of solar energy." It could also be seen as negative indications, making environments dull, lifeless, and leading to dispersion."[15]

The uniform has symbolic value and moral significance, and, in this sense, indicates the responsibilities of the wearer, given the position it occupies in its field of action. Thus, the consequences of the professionals' attitudes can always fall on the group to which the individual belongs. The uniform works as a disciplinary element that requires the person who wears it to behave coherently with the group and the institution he stands for.[9]

3.4 We are like angels: devotion and its updating in nursing

The following speech shows the uniform's meaning for the interviewee:

I put on my white uniform and feel like I am someone else, my thoughts about my life and my home are outside, I surrender to the profession, for this reason nursing has no sex, we are like angels, or we should be, it was something my teachers would always say (Z).

The uniform characterizes an exemplary conduct, symbolizing spiritual, moral and professional virtues such as humility, competence, selflessness and altruism. Teachers and nurses were identified and differentiated by their uniform. White, in addition to representing cleanliness, carries spiritual symbolism, being considered "the color of light, purity and perfection."[16]

The uniform's representation of some interviewees reveals the basis of the principles inherited by their professional training, which last throughout their career. The importance attributed to the uniform by the teacher above is also associated with expectations related to the female gender, to its association with care, seen as something "natural". This conception is linked, on the one hand, to the valuation that the profession given to women at the beginning of their professionalization. The nursing profession at that time represented an "open door" for its economic independence and some respect from society. Even nowadays, it is a profession that mainly concerns women.

On the other hand, gender expectations have historically linked nursing care to a "natural gift" of women. Rohden[17] in a study on the creation, in the 19th century, of gynecology in Brazil, reveals the existing concern with the difference between the sexes expressed in moral discourses of medicine on the role of women, which was previously defined by biology.

It is from this perception of the feminine, from the naturalization of certain characteristics considered proper to the women's "nature", that the idea of maternal care is linked to the figure of women, with regard to their "natural abilities".

The intensity with which the medical speeches set out to speak of the differences based on "nature" shows how indispensable they seemed in that context. On this basis it was described as natural that doctors created prescriptions relating to the social functions of both men and women.[17]

In another paper which discusses sexuality and gender in medicine, Rohden[6] shows how certain behaviors and perceptions of both doctors and patients are associated with gender differences. The author refers to a survey conducted in North American hospitals which shows that no other variable than gender influenced the attitude of those surveyed. One of these highlighted results shows that "patients tend to think that doctors are more 'human' and considerate, devoting more time to listening to patients and taking longer in consultations."[6] Another statement shows that patients used to interrupt women more frequently when talking to professionals than when they were discussing with a male doctor. This type of behavior, evaluates the author,   can only be explained by the attributes that are socially assigned to men and women, and that inspire different attitudes in doctors and patients in relation to people of the same or opposite gender.[6]

These attributes, considered as "female" ones, such as being more human and more caring, and which inform both health professionals and patients, interfering in how they relate to each other, are also expected in professions in which there are traditionally more women than men.

Historically, nursing is a priority category for women. When resuming its socio-historical aspects, it can be said that nursing is born as a service organized by Catholic religious institutions and the female figure is not at the center of this service. It is a woman who takes care of children, the sick and the elderly.[18] The professionalization process in nursing begins with Florence Nightingale and the use of the uniform so becomes mandatory.[19] Thus, a female nurse enters the world of work, wearing a costume that symbolizes respect and dignity, attributes that she needs to show in a society economically dominated by men.

Caponi[19] also makes reference to the idea, developed within nursing, of the nurse's association with devotion and submission. From Florence Nightingale onwards, the consecrated woman will be replaced by the professional nurse. She will no longer have a religious character, however, the assistance provided will continue to be considered as a bond that supposes and reinforces submission.[19]

Before Florence, there was what the author called "consecrated woman". For this "consecrated woman - the charity lady who precedes the professional nurse", there was "an almost sacred status. They were recognized as having divine gifts for their actions, their alms, their assistance, which made them benefactors."[19]

These almost sacred attributes end up being updated in nursing practice. As the interviewee pondered, one commits herself to the profession, for this reason nursing does not have sex, they are like angels, or they should be. And it is under the condition of angel, of devotion, that the interviewee perceives her performance in the profession. A devotion that supplants perception, sexual differences, making everyone

equal in nursing. As she points out, when putting on the white uniform, she leaves out thoughts about her life and home, giving herself totally to the profession. The uniform gives rise to this identity transformation and, as the interviewee points out, at that moment, she feels that she is someone else; she feels that she is an angel, as her teachers taught her.

This perception of devotion and sublimation through the profession results from a socialization process that includes the learning of certain values which are incorporated throughout professional training. A process of education that is partly intentional, but which also has an unintentional part, referring, to a large extent, to the observation of teachers' practices and discourses concerning the profession. A learned and incorporated devotion is not always free from unpleasantness. Some interviewees highlighted great disgust with the practice of assistance and, associated with it, with the uniform, resulting in a redefinition of identity and biographical review.

3.5 The uniform as a reminder of pain and the choice for teaching

"I prefer to teach nursing in theory, going to the field means wearing a white uniform again... this uniform brings painful memories to me" (*J*).

At work the nurse wears always wears a uniform, a white uniform. As the interviewee says, going to the field means wearing a white uniform again. However, wearing this uniform brings her back memories of pains suffered in her professional exercise; makes her live again, as a reminder, the pains experienced in professional practice – "this uniform brings me painful memories", she ponders. The uniform immediately recalls a professional practice that the interviewee no longer wants to remember. Work clothes / uniforms can be interpreted here as a kind of scar, obtained during professional practice. Although the memories do not depend on the wearing of the uniform, it brings them out, as if looking at the uniform would make the past and painful memories return. In this case, the uniform has a negative meaning for the interviewee, marking an experience she wants to forget, classified by the professional as a painful memory.

In modern Western societies, medicine has an authority over disease and a monopoly over its treatment[3]. There is a set of practices that cover the ritual of a consultation and have great symbolic importance, both for the professional and for the patient. The whole ritual of medical consultation - looks, gestures, questions, white clothing - is of enormous symbolic importance. The patient's - and doctor's - belief in the powers of medicine is a powerful ally in any circumstance.[4]

The white uniform worn by the doctor and also by nurses and other health professional categories is part of a set of ritualistic practices. It's wearing, at the beginning, in the first anatomy classes, works as a kind of rite of passage, integrating the student into the community of that profession, which includes a set of values, codes and rules. When wearing a white uniform, the student recognizes himself and is recognized as an equal, belonging to that professional training environment. Over time, the professional habitus[7] incorporates the white uniform, an outfit of great symbolic importance.

Van Gennep,[20] in a classic study on the different rites of passage, brings the following consideration: [...] individual life consists of a succession of stages, with ends and beginnings of the same nature, namely, birth, social puberty, marriage, paternity, class progression, occupation specialization, death. Certain ceremonies whose object is identical are related to each of these sets, making an individual move from a specific situation to another equally determined situation.[20]

In the health field, in the various professional categories, there is a set of situations that collectively mark the passage of the individual's entry into this new universe. The use of the white uniform can be considered, in many situations, as a rite of passage, a moment considered valuable and highly expected by students.

However, in professional practice, the same uniform that marks the entry into the profession can also mark, in the course of their exercise, the pains experienced by them, as the interviewee pointed out.

If, at the beginning of the career, the wearing of the uniform, as a rite of passage for entering the profession, has a positive meaning, belonging to the professional community, painful experiences lived during the practice, reorient the meaning of the uniform, now seen negatively. The uniform now means belonging to a certain area of the nursing profession, care for patients, which the interviewee no longer wants to access, as well as the pains that accompany it.

Thus, it is because she no longer wants to practice nursing care and sees painful memories in her uniform – the ones the interviewee wants to avoid-, that she then says "I prefer to teach nursing in theory", since assistance brings the memory of a pain that wants to be left behind.

Starts from a theoretical framework[21] that takes emotions as socio-cultural phenomena, and is not, therefore, given in itself, but a result of meanings shared collectively.

Despite its uniqueness for those who live and feel pain, their senses can be shared with others and this sharing highlights the social dimension of pain.

The states pain, like love, refers to a radically subjective experience[1]. The one who feels the pain says "I know". In the face of the other's pain, there is commotion, suffering (or even joy), with greater or lesser distance and intensity. Despite singular for those who feel it, pain, like any human experience, brings the possibility of being shared in its meaning, which is a collective reality (although we can never be sure that what we attribute to the other corresponds exactly to what he attributes to himself.[1]

Taken from the context in which it is inscribed and from the situation assessment by the individual at a given time and place[21], the pain can present positive meanings, referring to the idea of strength, courage and honor, making sense for those who live it and for the whole community that accompanies it. This is the case, for example, of societies in which initiation rites are carried out. These rites evidence the courage, bravery and belonging to the community in which the rite is performed. In this case, the pain is not only endured by the initiate, but is also seen by him and the community to which he belongs as something that has a sense of existence; that integrates him to the group, to its rules, which everyone also has already experienced, in their initiations, the same process, kept in the memory and marked on the body of each one of the initiates[22].

During the initiation ritual for adulthood, the initiation or passage rite takes the body of the initiates as an object to record the rules of these societies. In this case, the pain needs to be tearing in order to be marked in memory and in the body. The laws of society, the author points out, will be inscribed on the body of each of its members. This pain has an important sense of aggregation, not only the pain, but the marks left on the body that are its records. The body that society designates as the only propitious space to contain the sign of a time, the trace of a passage, the determination of a destination. The body mediates the acquisition of knowledge and that knowledge is inscribed in the body through a process of laceration and pain that is faced without complaints of suffering by the young person who attributes meaning to the ritual

of his society.[22]

Young people who enter adulthood through this ritual attribute to pain a positive meaning, belonging to the group they wish to be part of; they take part in the rite and do so keeping silence and, in some cases witnessed, even with tranquility. The scars imposed on the body are a permanent sign of this desire to belong.

Keeping the proper distances between societies and their cultural and historical context, it is possible to draw a parallel with the interviewee's speech, regarding the relationship established between pain, scar and belonging, which highlights the social character of pain in both contexts. It is not a matter of comparing the tearing pain experienced in the body of initiates in a ritual of passage into adulthood in societies without writing with the pain revealed by the interviewee when talking about her uniform. Rather, it is a matter of thinking about the place of this pain, less in its intensity and form than in its sense of existence. If, in the first case, of a society without writing, pain refers to a desired belonging, in the other, of the nursing professional, pain, which in addition to not being in relation to an allowed tearing of the body, as in the first case, is bonded precisely to an unwanted belonging, therefore, without a positive sense for the teacher. In this parallel that seeks to relate the triad pain, belonging and scarring, the nursing uniform acts as the skin of the initiate of society without writing, that skin where the pain is inscribed. In the case of the interviewee, this inscription is made through memory and the visualization of the object, the uniform, which brings the immediate association with the pains already experienced and unwanted. A pain that does not tear the flesh, but defines an important dimension of suffering for the teacher interviewed, when she refers to the uniform she stopped wearing in teaching activities.

Unlike the young man who, during the transition period, sees in the scars the positive meaning and belonging to the community group, for nurses, work clothes represent pain and suffering, negative meaning, without the desire to belong to the professional group.

As another interviewee says, *"once I enjoyed that white uniform, nowadays I want distance from it, I don't even want to see it, much less wear it"* (W).

Thus, it is clear that the representation of the uniform is not static, undergoing changes related to the re-signification by the wearer, based on the experiences she has lived. As already noted, during the training period, the nursing student seems to have a positive representation of the profession, however, during the daily work, this representation is modified and often becomes negative and painful. This fact could be identified in the respondents' speeches that migrated from assistance to teaching, as it was conceived as a job that causes less anguish and pain.

Nowadays, it is not required by training centers that the nursing teacher wear a uniform and not even an apron to teach. The uniform is restricted only to classes in the nursing laboratory and in the hospital internship. However, in the present study, it was observed that some teachers claim to insist on wearing the uniform. In this case, the statement of the professional identification that the uniform provides is made explicit, whereas in other cases its removal even from memory is necessary, implying a reconfiguration of the professional doing itself.

4. Conclusion

The present study sought to reflect on the meanings of the uniform for nursing teachers at a technical high school in São Paulo, Brazil.

The apprehension of these meanings was based on observation of classes taught by nursing teachers and semi-structured interviews with these professionals. In these two moments, it was at central focus both the teaching and assistance practices, activities experienced by all those surveyed, taken as a trigger to talk about the uniform in the exercise of the profession. Positive meanings, associated with status, identity, and professionalism, clash other perceptions, sometimes of the same interviewee, showing the lived dubiousness that the uniform brought out. Among pains and identifications, the existence of meanings that revitalize traditional values related to the profession and the female gender has been highlighted; meanings related to professional identity and the association of the uniform with pain and painful experiences with the profession.

It is interesting to observe how the generational factor is related to the meanings attributed to the uniform. Thus, among professionals in the age group of 50-60, positive meanings related to status, respect, and dignity are highlighted. Professionals aged 20 to 31 associate the uniform with the pain and suffering experienced in the profession. The first group belongs to a generation in which the nursing uniform meant respect, status, and dignity, being associated with the possibility of entering the universe of work and the professionalization of women. Unlike the experiences of the former, younger professionals enter a job market that presents them with more opportunities, and they can exercise a profession that is now more consolidated. Perhaps because of that, positive values such as status, respect, and dignity, evidenced among the older ones when they talked about the uniform, are relativized by the former. These ones highlight the pains and sufferings when mentioning the meanings attributed to the uniform, since they associate it with an exhaustive, stressful job, in which the nurse is exposed to borderline situations of life and death and does not feel valued for the work she does in the society in which she lives and in the environment in which she works, as highlighted by the interviewees.

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Virtual Reality: Authentic and Immersive Learning in the Science Classroom

Heather Stone, Manyu Li, Kenneth A. Ritter III, Terrence L. Chambers
University of Louisiana at Lafayette
USA

Abstract

The diversity of learners within education is neither linear nor constant. Educators are challenged to be responsive and understanding when encouraging learners to construct meaning while adhering to stringent standards. The objective of this study is to integrate science standards into authentic learning experiences, created in both a traditional teaching method and virtual reality (VR) platform, for 8th grade middle school students in Lafayette, Louisiana. The authentic experiences were based on oral histories of the residents of Isle de Jean Charles, Louisiana, who have lost 98% of their ancestral homeland since 1955. These experiences were then tied to the National Science Standards (8-MS-ESS1-4, 8-MS-ESS2-2, and 8-MS-ESS3-1). The students were split into two groups and given either a PowerPoint or VR experience, both having the same content. The researchers tracked engagement, focus, interest, and how important the students thought the content was. Using an experimental approach, the researchers also gave a pre- and posttest to determine if the VR experience resulted in better academic learning than a regular, PowerPoint-based lecture. The students were also asked to comment on their experience of the PowerPoint versus the VR and describe their experience. As shown in the results of the study the students who completed the PPT experience **agreed** it was engaging, but those who completed the VR found the experience **strongly agreed** that it was engaging. When the students were asked about the experiences helping with focus the students **agreed** that it did help them, but those who were tested with the VR **strongly agreed** that it helped with focus.

1. Introduction

Few approaches offer the potential benefits of VR learning technology. Though the design and implementation of immersive learning experiences is closely tied to curriculum standards, there is an opportunity to speed up the learning process and simultaneously measure student progress. The overarching goal of this project is to enhance the quality of research and education in experiential learning about sustainability by using 360-degree videography to capture oral history and present this in a VR platform. According to *U.S. News & World Report*, Louisiana currently ranks 49th among the 50 states in terms of education. There is a myriad of efforts that are underway to address students' deficiencies in Louisiana's public-school systems. The use of VR and serious gaming for education has been shown, under certain circumstances, to allow for more efficient learning and cognitive material intake [1],[2]. It has been statistically shown that students are more motivated by game-based learning and that this has a significant impact on their learning achievement [3]. Serious game tasks can promote 21st century problem-solving skills and knowledge of concepts [4]. Interaction with a 3D environment in VR is powerful for both static and dynamic information, and some of the most well-engineered and commercially successful applications for direct-manipulation interfaces are video games [5]. Using knowledge tests, immersive serious games have been shown to captivate students more than traditional methods, leading to superior retention [6]. The results from this research corroborate these results and show that more testing is needed to determine how

and when to VR should be implemented in the K–12 classroom.

Authentic learning, such as that focused on sustainability has a global interest, but it is especially critical in Louisiana as the state lies only 100 feet above sea level. Too, one-quarter of Louisiana's land is in the Mississippi delta, where one-third of it is covered by fresh- and saltwater wetlands. The content for this lesson focused on Isle de Jean Charles, the ancestral home of the Isle de Jean Charles Band of Biloxi-Chitimacha-Choctaw Indians. The tribe is recognized as the first climate refugees in the contiguous United States. They want to share their experiences in order to prevent future communities from losing their homes. The lessons were created using archival research about the Island and include simulations and 360-degree video of the Island. The resources listed above are integrated into the application and presented in VR headsets.

1.1. Overview of the Literature

Until recently, the use of VR in the schools has been cost-prohibitive. The use of immersive VR environments in order for students to experience authentic and realistic virtual scenes is becoming more and more possible [7]. Virtual environments allow for the blending of real places with virtual content. As an educational tool, immersive environments allow students to reach places not easily accessible from within the classroom setting, creating learning interactions within the virtual environment [8]. This is integrated into the current curriculum standards [9]. Additionally, VR is preferred by educators over traditional learning tools [10] as, specifically, the opportunity to develop immersive learning experiences. Teachers found VR beneficial in teaching complicated concepts [11],[12]. Recent developments found that VR paired with immersive experiences can significantly help in learning complicated scientific concepts [13]. Other studies found strong evidence that enhancing interactive (e.g., allowing users to interact with the environment) and immersive components (i.e., allowing users to immerse in the virtual world) in VR can increase engagement of learners in educational settings [14].

Another benefit of applying VR in an educational setting is that it can immerse students in an interactive educational environment that is too expensive to create [15]. Although some scientific concepts are visible (e.g., a chemical reaction that has change in colors), many are not observable in the real world (e.g., planets). Even if it is observable, it may be too expensive for some schools (e.g., a field trip to understand a specific ecology). This is particularly problematic for low-performing students who often come from lower socioeconomic status.

1.2. Project Goals and Research Questions

The goals of this project are to design and implement an immersive learning experience using VR for middle school science teachers to teach topics relating to sustainability. To assess the effectiveness of the pedagogy, an experimental design was used to test whether students who learned the materials using VR had better outcomes than students who learned with a traditional PowerPoint (PPT) lecture. Specifically, our research questions asked, when compared with the PPT lecture condition, if students in the VR condition:

1. have a higher quiz score of knowledge after the lesson?
2. show higher academic motivation to science and school after the lesson?
3. show higher engagement in learning science after the lesson?
4. show a more positive sentiment about the lesson?

2. Lesson Design and Method

2.1. Sample and Procedure

The study used both quantitative and qualitative methods to gauge the students' experience. The VR and PPT experience both took between 15–20 minutes to complete. There was a check for understanding in both the VR and the PPT experiences. The content of the VR and PPT were completely the same.

There were five sessions of classes that were taught the same topic. These sessions were taught via the VR condition or through traditional PPT slide. Because of the unequal number of students in each session, we had more students in the VR than in the PPT slides group. Students completed a pretest a week before the lesson and a posttest right after the lesson.

Our sample consisted of 116 8th graders who completed both the pretest, posttest, and the lesson (PPT vs. VR). Among them, 68 were female and 48 were male; 70 were in the VR condition and 46 were in the PPT slide condition. Students in the VR condition were not significantly different from students in the PPT slide condition in their pretest quiz score or pretest academic motivation score. This showed that the samples in the two conditions were not different.

2.2. Planning

In planning the lesson design, the researcher worked with the classroom teacher to determine what lesson would align with both the classroom lessons and the curriculum for the district. Researcher Stone had been working with the Biloxi-Chitimacha-Choctaw tribe from Isle de Jean Charles (IDJC) and wanted to tie in the tribe's experiences with land loss to the standards 8th grade students were learning in their classroom. The essential questions from the Lafayette Parish School System curriculum that would be answered based on the lesson were as follows:

1. Why is Louisiana such a fragile region?
2. How does the land loss in Louisiana affect the natural resources?
3. What are the human factors that impact land loss in Louisiana?

These essential questions tie into the Next Generation Science Standards. The specific standards, which are all 8th grade standards in the category of Earth Science, are as follows:

- 8-MS-ESS1-4: Earth's Place in the Universe
- 8-MS-ESS2-2: Earth's Systems
- 8-MS-ESS3-1: Earth and Human Activity

Once the determination had been made on which standard the experiences would teach, the researcher and the teacher worked together to determine a set of multiple-choice questions to test the knowledge that the students needed to know. Below are some of these questions:

- What long-term effect did the loss of marshland have on local animals?
- How were the residents of the Island economically affected by land loss?
- How was the bayou cut off from fresh water?
- How have the changes on IDJC impacted its people?

Researcher Stone then reviewed the 360-degree videos of oral histories collected from tribal members living on the Island and chose specific segments that would demonstrate the key concepts chosen for the lesson. A script was created to supplement the narrator's stories and explain the background of how the land loss was affecting IDJC.

The same script was used for both the VR and the PPT versions of the lesson. There are four scenes with follow-up questions that are a check for understanding. The first sets the stage and shows the students where IDJC is in relation to the world. The next shows a backwards model of what IDJC looks like in 2016 versus what it looked like in 1963. The narrator points out the difference in the marshland surrounding the Island in 1963 and the water in 2016. The next three scenes feature videos of IDJC Tribal members, starting with Wenceslaus Billiot, then moving on to Maryline Naquin, and finishing up with Father Roch Naquin.

1932-1956   1956-1973

1973-1975   1975-1977

1977-1985   Present Day
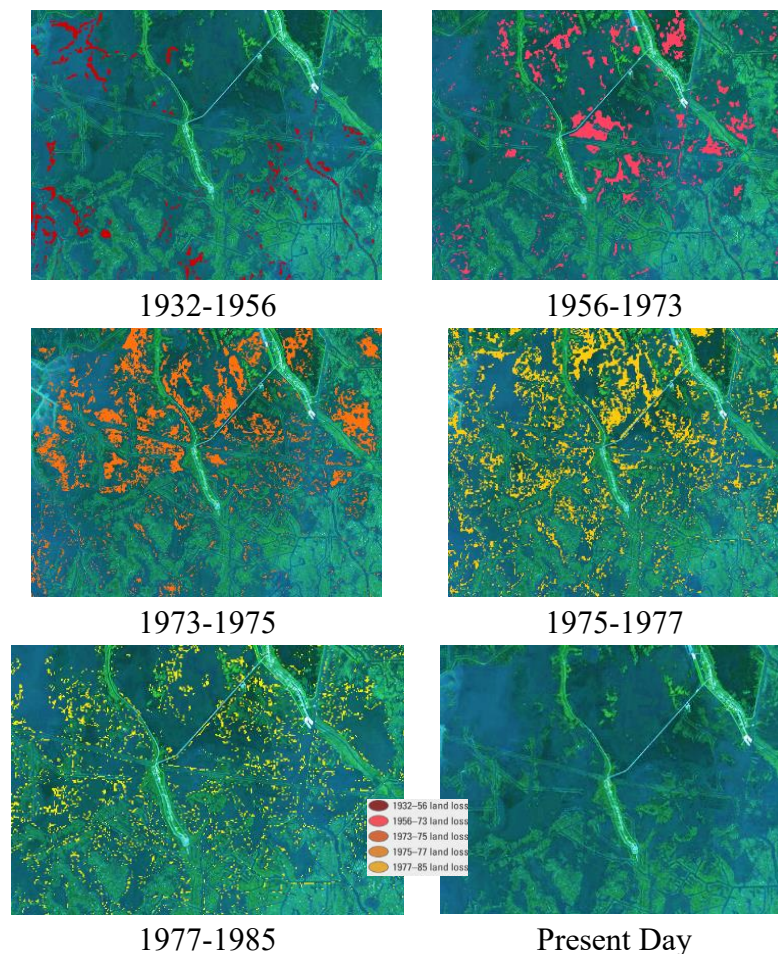
Figure 1. Changes on Isle de Jean Charles from 1932–1985.

2.3. Differences in Virtual Reality and PowerPoint Versions

In the VR version, the students were shown a world map that zoomed in slowly to the U.S., Louisiana, and then finally IDJC. Throughout the process, each area is highlighted. The PPT version begins with a picture of the world that then zoomed to IDJC, using Google Earth (see Figure 1). During this, the narration below was presented to students.

Narrator:

The Mississippi delta region was slowly created by the Mississippi River over the last 8,000 years. Over the last 300 years, humans have significantly altered its natural path and disrupted its flow. The river flow has been forced on new paths to the Gulf and fresh water is not being distributed to all areas of the Mississippi delta; Isle de Jean Charles, Louisiana, in Terrebonne Parish is one such area.

The depletion of natural resources in the coastal region of Louisiana was first seen in the early 1800s with the beginning of the exhaustion of hardwoods due to logging and the levee system. These forests were for materials in building homes and other construction. The trees also prevented the erosion of soil, which helped maintain the marsh.

Louisiana's 3.5 million acres of coastal wetlands have been condemned as suffering the fastest land loss on the continent. The damage to the ecosystem changed the land and with it the lives of those there first. Louisiana is predicted to lose 1,750 square miles of land in the next 50 years if no action is taken.

In the creation of the VR lesson, 360-degree videos are integrated into the virtual environment. This allows

the students to look around the home of the narrator and be immersed in the experience (see Figure 2,3). In the PPT lessons, the 360-degree videos are flattened into a typical video one would see embedded in a PPT presentation (e.g., MP4).
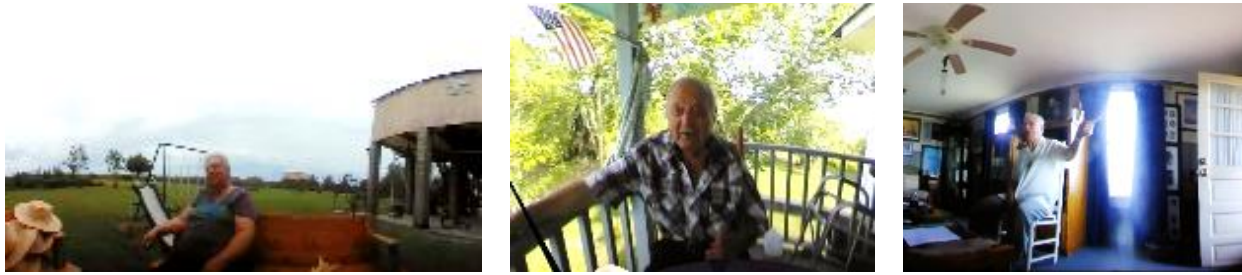
Figure 2. Images from 360-degree videos: left, Maryline Naquin; middle, Wenceslaus Billiot; right, Father Roch Naquin.
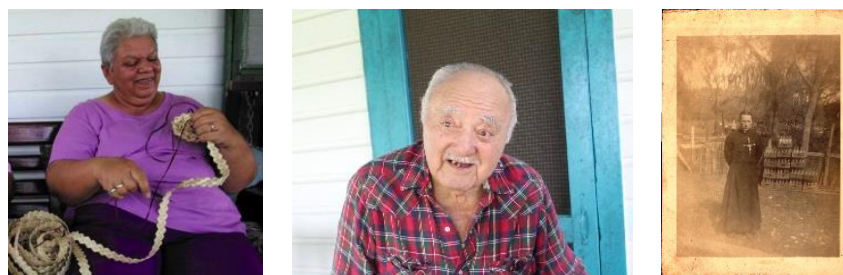
Figure 3. Images from PowerPoint presentation left, Maryline Naquin; middle, Wenceslaus Billiot; right, Father Roch Naquin.

The check for understandings was built into the VR environment with the student using the remote from the Oculus Go (Facebook, California) to answer (see Figure 4). If the student gets the answer correct, then the narrator says, "Correct," and proceeds to tell them why. If the student answers incorrectly, then the narrator says, "Not exactly," and proceeds to explain why they did not get the answer correct. The student must click on the correct answer to move on to the next scene. In the PPT version, the answers are displayed on the PPT slide, which the teacher reads to the whole class; the students answer as a group. The teacher then reads both what would happen if the student got the answer wrong and if they answered correctly.
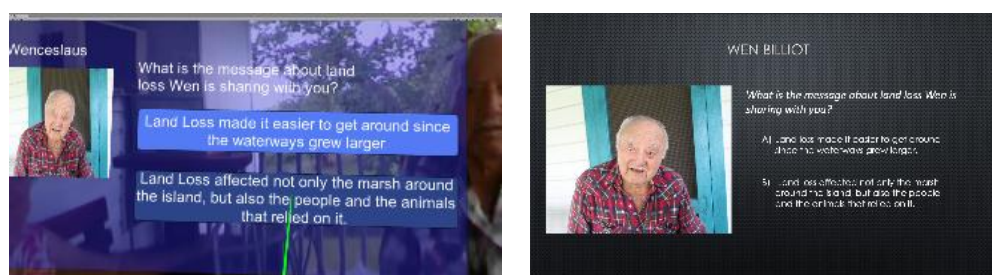
Figure 4. Images of check for understanding left, in virtual reality; right, in PowerPoint presentation.

The final scene for the PPT ends with the check for understanding on the information that Maryline Naquin shared. There is a bonus scene in the VR version. The student is immersed in a submersible and the effect of erosion is coming at the window in a 3D effect. While this is occurring, the screen on the submersible shows the land loss from 1963 to the current on IDJC. This was not possible to do in the PPT version as it was modeled in the VR environment.

2.4.Assessment Measures

To assess whether students in the VR condition had better learning outcomes than students in the lecture condition, several learning outcomes were measured before and after students learned the materials. Specifically, we measured students' knowledge of the content and academic motivation a week before the lesson and immediately after the lesson. We also measured students' attitudes toward the lesson after the lesson. To assess students' knowledge, ten quiz questions were developed by the classroom teacher and the educational researcher. In addition to knowledge, academic motivation was rated from 1 (strongly disagree) to 5 (strongly agree) and measured using a modified version of an academic motivation scale previously tested in the same population, tapping into students' interests in school, science, and the class topic. Attitudes toward the lesson were measured using a 9-item Likert scale measuring students' engagement in the lesson (VR vs. PPT lecture) (see Figure 5,6).
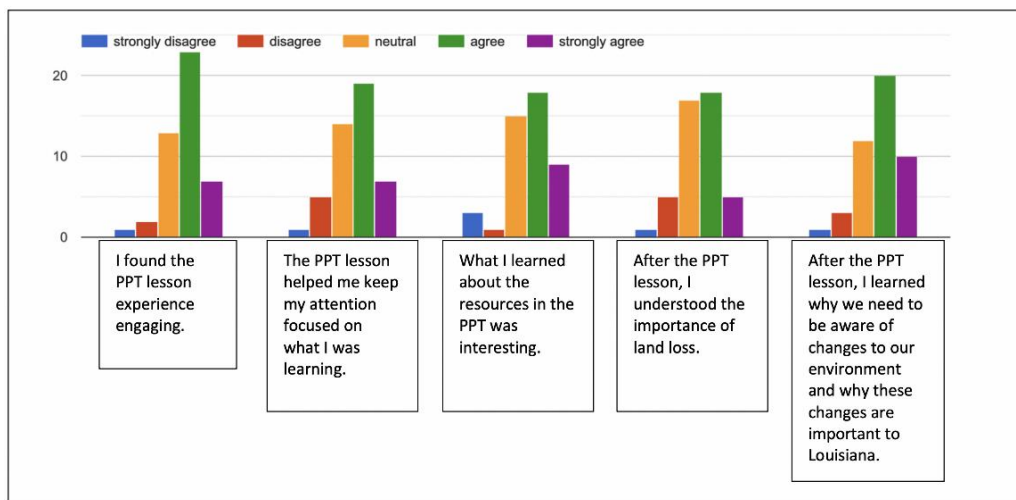
Figure 5. Results from the PowerPoint (PPT) presentation lesson.
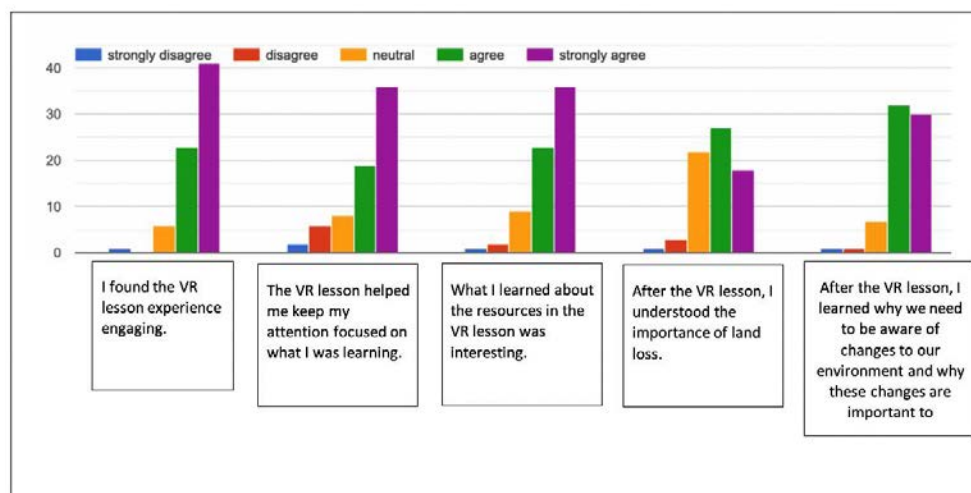
Figure 6. Results from virtual reality (VR) immersion lesson.

Finally, students were asked to write freely their feelings and thoughts of the lesson. Text mining strategy was then used to compute students' sentiments as reflected in their written responses. Specifically, R package sentiment [16] was used to extract sentiment scores from students' written responses.

To assess students' learning outcomes across conditions, a series of nonparametric Wilcoxon rank sum tests was performed using R programming. Wilcoxon rank sum tests were chosen because our sample is small,

and the two conditions have unequal sizes.

2.5. Application Development

To develop the application, 360-degree videos were taken on location. The videos and 3D models were then brought into the Unity 3D game engine [17], where interactive educational content is added. The 360-degree videography used for content creation was filmed using three 360-degree cameras: the 360 Fly, which has a single fish-eye lens, the YI 360, which had dual fish-eye lens, and the Panotek camera rig, which uses ten YI 4K cameras. The Panotek camera rig requires postprocessing in the form of stitching and editing to correctly align all the videos. The Kolor software, (GoPro, California) Autopano Video Pro [18], and Autopano Giga [19], are used to stich and edit the videos. Audio is recorded and edited using the digital audio editor, Audacity [20]. Blender [21] and Maya [22] are used for 3D modeling of objects in the scene and applying textures. The Unity 3D plugin iTween [23] provides an animation system that was used to control the vehicle and player locomotion, and the plugin, VRTK (VR tool kit) [24], provided grabbing interactions and controls. All of the programming was done using C# in Visual Studio [25] for the Unity 3D game engine. The Oculus Go VR headset is used for display and interaction.

3. Results/Assessment

3.1. Statistical Findings

Paired sample Wilcoxon rank sum tests were performed to test, across the two conditions, whether students' quiz scores and academic motivation were improved after the lesson. Results of the statistical tests revealed that students showed improvement in the quiz scores in both VR condition (W = 269.5, $P < 0.001$) and PPT slide condition (W = 65, $P < 0.001$) (see Figure 7).
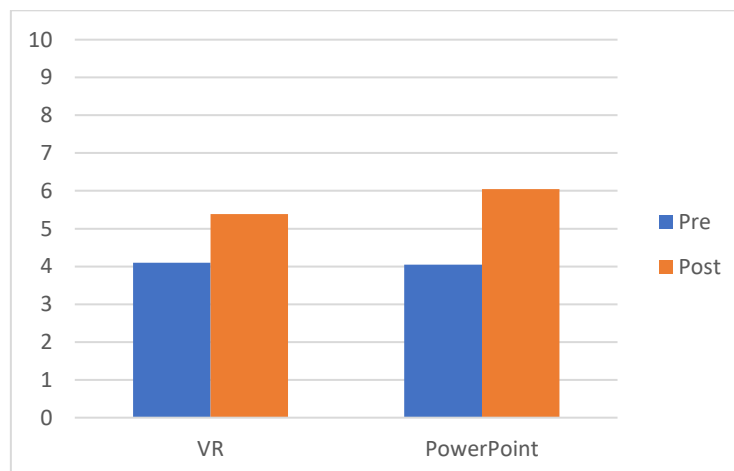
Figure 7. Quiz scores across conditions.

In addition to quiz scores, our results showed that students in the VR condition showed significantly more improvement in academic motivation than had students in the PPT slide condition (W = 3592.5, $P < 0.001$). Specifically, compared with baseline measure, students in VR condition reported higher academic motivation (W = 422.5, $P = 0.006$). However, students in the PPT lecture showed no significant improvement in academic motivation (W = 144.5, $P = 0.184$) (see Figure 8).
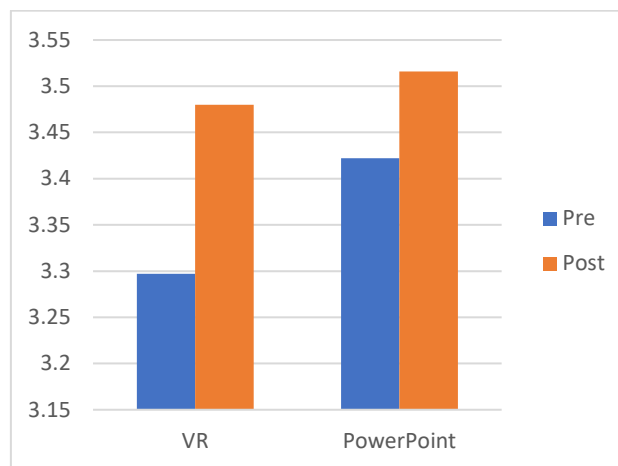
Figure 8. Academic motivation across conditions.

Overall, students in the VR condition reported feeling more engaged (i.e., had a more positive attitude toward the lesson) (W = 13225, $P < 0.001$) and showed more positive sentiments in their lesson feedback (W = 4005, $P < 0.001$) than students in the PPT slide condition.

In summary, although both conditions showed improved knowledge toward the learning materials (i.e., both the VR and the PPT conditions are useful in improving students' knowledge), students that were taught with the VR condition showed greater improvement in academic motivation (i.e., interests in school, science, and the class), more positive attitudes toward the lesson, and more positive sentiments toward the lesson than students who were taught with the traditional PPT lesson (see Figure 9,10).
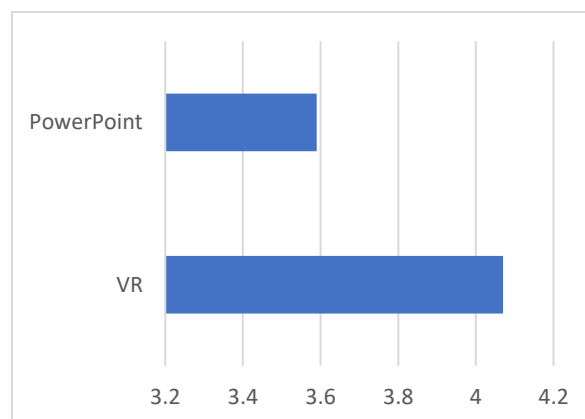
Figure 9. Lesson engagement.
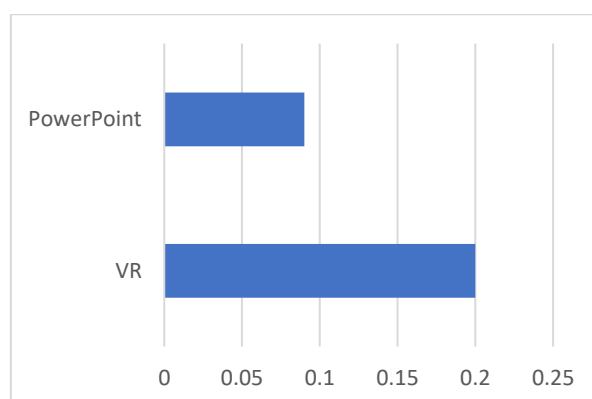
Figure 10. Positive emotion experienced.

3.2.Students' Feedback for the Virtual Reality Experience

Students' feedback was in general positive about the VR experience. Our sentiment analysis showed that for participants in the VR condition, 85.7% of the students expressed positive emotion after the lesson, while only 62.2% of the students in the PPT condition expressed positive emotion. Some students expressed that being able to use VR to view the actual environment helped them understand the materials and visualize science.

- *"It is like you are right there with them—they are talking to and with you. I liked it and [am] glad I got to experience it."*
- *"…my virtual reality experience was amazing.… This VR showed me different things and how awesome it is to pay attention to actual science."*
- *"I've had fun seeing stuff like I was really there on the VR. I've learned about how people use to love fishing and getting on their boats in the water and the VR made it so much more real."*

  Students also expressed that they would like more VR experiences in the future.

- *"The virtual reality was really cool, and I think that if we did it more often that it would really help us with the lessons."*
- *"…VR was a really fun way to learn [ring levee] and I think we should use this in school like how we use the chrome books."*

  Other students reported how VR helped them focus when learning.

- *"It was great, it helped me stay on task and it helped me learn about the subject faster."*

3.3.Students' Feedback for the PowerPoint Experience

Students' feedback showed they related to the IDJC residents through the PPT experience. The students were interested in the content and felt like they learned from a story to which they could relate.

- *"I learned about the land loss and the climate troubles and the people who were affected by the loss of the land."*
- *"The PowerPoint lesson was interesting. I like the fact they got people from the community [got] to show their perspective. It showed me how bad land loss is and makes me interested on the topic of trying to stop it."*
- *"The PowerPoint was nice and interesting. I learned why the people of the island cannot go fishing and have barely any trees. I liked the videos and how the globe zoomed into the island."*

None of the students said they wished for more PPT experiences in the future nor did they give any mention of how the PPT focused or increased their understanding.

4. Summary/Conclusion

As shown in the results of the study the students who completed the PPT experience ***agreed*** it was engaging, but those who completed the VR found the experience ***strongly agreed*** that it was engaging. When the students were asked about the experiences helping with focus the students ***agreed*** that it did help them, but those who were tested with the VR ***strongly agreed*** that it helped with focus. As for the Wilcoxon rank sum indices, the results showed that higher improvement with the VR versus the PPT between the pre- and posttests. When the students were asked to comment on the experiences, the typical response for the PPT was about how they enjoyed the content; however, for the VR, this comment sums them up, "My experience with virtual reality was incredible. I really like it. It was something new and something different for me." The analysis of this project shows that students were not only more engaged and focused with the VR experience, but that they improved academically.

5. Recommendations for Future Educational Virtual Reality Applications

- Create interactive lessons where students can engage with the content in VR.
- Discover other communities to tell their stories in a VR experience that will support other curriculum standards.
- Support students research on communities undergoing change that would support learning standards.
- Create a platform where students can help build the VR experiences.
- Assess students' long-term retention by retesting a month after the experience.

6. Acknowledgments

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Perception of Organizational Support in the Superintendence of Management of Public Administrative Expenses of the Government of the State of Rondônia

Bruna Livia Timbo de Araujo Balthazar, Jackson Balthazar de Arruda Camara, Gleimiria Batista da Costa Matos

Universidade Federal de Rondônia, Brazil

ABSTRACT

This research was motivated by the need to identify what is the relationship between organizational support provided by the Superintendence of the Public Administrative Expenses Management – SUGESP to its servants, the perception of servants of this support and to the concepts of sustainability. The general objective is to assess the relationship between the organizational support offered by SUGESP and the perception of employees. Theoretical aspects were addressed, such as the theory of Organizational Support, the conceptualization of the importance of employee satisfaction for the success of organizations, the Theory of Organizational Support, concepts of Public Administration and sustainable development. The methodology employed is quantitative approach, the search strategy used was the case study and study procedures were done through document analysis. Data collection was carried out by applying a self-administered questionnaire to a sample of employees working at SUGESP, as well as with the managers of the Superintendence. At the end of the research, it was identified that the average responses from the interviewed employees point out that they are indifferent to the perception of organizational support, while the manager, in the direct affirmative questions, identifies that the support offered is indifferent. In the inverse affirmative questions, he agrees that there is effective support. It was also identified that approximately 56% of the employees do not have a clear understanding of the concepts of sustainability, a fact that influences the achievement of objectives and goals defined by managers.

Keywords: Organizational Support. Public Servants. SUGESP.

1 INTRODUCTION

Public Policies constitute State actions formulated with the objective of fulfilling their institutional and non-delegable role of promoting the well-being of all, especially by ensuring and universalizing basic rights to citizenship, such as education, health, housing, sanitation , urbanization, sport, culture, leisure, professionalization and, in a supplementary nature, social assistance. However, so that you can achieve these goals, it is necessary the performance of several servants, managers and the good functioning of the public machine. Santos (2003) states that in the subjective sense, public administration encompasses the set of bodies and legal entities that exercise administrative functions of the State assigned by law.

Based on this assumption, this research was developed to assess the relationship between the organizational support offered by SUGESP and the perception of employees, and also the understanding of the sustainability concepts of employees who work with the essential services of the Government of the State of Rondônia. Since the creation of the Superintendence there was an increase in the results obtained with is the public policy: based on Economy reports there is a reduction in consumer spending of over 20% in recent years. Thus, it can be inferred that this study is essential to maintain the satisfaction of the servants, since without their dedication the results can change.

During the studies and theoretical surveys, the existence of scientific research that addressed the theme of Perception of Organizational Support was identified with the CAPES journal, the most relevant being the Doctoral Thesis entitled "Organizational Support Perceived in the Brazilian Navy: In search of the Sacred Fire" by Pereira (2016), who investigated the different ways that members of the military organization perceive support in the workplace and obtained as a result: that the perception of individuals "shield" the institution and that there are flaws in training or character of isolated individuals.

When addressing aspects of Organizational Support, it is necessary to study the Theory of Organizational Support, which in Eisenberg's view (1986) is the set of general beliefs that employees of an institution regarding the valorization of the organization and its contributions to employee well-being. This theory considers the development of employees, the nature and the results obtained from the perceptions as crucial points for the development and supply of the organizations' needs. The relationship between employer-employee, the basis of the reciprocity norm, the commercial effort spent by workers and the dedication to tangible, intangible and remuneration incentives work as socio-emotional incentives, of approval and care of the institution with employees (EISENBERG et al., 1986).

Laswell (1936/1958) defines that public policies are based on answering questions such as: who wins what, why and what difference does it make. At this point, we identified that for the Public Policy to Control Expenses with Essential Services, the environment gains indirectly from the economy, as there is less pollution and greater care with "waste" and the big difference will be found in the economic and social aspects, as there will be less expenditure on essential expenses (sometimes unnecessary) and these may be directed towards a social purpose of the State Government.

Sustainable Development based on public policies needs these to be based on the triple bottom line (TBL), which reflects on the need to consider in its strategic decisions the economic bottom line, the social bottom line and the environmental bottom line (ELKINGTON, 1997). Nascimento (2012) states that sustainable development, apparently, presupposes an intellectual and moral reform in order to welcome and encourage the adoption of new technologies and new ways of living. Suggesting that sustainability, in its essence, should not only have "three leaves", should not forget the political issue and will have as a transversal line the solidarity ethics to the excluded today, so that there will be no excluded tomorrow.

In this study we adopted a hybrid method based on the Organizational Support Theory of Eisenberg et al. (1986) and the concepts of sustainability, being divided into five stages: assumptions, theoretical support, data collection, tabulation and analysis. In the first stage, the assumptions, general and specific objectives that guided the studies were defined. In the second, the theoretical survey was elaborated about the theories and instruments that supported the collection and analysis of the data.

In the third stage, data was collected with SUGESP public servants regarding the perception of

organizational support (questionnaire I) and with Managers regarding the organizational support offered (questionnaire II, adapted from the Theory of Organizational Support by Eisenberger et al, 1986). In the fourth, all collected data was tabulated to support the completion of the fifth stage. Finally, the fifth stage was based on the interpretation of the tabulated data and on the analysis of the sustainability concepts that the interviewed employees answered in the questionnaires, in an essay.

Considering that the Public Policy Control with Essential Expenses directly impact across the population of the state of Rondônia, the following question arises: What is the relations between the effective organizational support provided by the Office of the Public Administrative Expenses Management - SUGESP to its servants with the perception of organizational support by the servants?

The general objective of this research is to evaluate the relationship between the organizational support offered by SUGESP and the perception of the employees. Which was subdivided into three specific objectives: verify what is the Perception of Organizational Support that SUGESP's employees have; study the perception of employees of the superintendence of sustainability concepts; and identify what is the relationship between the perception of organizational support by the employees and the organizational support offered by managers.

2 THEORETICAL FRAMEWORK

This chapter comprises aspects such as Theory of Organizational Support, Importance of employee satisfaction for the success of organizations, Public Administration, Sustainability and other theoretical aspects that are necessary for the development of research, problem response and achievement of objectives.

2.1 *Theory of Organizational Support*

The Theory of Organizational Support had its main insights originated in the work of Eisenberger et al. (1986) through the concept of Perception of Organizational Support (POS), currently developed by Baran et al. (2011). Based on the initial definition of the Theory, POS is understood as the set of general beliefs that employees of an institution have in relation to the valorization of the organization and its contributions to the well-being of employees. Taking this concept as a starting point, the entire development of the theoretical construct follows.

Eisenberger, Huntington, Hutchison and Sowa in 1986 started studies on the Theory of Organizational Support and, from the beginning, the Perception of Organizational Support was studied through their own questionnaires, forming a construct of high reliability indexes: as it had questionnaires with composition of 36 items, which presented Cronbach's Alpha of .97 in the work carried out in 1986 by Eisenberger et al, and in 1990, with the same author, the Alpha ranged from .74 to .95. The table below shows the 36 statements in Table 1 - Survey of Organizational Support Perceived in the work carried out by Eisenberger et al in 1986.

Table 1 – *Survey of Perceived Organizational Support*

QS	Affirmation
1	The organization values my contributions to well-being.
2	If the organization could hire someone to replace me with a lower salary it would do that.
3	The organization fails to recognize any extra effort on my part.
4	The organization strongly considers my personal goals and values.
5	The organization would comprehend a long period of absence due to illness.
6	The organization would ignore any complaints from me.
7	The organization does not care about my interests when it makes decisions that affect me.
8	When I have problems, the organization offers help.
9	The organization really cares about my well-being.
10	The organization is trying to expand to help me do my job and leverage my skills.
11	The organization fails to understand my absences due to personal problems.
12	If the organization finds a more efficient way to get my job done, it will replace me.
13	The organization would forgive a mistake without deception on my part.
14	It would take a small drop in my performance for the organization to want to replace me.
15	The organization thinks there is little to be gained by keeping me employed for the rest of my career.
16	The organization offers me few opportunities to continue being promoted.
17	Even if I did the best job possible, the organization would fail to notice.
18	The organization would lovingly consider a request to change my working conditions.
19	If I got fired, the organization would rather hire someone new than have me back.
20	The organization is always willing to help me when I need a special favor.
21	The organization is concerned with my overall job satisfaction.
22	If it had the chance, the organization would take advantage of me.
23	The organization shows little concern for me.
24	If I decide to resign, the organization will try to persuade me to stay.
25	The organization cares about my opinions.
26	The organization thinks that hiring me was a mistake.
27	The organization is proud of my achievements at work.
28	The organization is more concerned with achieving results than with me.
29	The organization would understand if I was unable to finish a task in time.
30	If the organization has an expansion, it will consider increasing my salary.
31	The organization thinks that anyone can do my job as well as I can.
32	The organization is not concerned with paying what I deserve.
33	The organization wants to give me the best job that I'm qualified to do.
34	If my job goes extinct, the organization would rather fire me than transfer me to another position.
35	The organization tries to make my work as interesting as possible.
36	My supervisors are proud that I am part of the organization.

Source: Elaborated by the author (2018), adapted from Eisenberger et al (1986).

Among the studies found related to the theme of Organizational Support, we highlight the one carried out by Hochwarter et al. (2006) that addresses Job performance, that is, job performance being used as a parameter for the development of this research and for the analysis of social exchanges, since the interest of the organization will be reached when the recognition of employees obtains the same degree of importance.

Still in the seminal study developed by Eisenberg et al. (1986), a Perception of Organizational Support questionnaire was presented to identify which aspects would influence the perception of this support: company satisfaction in having him as an employee; valuing the employee's extra effort; satisfaction with employee performance; anticipation of the employee's future value; concern with employees' opinions and goals; the organization's concern about making a fair payment; job enrichment; job satisfaction; and also the measures that the organization would take in the various hypothetical situations proposed (replacement of employees with less costly ones, response to complaints, acceptance of delays and failures, increase of wages due to increased profitability).

After applying these questionnaires, reliability and validity tests were performed, obtaining 93.9% of common variance and 48.3% of total variance, and through the analysis it was concluded that the 36 questions had a load above 60% and it was suggested that all of them remain (EISENBERG ET AL., 1986). In the view of Pereira (2016), all research that was located on this topic made use of an instrument translated and validated by Siqueira (2003), which validated the use of a questionnaire with a reduced scale of 6 items.

Before the theory was created, Levinson (1965) made observations regarding the actions taken by the agents of the organizations that are often understood as the mirror of the main intentions, that is, the organization's guidelines and not attributed solely to the personal reasons of each of the agents. These perceptions are directly influenced by the legal, moral and financial responsibility of the organization and the actions of its agents, by organizational policies, norms and culture that provide continuity and prescribe role behaviors, or even by the power that the agents of the organizations exercise over individual employees.

It is difficult to find study of the Theory of Organizational Support in an individualized way, being mostly linked to studies of psychological contract, theories of social support, employee turnover, job performance, employee well-being, commitment and others. This situation is explained by means of the Social Exchange Theory, which states that "effort and loyalty are the result of tangible benefits or socially recognized awards" (RHOADES and EISENBERGER, 2002). Thus, behavioral analysis and all the other studies mentioned above are always looking for a better understanding of POS and the justification for the satisfaction of valuation through tangible elements (salary increases and bonuses) and intangible elements (recognition and respect).

The Theory of Social Exchanges also states that there must be a pair of elements that will interact in a compensatory way, that is, it will resemble the law of physics of action and reaction, and there should be a reciprocity to each job well performed by one of the parties. Cropanzano and Mitchell (2005) detail the rules of reciprocity in three types: reciprocity as a pattern of interdependence; reciprocity as a culture belief; and reciprocity as a normative or personal moral issue. Therefore, it is observed that it is a cyclical and continuous process of reciprocity, where the action of one agent will be directly related to the action of the other, explaining the interdependence relationship classified in the first type of reciprocity. The

second type is linked to the cultural issue, as it will be motivated by the sense of justice in the long term, being recognized and given an answer in relation to the first action taken. And in the latter type are normative questions, that is, goals must be met and actions taken in exchange for punishments for non-compliance.

Emerson (1976) warns that the Exchange Theory focuses on the movement (exchange) of resources through social processes and assumes that a given resource will only continue to flow if, and only if, it obtains an equally valued return. This return should not necessarily be monetary, but must be linked to issues of reciprocity, according to one of the three types mentioned above, and must be defined according to the pre-established relationship.

Based on the Theory of Organizational Support and the studies of Rhoades and Eisenberger (2002) it appears that there are three ways to observe the existence of this support within organizations, namely: awards and working conditions, justice and support from the supervisor. In addition to the three mentioned, there are also issues that are linked to personality traits and personal characteristics of employees, such as: age, education, gender and time working in the organization. In addition to the Theory of Organizational Support, there needs to be an effective perception of this support.

2.1.1 Perceived organizational support

The first way of perception mentioned is linked to awards and working conditions that can occur in different sectors of the company and to demonstrate to employees the existence of this organizational support, namely recognition, salary, promotions, stability, autonomy and training.

The concept of perceived support according to the Social Exchange Theory will only be maintained if there is constant reinforcement at all levels, whether micro or macro, that is, there is a need for social interactions (different conditions, salaries, promotions and enrichment of the that create mutual obligations (EMERSON, 1976). Another aspect is addressed by Rhoades and Eisenberger (2002), which are the personality traits - positive or negative view of the world -, and the despotic performance of the company, influence as moderators of the formation of perception.

The second way of perception is through justice, which is subdivided into four dimensions according to Colquitt et al. (2013), which are:

- Procedural justice: will reflect the perception of how the decision-making process is immaculate and to what extent conscious, accurate and open to opinions;
- Distributive justice: it will reflect the perception of how fair the result of the decisions, in greater emphasis the degree of equivalence of the results;
- Interpersonal justice: will reflect justice in the implementation of decisions taken;
- Informational justice: will reflect the quality and ownership of communications.

Rhoades and Eisenberger (2002) stated that justice is directly linked to the way of treating and respecting the employees of the institutions, to the reward systems and also to the procedures, rules and policies for the distribution of resources. In view of this, it is observed that the employee's satisfaction with some award received is not a sign of a sense of justice and of agreement with the awards made by the system. For these reasons, greater detail and perception on the part of superiors is necessary in the analysis of the existence or not of organizational support in the institutions.

Therefore, the perception of procedural fairness is what defines the support that the institution provides, influencing with subjective reasons the way that employees understand to be treated. When situations are widely perceived that there is a demonstration of concern for the well-being of employees, they are always taken to future attitudes, as there is a probability of provoking greater productivity in the individual and also a social exchange of action and reaction.

The supervisor's support is closely related to the concept of support perceptions, since similarly the perceptions that occur in relation to organizations, there is with the supervisors and a concern with them. On the other hand, there is a responsibility for organizational actions, which is attributed to the fact that it is the first element to have contact with employees, and also as a consequence of the actions taken by them.

These relationships can be good or bad, because if there is an aggressive behavior by supervisors and the employees notice that there is a hostile feeling, verbal or non-verbal aggressions, which damages these relationships will generate unproductive impacts and consequently compromise the company's results. Another relevant aspect is the organizational support that the supervisor himself receives from his superiors, because if this support is influenced in a positive way, he will be feeling more confident and supported to influence his subordinates and the interaction rates will be increasingly higher.

Figure 1 shows the relationship and the existing cause and effect situation between the way of treating the employee, the way of providing existing support and the result obtained with the perceived support.
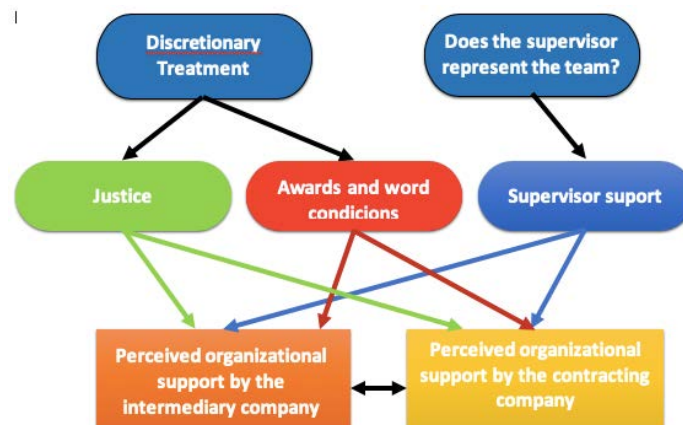
Figure 1 – Theoretical model of perception of organizational support – Outsourced companies
Source: Elaborated by the author. Adapted from Baran et. al. (2011)

2.1.2 The marginal view vs. the humanistic view

Within the study of the Theory of Organizational Support. Eisenberger and Stinglhamber (2011) classified that in modern organizations there are two distinct visions to managing people: marginal and humanistic vision sight. The marginal view is based on the premise that employees do not have a natural talent for the activities they perform, are unmotivated and ignorant and still generate a very high cost for the institution in exchange for low added value. The humanistic view, on the other hand, is contrary to seeing natural talent, believing that with training and motivation employees are able to become effective and still see them as the pillar for organizational success. These assumptions cause consequences in the managing people in each of the views.

In the marginal view, training is focused on the performance of specific tasks, the skills of employees are standardized and in a simple way, low wages, work overload, there are no awards as motivation, but punishments when failures occur and safety at work is almost null, as these are discarded as soon as the company finds technologies that replace or cheaper labor.

In the humanistic view, from a social point of view, the consequences are milder, as the training is carried out to develop the personal and professional skills and the talent of each of the employees. Personal skills are used to advance organizational goals, that is, there is an appreciation on the part of the organization. And professional experiences are recognized for superior performance and the identification of the employee with the organization's interests is cultivated, with no professional discarding, but an increasing investment to make it human capital.

It is noted that the two views are very different in relation to the of the organization's interest on the employee. In the marginal view, there is an enormous demand on the part of the employees without the minimum remuneration, leaving them totally marginalized. The humanistic view, on the other hand, gives all the necessary support and makes the employee feel motivated to stay at the institution, contribute to success, give all the necessary support. It is through this reciprocity that Eisenberger et al. (2002) state that the Perception of Organizational Support will emerge in the environment of mutual obligations.

2.1.3 Reflexes of the perception of organizational support

Rhoades and Eisenberger (2002) stated that the perceptions of organizational support presented are classified in seven: organizational commitment, affection for work, involvement with work, performance, reaction of aversion, desire to stay or quit work. Later, Baran et al. (2011) complemented with worker safety, commitment to the company in the case of outsourced or temporary workers, and cultural values as a mediator of commitment and performance. The seven perceptions in the authors' view are detailed below.

Organizational commitment: this perception will be composed of affective feelings, an emotional connection between the individual and the organization; continued, when dealing with rational relationships involving cost-benefit analysis for remaining in the organization; and normative, comply with all contractual rules to remain in the organization. When there is interference by an intermediary agent, in the case of outsourced contracts, there is a need for greater concern, as it will require that organizational commitment relationships occur in two ways.

Affection at Work is understood as the set of feelings and emotions that the employee may feel, whether positive or negative. When there is a great perception of organizational support, there will be a direct impact, for the better, on the worker's mood and satisfaction.

Involvement with work: it is directly related to personal interest in the performance of work activities. When employees' perception of competence increases, interest in doing the job will increase.

Performance: these are the behaviors that employees develop beyond normal, that is, stressors that influence situations such as stress level or desire to stay or leave the organization. These influences are natural and modified according to each degree of incidence and can help the organization in its growth.

Aversion Reaction: Support measures can reduce aversion reactions, that is, the tensions that employees develop in relation to stressors, indicating the possibilities of help, both material and emotional,

that they will need to increase their demands and results. The consequences of these aversions are directly related to fatigue, anxiety and headaches.

Desire to stay or quit work: When employees are likely to leave the organization, they are motivated to stay as a result of receiving higher wages and high costs if they choose to leave. Thus, the influence of the POS can be clearly seen. Withdrawal behavior occurs when employees stop actively participating in the organization and POS will work to reduce possible delays, absenteeism and voluntary employee turnover, changing this thinking.

In order to apply the aforementioned Theory and obtain the greatest success, the study of the concepts of public administration and sustainability was carried out so that it was possible to establish links and better interpret the results achieved.

2.2 Superintendence of management of public administrative expenses - SUGESP

SUGESP was instituted and created initially by Complementary Law No. 706, of April 10, 2013. Among the incorporated duties, are found in art. 3 of CL No. 706/2013 the coordination, operation, technical advice and standardization of activities related to official transport; general protocol and general services; and control of spending on essential services. It should be noted that in 2013 the control and implementation of the Public Policy for the Control of Essential Expenses began, through SUGESP.

Subsequently, in 2015, Complementary Law No. 827, of July 15, 2015, which provides for the organizational structure and functioning of the State Public Administration, incorporating organs of the State Executive Branch and takes other measures under this law. SUGESP became part of the Governance structure, providing support, control, advice and representing the government.

In art. 58, § 1 of Complementary Law No. 827/2015, it is emphasized that the Office of the State Governor will have its own organizational structure and will be complemented with technical and operational support from SUGESP. Thus, demonstrating its importance for the structure and smooth running of the public service. And Art. 70, makes it clear that it is a body of "governmental management, as an instrument for planning, coordinating and executing middle activities, related to expenses of an essential nature, logistics, assets and maintenance of administrative units of the Executive Power, under the terms of the Complementary Law n. 706, of April 10, 2013 ".

In November 2015, there was one more amendment through Complementary Law No. 841, of November 27, 2015 that Amends and adds provisions of Complementary Laws n. 827, of July 15, 2015; n. 622, of July 11, 2011; n. 447, of June 2, 2008; n. 68, of December 9, 1992, and Law no. 2,981, of March 5, 2013; repeals Complementary Law no. 706, of April 10, 2013, and article 47, of Complementary Law no. 827, of July 15, 2015, and changes the name of the Superintendence of Supply Management, Logistics and Essential Public Spending - SUGESPE and other provisions. Thus, passing the name of the Superintendence of Management of Supplies, Logistics and Essential Public Spending - SUGESPE to Superintendence of Management of Public Administrative Spending - SUGESP.

After all these changes, it was confirmed that SUGESP is a management body and instrumental in supporting, controlling, advising and governmental representation. And its objective is the planning, standardization, control and coordination of the middle activities, related to the quality of the administrative

expenses and the logistics of the Executive Branch, including all the bodies that make up the direct State Public Administration, and also, in the same scope:

- Propose policies, schedule and monitor the activities of using and moving logistical resources, supplies and contracting services, acquiring and disposing of movable assets, acting as the central organ of the logistical system and of controlling activity costs in the structure of the Executive power;

- Implement, standardize, coordinate, supervise, guide and improve operational management practices involving expenses with transportation logistics, administrative services in general and documents, including general protocol;

- Promote transparency, control and increase the level of efficiency in the quality of public spending on supplies, logistics and administrative structure services;

- Increase the quality and economy of the purchases and contracting of services aimed at supporting the operationalization of the Executive Branch's activities;

- Make corporate acquisitions and contracts, generating efficiency gains, economies of scale and logistical organization, expanding the list and fostering the competitiveness of state suppliers;

- Provide administrative, financial and logistical support to the offices of the Governor, the Vice-Governor, the Military House and the Civil House, including regarding ceremonial, official press, ombudsman, legislative and public relations activities;

- Ensure the efficient management of the fleet of official vehicles;

- Provide administrative, financial and logistical support to the offices of the Governor, the Vice-Governor, the Military House and the Civil House, including regarding ceremonial, official press, ombudsman, legislative and public relations activities;

- Advising the Governor, the Vice-Governor and the Chief Secretary of the Chief of Staff in their respective areas of competence;

- Directly assist the administration of the state departments used as headquarters by the State Governor, including their residence;

- Plan, coordinate and execute processes for central acquisition of goods and contracting of services inherent to the operation of Palácio Rio Madeira and its annexes, as well as managing contracts, considering the levels of services associated with them, with a view to optimizing logistics / operations and the public spending;

- Manage the maintenance of the official fleet, whether owned or leased;

- Manage the supply of essential water, energy and telephone services, within the scope of the State Executive Branch;

- Standardize and operate the core of travel and daily allowances for public servants and occasional employees of the Executive Branch, with a view to control, economy, safety and efficiency, centralizing the receipt, analysis and deliberation of requests from the Holders of the bodies, in accordance with the guidelines defined by the Chief Executive, promoting, when authorized: the indication of the appropriate means of transportation, cost collection, ticket issuance, traffic authorization and preparation of travel

decrees, following the publication in the State Official Gazette and compliance with the objectives.

To act in cooperation with all bodies that make up the direct and indirect State Public Administration,

It also aims to comply with and enforce the provisions of Decree 19.462, of January 20, 2015, which establishes rules and measures for the efficiency of public spending, within the scope of the Executive Branch, with SUGESP coordinating and supervising the logistics of the goals passed on to each within its scope of action.

In view of the above, we can see that the macro objective is to comply with and enforce the Public Policy for the Control of Essential Expenses so that the sustainable development of the State of Rondônia can be achieved, with economically viable, environmentally correct and socially just actions.

3   Methodological procedures of research

The research was divided into five stages, in the first one, the assumptions, general and specific objectives were defined, guiding the studies. In the second, a theoretical survey was elaborated about the theories and instruments that supported the collection and analysis of the data. In the third stage, data collection was carried out with SUGESP public servants regarding the perception of organizational support (questionnaire I) and with the Managers regarding the organizational support offered (questionnaire II). In the fourth, all collected data was tabulated to support the completion of the fifth stage. Finally, the fifth stage was based on the interpretation of the tabulated data and on the analysis of the sustainability concepts that the interviewed employees answered in the questionnaires, in an essay.

3.1 Research classification

Classified as a survey of mixed methods, it combines the predetermined methods of quantitative research with emerging methods of qualitative as well as open and closed questions, with multiple forms of data covering all possibilities, including statistical analysis and textual analysis. In this case, the data collection instruments can be expanded with open observations, the researcher bases the investigation on the assumption that the collection of different types of data guarantees a better understanding of the researched problem (CRESWELL, 2007, p. 34-35). The research was carried out in the natural environment of the respondents, the researcher was the fundamental instrument for development, using a theoretical lens and collecting data by means of a questionnaire, characteristics that are substantiated by Creswell (2010).

Using documents to support this research, it characterizes as a documentary analysis, as it seeks to identify factual information in the documents from questions and hypotheses of interest (CAULLEY apud LÜDKE and ANDRE, 1986). "The documentary technique uses original documents, which have not yet received analytical treatment by any author. [...] it is one of the decisive techniques for research in social and human sciences" (HELDER, 2006)

In the view of Ander Egg (1978), research can be defined as applied when "it pursues direct and immediate application, however, it is related to the discoveries and advances of basic research", so it is stated that this dissertation resulted in a research of an applied nature that after carrying out the theoretical

contribution, a questionnaire was applied to collect data, according to the specific methodology of the theory, and the analysis of the results was carried out based on the theories presented and on the results found from the documentary analysis of the Essential Expenses Control reports.

Regarding the procedures, in the first moment bibliometrics was carried out, which according to Vanti (2002) "is the study of the quantitative aspects of the production, dissemination and use of registered information, which develops mathematical models and patterns to measure these processes, using their results to prepare forecasts and support decision-making ". This method was chosen in order to compose a theoretical framework that is of fundamental importance for understanding the theories and analyzes of the data collected.

According to Mazzotti (2006) "in the collective case study the researcher jointly studies some cases to investigate a given phenomenon, which can be seen as an instrumental study extended to several cases". Based on this statement, it appears that this procedure is fundamental for the development of the proposed research and was adopted in the second stage of the work as a research strategy. Demo (1995) corroborates this procedure, stating that it is a very specific research modality, as it requires a deep and exhausted study of a particular case that is strongly linked to the context and its result cannot be generalized.

One of the objectives of this research is to carry out a descriptive analysis of the data, which according to Creswell (2010) is used for the variables in a study that includes the description of the results by means of means, standard deviations and variation of scores, thus defining regarding the typology as a descriptive research.

3.2 Population and sample

The initial population of data collection from the servants was based on the fifty servants that work in the administrative part of the Superintendence, however we only got responses from thirty-two servants, composed of commissioned and effective staff. In the case of managers, the population would be the Superintendent and Executive Director, however only this one answered the questionnaire. The application of two questionnaires is based on the need to analyze the effective Organizational Support in a comparative way between that offered by the Managers and that perceived by the employees. During the execution of the research, a sample of thirty-three people was completed for the application of questionnaires I and II, as detailed below.

3.3 Instruments used

To collect data from the servants, a self-administered questionnaire was used, composed of 36 statements that were placed on the Likert scale , where the respondents needed to mark only the fixed points stipulated in the line, in a system of seven response categories (points) that range from "totally disagree" to "totally agree" (LIKERT, 1932).

The statements that were part of the questionnaire originated from the 36 items proposed in the Organizational Support theory itself, as expressed in topic 2 Theoretical Reference. In addition to these statements, Questionnaire I was also made up of questions about the level of education, gender, age, marital status, whether you have a leadership role and time working at the institution. In order to make a posteriori

comparison, in terms of knowledge of sustainability, an essay question about the interviewee's understanding of Sustainability was included at the end of the questionnaire.

For the elaboration of Questionnaire II, an adaptation of Questionnaire I was made, as it deals with the perception on the part of the server and the one was created to identify what managers think they are offering support. The questionnaire methodology remained the same, that is, composed of 36 statements that were placed on the Likert scale , so that respondents needed to mark only the fixed points stipulated in the line, in a system of seven response categories (points) ranging from "totally disagree" to "totally agree" (LIKERT, 1932). He contemplated questions about the level of education, gender, age, marital status and time that the role of gestures plays within the institution.

3.4   Data collection

The data collection made with the SUGESP servants, was based on the forwarding of the electronic questionnaire to the personal and corporate e-mail of all fifty servants, using the Google Forms platform. For the collection of data with the managers who work in the Superintendence (members of the Office - Superintendent and Executive Director), the same electronic platform and the mechanism of distribution of the access link by e-mail were used, as described in item 3.2 Population and Sample and in item 3.3 Instruments Used.

3.5   Data analysis

When the questionnaires were applied, all results were tabulated individually, using the SPSS software, version 22 for IOS, considering a 95% confidence level and a 5% risk of statistical inference. The responses that were linked to the Likert scale were thus transcribed for the program and the rest were used to stratify the collected data and perform comparative analyzes.

Within the statistics of the factor analysis , the Bartlett's Sphericity Test was performed , which is a test statistic used to examine the hypothesis that the variables are not correlated in the population, that is, the population correlation matrix is an identity matrix, where each variable correlates perfectly with itself ($r = 1$), but has no correlation with the other variables ($r = 0$). The KaiserMeyer - Olkin Adequacy Measure (KMO) is the Index used to assess the adequacy of factor analysis. The values obtained through this test vary between 0 and 1, where 0.80 or above is admirable; 0.70 or above, median; 0.60 or above, mediocre; 0.50 or above, bad; and below 0.50, unacceptable (MALHOTRA, 2001)

According to Hair et al. (2005), the net effect of rotate r factorial matrix is to redistribute the variance of the first factors to the last in order to achieve a simpler and more significant factor standard. There are different types of possible application speeds. The orthogonal rotation used was called VARIMAX, which concentrates the maximum simplification of the columns of the factorial matrix by maximizing the sum of variances of loads required from the factorial matrix.

The results found on the perception of the servants were also compared with the perception of the managers, so that it was possible to identify the difference between the view of those who offer support and those of those who receive it. It should be noted that the questionnaire was only answered by the Executive Director, given that it is not possible to perform Factor Analysis and not even establish the correlation matrix.

Therefore, we proceeded with the comparison between the average response of the servants and the response of the executive director so that we could confront and demonstrate the support offered with the support perceived by the servants.

4 Data results and discussions

In this chapter, all the results obtained after processing all the material collected during the research and which supported the assessment of the relationship between the organizational support offered by SUGESP and the perception of employees and the concept of sustainability will be addressed.

4.1 Organizational support – Servants

In order to analyze and discuss the data, the sample was initially detailed, which was done using a descriptive frequency statistic, composed of the minimum, maximum, average and standard deviation, according to the analysis that each variable allows. When tabulating the data, we observe that the average time in which the employees act in the Superintendence is 3.58 years, with a standard deviation of time oscillating in 2.64 years more or less in relation to the average.

Regarding the age of these employees, it is observed that they range from 21 to 60 years old, with an average of 36.34 years, and has a standard deviation of 10.80 years more or less in relation to the average. Detailing the profile of all the employees who answered the questionnaire, 22% had a leadership position, while the other 78% did not. Graph 1 shows the stratification of the sample of servants according to the Degree of Instruction declared at the time of answering the questionnaire.

Graph 1 - Degree of Instruction of Servants
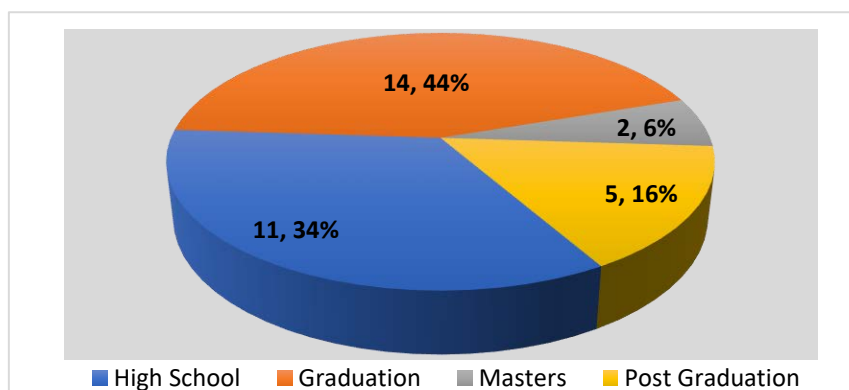
Source: Elaborated by the author (2018)

Among the respondents, 14 (44%) had only graduation as a maximum level of education, 11 (34%) had high school, 5 (16%) Post-Graduation and 2 (6%) masters.

The first inference that can be made with the data is the detailing of the Correlation Matrix, which presented as the highest positive correlation found of 0.853 between statements QS35 and QS21, demonstrating that the servants have a perception bias according to the predicted in theory. Because if there is an interpretation that the organization is concerned with the general satisfaction of each server with the work developed, there is also a concern to make the work as interesting as possible.

In addition to the greatest positive correlation, we also found the greatest negative correlation, which reached the level of -0.807, between variables QS21 and QS16, also demonstrating adherence in responses, since these variables must be analyzed in reverse. Because if the organization is concerned with the general satisfaction of its servants, it is normal for it to provide more opportunities for the servants to be promoted, corroborating the negative correlation found.

When separating the claims according to the form of analysis (forward or reverse), we conclude that is divided in half, i.e. eighteen claims Direct analysis (closer 7 = totally agree will be better) and eighteen claims that the analysis should be done in reverse (the closer to 1 = completely disagree the better). The table below shows the statements that are analyzed directly with their respective averages of the answers given by the servants, according to the analysis of Descriptive Statistics performed with the data.

Table 2 - Statements analyzed directly

QS	Affirmations	Average
1	The organization values my contributions to well-being.	5.28
4	The organization strongly considers my personal goals and values.	4.47
5	The organization would comprise a long period of absence due to illness.	4.91
8	When I have problems, the organization offers help.	4.16
9	The organization really cares about my well-being.	4.75
10	The organization is trying to expand to help me do my job to leverage my skills.	4.38
13	The organization would forgive a mistake without deception on my part.	4.53
18	The organization would lovingly consider a request to change my working conditions.	4.34
20	The organization is always willing to help me when I need a special favor.	4.47
21	The organization is concerned with my overall job satisfaction.	4.34
24	If I decide to resign, the organization will try to persuade me to stay.	3.28
25	The organization cares about my opinions.	4.31
27	The organization is proud of my achievements at work.	5.56
29	The organization would understand if I were unable to finish a task in time.	4.22
30	If the organization has an expansion, it will consider increasing my salary.	4.34
33	The organization wants to give me the best job that I'm qualified to do.	4.88
35	The organization tries to make my work as interesting as possible.	4.28
36	My supervisors are proud that I am part of the organization.	6.09
Overall average of 18 statements		**4.59**

Source: Elaborated by the author (2018)

If we observe the statements in table 2, we can see that the overall average was 4.59, so it is understood that it is between four and five, where four is understood as indifferent and five partially agree. In view of this, it appears that the servants partially agree that they have effective organizational support.

The pride that supervisors feel (QS36) is the aspect that has the greatest agreement, corroborating the theory of Organizational Support when it states that the recognition by the Supervisor is one of the

points that must be taken into account at the time of recognition and to achieve the perception of organizational support. As expressed by the author in Figure 1 - Theoretical Model of Perception of Organizational Support - Outsourced Companies, which can be applied to a direct relationship between Superintendent, supervisors (managers) and employees.

The uncertainty that the employees would be persuaded to remain, if they asked to resign (QS24), represents the aspect in which the employees disagreed most with the statement, that is, they do not feel safe or do not perceive effective organizational support in this regard.

The table below shows the eighteen statements that should be analyzed inversely according to the Theory of Organizational Support and their respective average responses given by the employees.

Table 3 - Affirmations analyzed inversely

QS	Affirmations	Average
2	If the organization could hire someone to replace me with a lower salary it would do that.	4.06
3	The organization fails to recognize any extra effort on my part.	3.56
6	The organization would ignore any complaints from me.	3.47
7	The organization does not care about my interests when it makes decisions that affect me.	4.06
11	The organization fails to understand my absences due to personal problems.	2.66
12	If the organization finds a more efficient way to get my job done, it will replace me.	5.16
14	It would take a small drop in my performance for the organization to want to replace me, that is, it is satisfied with me.	4.16
15	The organization thinks there is little to be gained by keeping me employed for the rest of my career.	2.56
16	The organization offers me few opportunities to continue being promoted.	4.03
17	Even if I did the best job possible, the organization would fail to notice.	3.53
19	If I got fired, the organization would rather hire someone new than have me back.	3.75
22	If I get the chance, the organization would take advantage of me.	3.72
23	The organization shows little concern for me.	3.03
26	The organization thinks that hiring me was a mistake.	1.78
28	The organization is more concerned with achieving results than with me.	4.00
31	The organization thinks that anyone can do my job as well as I can.	3.72
32	The organization is not concerned with paying what I deserve.	3.22
34	If my job goes extinct, the organization would rather fire me than transfer me to another position.	3.59
Overall average of 18 statements		**3.56**

Source: Elaborated by the author (2018)

If we observe the statements in Table 3, we can see that the overall average was 3.56, so it is understood that it is between three and four, where three represents partially disagree and four is understood as indifferent. In view of this, it is inferred that the servants either disagree with the negative statements or are indifferent to them, as it is an inverse analysis, it is necessary to interpret it in the opposite way, so the more they disagree the better the results and the perceived support will be. .

The feeling of error at the time of hiring (QS26) is the one they most disagree with, that is, they feel that they are well accepted by the organization. However, they do not feel support on the personal issue, as they agree that if the organization can replace them with someone who does the job more efficiently, they will do it (QS12).

After the elaboration of the Correlation Matrix, a Factorial Analysis was performed, of the variables that are analyzed directly (Chart 2), with the objective of identifying a smaller number of new alternative variables, not correlated and that, in some way, summarize the main information of the original variables finding the latent factors or variables (MINGOTI, 2005).

To verify the application of Factor Analysis, the KMO test of sample adequacy was used. The result expressed in this test (0.765) demonstrates a median degree of adjustment for the application of the multivariate Factor Analysis technique, being ratified by the Bartlett Sphericity test at the 0.000 level of significance, which according to Malhotra (2001) this cannot be greater than 0.05.

Ahead, it is necessary to detail which variables will compose each of the five specific factors generated through the Rotating Component Matrix (Varimax rotation with Kaiser Normalization) with Principal Component Analysis, as an extraction method. Table 4 shows which variables will compose each factor, that is, when the correlation of the variable-factor is closer to 1, indicating a positive association between the variable and the factor, while close to 0 indicates a lack of association.

Table 4 - Rotating component matrix[a]

QS	Affirmation	Component				
		1	2	3	4	5
36	My supervisors are proud that I am part of the organization.			0.794		
1	The organization values my contributions to well-being.		~~0.312~~	0.785		
27	The organization is proud of my achievements at work.			0.836		
4	The organization strongly considers my personal goals and values.		0.668	~~0.371~~		
25	The organization cares about my opinions.	~~0.345~~		~~0.496~~	0.589	
35	The organization tries to make my work as interesting as possible.	0.844		~~0.366~~		
33	The organization wants to give me the best job that I'm qualified to do.				0.841	

21	The organization is concerned with my overall job satisfaction.	0.846			~~0.332~~	
9	The organization really cares about my well-being.	0.622		~~0.368~~	~~0.523~~	
10	The organization is trying to expand to help me do my job to leverage my skills.	0.735	~~0.322~~	~~0.318~~		
13	The organization would forgive a mistake without deception on my part.		0.760			
18	The organization would lovingly consider a request to change my working conditions.		~~0.322~~	0.509	~~0.320~~	~~0.470~~
20	The organization is always willing to help me when I need a special favor.					0.782
24	If I decide to resign, the organization will try to persuade me to stay.		0.797			
29	The organization would understand if I were unable to finish a task in time.		0.617		~~0.462~~	~~0.447~~
5	The organization would comprise a long period of absence due to illness.					0.778
8	When I have problems, the organization offers help.	0.672	~~0.422~~			~~0.420~~
30	If the organization has an expansion, it will consider increasing my salary.	~~0.490~~	0.704			

a. Rotation converged in 8 iterations.

Source: Elaborated by the author (2018)

Factor 1 is made up of statements QS 35 (The organization tries to make my work as interesting as possible.), QS 21 (The organization is concerned with my overall job satisfaction.), QS 9 (The organization really cares about my well-being.), QS 10 (The organization is trying to expand to help me do my job to leverage my skill.) and QS 8 (When I have problems, the organization offers help.), who will be appointed as Relationship of the Organization with the Server, considering that these five statements refer to the concern that the organization has with the work developed by the servants and their well-being.

Factor 2 consists of statements QS 4 (The organization strongly considers my personal goals and values.), QS 13 (The organization would forgive a mistake without deception on my part.), QS 24 (If I decide to resign, the organization will try persuade me to stay.), QS 29 (The organization would understand if I were unable to finish a task in time.) and QS 30 (If the organization has an expansion, it will consider increasing my salary.), which will be named as Personal Recognition, considering that these five statements relate to problems, mistakes and personal desires of your employees.

Factor 3 is made up of statements QS 36 (My supervisors are proud that I am part of the organization.), QS 1 (The organization values my contributions to well-being.), QS 27 (The organization is proud of my achievements at work.) and QS 18 (The organization would lovingly consider a request to change my working conditions.), which will be called Personal Satisfaction, considering that these four statements relate to the organization's satisfaction with personal development and growth each server.

Factor 4 is made up of statements QS 25 (The organization cares about my opinions.) And QS 33 (The organization wants to give me the best job I am qualified to do.), Which will be named Server Talent, considering that these two statements concern the opinion and qualification of the work developed by each server, according to their potential.

Finally, Factor 5 is made up of statements QS 20 (The organization is always willing to help me when I need a special favor.) And QS 5 (The organization would understand a long period of absence due to illness.), which will be called the Special Request of the Servants, considering that these two statements concern the solution of personal problems and that the organization would not be obliged to comply.

Thus, there are five factors that generalize the statements and guide the understanding of the statements that were in the questionnaire: Factor 1 - Relationship between the Organization and the Server; Factor 2 - Personal Recognition; Factor 3 - Personal Satisfaction; Factor 4 - Server Talent; and Factor 5 - Special Server Request.

After defining and naming the factors based on the Rotating Component Matrix - Table 4, it is necessary to include the statements that are inversely analyzed in each of the pre-established factors, according to the existing relationship, since it wasn't identified disagreement between direct and inverse statements. Based on this question, we present in the table below the statements allocated to each of the factors.

Table 5 - Classification of Affirmations in Factors

Factors	QS	Affirmations - Direct	QS	Affirmations - Reverse
Factor 1 - Organization's Relationship with the Server	35	The organization tries to make my work as interesting as possible.	2	If the organization could hire someone to replace me with a lower salary it would do that.
	21	The organization is concerned with my overall job satisfaction,	7	The organization does not care about my interests when it makes decisions that affect me.
	9	The organization really cares about my well-being.	22	If I get the chance, the organization would take advantage of me.
	10	The organization is trying to expand to help me do my job to leverage my skills.	23	The organization shows little concern for me.
	8	When I have problems, the organization offers help.	28	The organization is more concerned with achieving results than with me.
Factor 2 - Personal Recognition	4	The organization strongly considers my personal goals and values.	3	The organization fails to recognize any extra effort on my part.
	13	The organization would forgive a mistake without deception on my part.	12	If the organization finds a more efficient way to get my job done, it will replace me.

	24	If I decide to resign, the organization will try to persuade me to stay.	15	The organization thinks there is little to be gained by keeping me employed for the rest of my career.
	29	The organization would understand if I were unable to finish a task in time.	16	The organization offers me few opportunities to continue being promoted.
	30	If the organization has an expansion, it will consider increasing my salary.	32	The organization is not concerned with paying what I deserve.
			26	The organization thinks that hiring me was a mistake.
Factor 3 - Personal Satisfaction	36	My supervisors are proud that I am part of the organization.	6	The organization would ignore any complaints from me.
	1	The organization values my contributions to well-being.	14	It would take a small drop in my performance for the organization to want to replace me, that is, it is satisfied with me.
	27	The organization is proud of my achievements at work.	19	If I got fired, the organization would rather hire someone new than have me back.
	18	The organization would lovingly consider a request to change my working conditions.	31	The organization thinks that anyone can do my job as well as I can.
Factor 4 - Server Talent	25	The organization cares about my opinions.	17	Even if I did the best job possible, the organization would fail to notice.
	33	The organization wants to give me the best job that I'm qualified to do.	34	If my job goes extinct, the organization would rather fire me than transfer me to another position.
Factor 5 - Special Server Request	20	The organization is always willing to help me when I need a special favor.	11	The organization fails to understand my absences due to personal problems.
	5	The organization would comprise a long period of absence due to illness		

Source: Elaborated by the author (2018)

After performing the analysis and interpretation of the questionnaire data applied to the servants, it is necessary to proceed with the interpretation of the managers' response, so that we can compare the effective organizational support offered by the institution and that perceived by the servants. However, we found an obstacle, since the managers of the superintendence are composed of a Superintendent and an

Executive Director and only the last one answered the questionnaire. In the following item, we present the data regarding the response of the Executive Director of SUGESP.

4.2 Organizational support - Managers

In order to analyze and discuss the data, we first need to detail the sample. In this case, the initial objective was to collect information from the Superintendent and the Executive Director, however, as mentioned earlier, he did not answer the questionnaire. The Executive Director had been in that position for approximately 4 months (0.34 years), is 40 years old, is single and has a graduation degree as a maximum educational level.

By separating the statements according to the form of analysis (direct or inverse) we find that they are divided half and half, that is, there are eighteen statements with direct analysis (the closer to 7 = I totally agree will be better) and eighteen statements that the analysis should be done in reverse (the closer to 1 = completely disagree the better), also found in the analysis of servants presented in topic 4.1. The table below shows the statements that are analyzed directly with their respective response.

Table 6 - Statements analyzed directly - Manager

QM	Affirmations	Answer
1	The organization values individual contributions to the welfare of its employees.	5.00
4	The organization strongly considers the objectives and personal values of its employees.	5.00
5	The organization would comprise a long period of absence due to illnesses of its employees.	6.00
8	When servants have problems, the organization offers help.	4.00
9	The organization really cares about the individual welfare of its employees.	4.00
10	The organization is trying to expand in order to help perform the work of the servants to leverage their skills.	5.00
13	The organization would forgive a mistake without deception on the part of its employees.	4.00
18	The organization would lovingly consider an individual request to change the working conditions of its employees.	7.00
20	The organization is always willing to help when its servants need a special favor.	2.00
21	The organization is concerned with the general satisfaction of its employees at work.	4.00
24	If any employee decides to resign, the organization will try to persuade him to stay.	4.00
25	The organization is concerned with the individual opinions of its employees.	5.00
27	The organization prides itself on the individual achievements of its employees at work.	6.00
29	The organization would understand if a server was unable to complete a task in time.	4.00
30	If the organization has an expansion, it will consider increasing the salary of its employees.	4.00
33	The organization wants to do the best job that each server is qualified to do.	4.00
35	The organization does not try to make the work of its servants as interesting as possible.	1.00
36	The organization is proud of the servants that are part of it.	4.00
Overall average of 18 statements		**4,33**

Source: Elaborated by the author (2018)

If we observe the statements in table 6, we can see that the overall average was 4.33, so it is understood that it is between four and five, where four is understood as indifferent and five partially agree. In view of this, it appears that the manager's view is that he partially agrees that effective organizational support is offered to his employees.

Being the individual request to change the working conditions of their employees (QM 18) the aspect that has the greatest agreement (7), corroborating with the theory of the humanistic vision that sees the employees' natural talent, believes that with training and motivation they are capable of becoming very effective and still see them as the cornerstone for organizational success. Thus, the organization carefully reflects on the request of its employees so that they can perform their work better, taking a humanistic view.

The fact that the organization does not try to make the work of its employees as interesting as possible (QM 35), is the aspect in which the manager most disagrees with the statement, that is, they understand that their servants, whenever possible, have the attractive and interesting work to be performed.

The table below shows the eighteen statements that must be analyzed inversely according to the Theory of Organizational Support and their respective answer given by the Executive Director of SUGESPP.

Table 7 - Affirmations analyzed inversely - Manager

QM	Affirmations	Answer
2	If the organization could hire someone to replace a server for a lower salary, it would do so.	4.00
3	The organization fails to recognize any extra individual effort from its servants.	1.00
6	The organization would ignore individual complaints from its servants.	1.00
7	The organization does not care about the interests of its employees when they make decisions that affect them.	2.00
11	The organization fails to understand the absences of its employees due to personal problems.	1.00
12	If the organization finds a more efficient way to get the job done, it will replace its servants.	2.00
14	It would take a small drop in server performance for the organization to want to replace them, that is, it is satisfied with the servants it owns.	2.00
15	The organization thinks there is little to be gained if it keeps its employees for the rest of their careers.	2.00
16	The organization offers few opportunities for its servants to continue being promoted.	4.00
17	The organization fails to realize the best work done by its employees.	3.00
19	If a server were fired, the organization would rather hire someone new than try to get him back,	2.00
22	If given the opportunity, the organization would take advantage of its servants.	1.00
23	The organization shows little concern for its servants.	1.00
26	The organization makes mistakes when hiring its servants.	4.00

28	The organization is more concerned with achieving results than with servants	1.00
31	The organization thinks that anyone can do the other's job as well as he can.	5.00
32	The organization is not concerned with paying what each server deserves.	1.00
34	If any jobs go extinct, the organization would rather fire its employees than transfer them to another role.	1,00
Overall average of 18 statements		**2,11**

Source: Elaborated by the author (2018)

If we observe the statements in table 7, we can see that the general average obtained was 2.11, so it is understood that it is between two and three, where two represents disagree and three represents partially disagree. In view of this, it appears that the managers disagree with the negative statements or have little agreement, because it is an inverse analysis, it is necessary to interpret it in the opposite way, so the more they disagree the better the results and the support offered.

The organization thinks that anyone can do the work of the other as well as he (QM 31), it was the aspect that stood out most among the statements analyzed inversely, meaning that the managers partially agree with this aspect. Thus, presenting a corroboration with the marginal view presented in the topic of the theoretical framework, which states that work safety is almost nil, as employees are discarded as soon as the company finds technologies that replace them or cheaper labor.

There are several statements that the manager totally disagrees with (QM 3, QM 6, QM 11, QM 22, QM 23, QM 28, QM 32 and QM 34), if we are going to create a group that represents all these statements we will realize that they are all linked to the Personal and Individual Aspects of the Servants, therefore, we can understand that the organization believes that it provides the necessary support. As in personal matters, recognition of extra efforts in the development of functions, individual concern for each employee, always keeping them well paid and within the staff.

4.3 Comparison of Organizational Support - Servants x Manager

After the individual analysis of the responses of the servants and managers, it is necessary to carry out a comparison between them, so that we can identify step by step, what support is offered with what is really perceived.

Table 8 - Comparison of Answers - Servants x Manager - Directly

QS	Average Servants	QM	Response Manager
1	5,28	1	5,00
4	4,47	4	5,00
5	4,91	5	6,00
8	4,16	8	4,00
9	4,75	9	4,00
10	4,38	10	5,00
13	4,53	13	4,00

18	4,34	18	7,00
20	4,47	20	2,00
21	4,34	21	4,00
24	3,28	24	4,00
25	4,31	25	5,00
27	5,56	27	6,00
29	4,22	29	4,00
30	4,34	30	4,00
33	4,88	33	4,00
35	4,28	35	1,00
36	6,09	36	4,00
Overall average of 18 statements	**4.59**	**Overall average of 18 statements**	**4.33**

Source: Elaborated by the author (2018)

Looking at Table 8, we find that the general average of the eighteen statements that are analyzed directly is within the same quadrant, that is, between four and five. However, when detailing the statements, we will notice that there are some that are very disparate, such as the QS18 and the QM18, where the first has an average response of 4.34 and the second 7. It can be inferred then that there is a divergence between the support that the organization believes it offers and that which the server perceives, since they do not feel safe to ask for an exchange in their working conditions, as they partially agree that their requests would be accepted. When the organization states that it would totally consider an individual request to change the working conditions of its employees.

In QS20 and QM20, the situation is reversed, as the organization disagrees (2.00) that it is always willing to help when its servants need a special favor and the servants partially agree that the organization is always willing to help them when they need a special favor. Bringing a false support, because the server feels that it is well interpreted when it needs a special favor, when in reality it is not so well accepted, since there was a disagreement with this provision to help when they need a special favor.

In QS35 and QM35 it is understood that there is a disagreement in perception, when the server once again believes that it has support, as the average response is between indifferent and partially agree (4.28) and the institution disagrees completely (1.00) that doesn't try to make your server's work as interesting as possible. As can be seen, the statement that belongs to the questionnaire of the employees must be analyzed directly (The organization tries to make my work as interesting as possible.) And the one in the manager's questionnaire must be analyzed inversely, because when more disagree that it does not try making the work of the server as interesting as possible, means that she does make this effort.

Analyzing the QS36 and QM36 there is also a divergence, when the servants agree and the manager is indifferent in his response. Detailing the statement, we will understand that the employees agree that their supervisors are proud to have them as part of the organization, when the manager is indifferent, that is, he does not and does not stop being proud of his employees.

After analyzing the responses to the statements that were designed to be analyzed directly, with the exception of the QM35, we will now compare the statements that should be analyzed inversely, as shown in the table below.

Table 9 - Comparison of Answers - Servants x Manager - Inversely

QS	Average Servants	QM	Manager Response
2	4,06	2	4,00
3	3,56	3	1,00
6	3,47	6	1,00
7	4,06	7	2,00
11	2,66	11	1,00
12	5,16	12	2,00
14	4,16	14	2,00
15	2,56	15	2,00
16	4,03	16	4,00
17	3,53	17	3,00
19	3,75	19	2,00
22	3,72	22	1,00
23	3,03	23	1,00
26	1,78	26	4,00
28	4,00	28	1,00
31	3,72	31	5,00
32	3,22	32	1,00
34	3,59	34	1,00
Overall average of 18 statements	**3,56**	**Overall average of 18 statements**	**2,11**

Source: Elaborated by the author (2018)

Looking at Table 9, we find that the general average of the eighteen statements that are analyzed inversely are within very close quadrants, since the response of the servants had an average of 3.56, which represents partially disagree, while the general average of the Manager was of 2.11, that is, disagrees. However, when detailing the statements, we will notice that there are some that are very disparate, such as the QS28 and the QM28, where the first has an average response of 4 and the second 1. It can be inferred that there is a greater divergence between the support that the organization believes it offers and the one that the server perceives, since the organization does not agree that it is more concerned with achieving results than with its servants and the servants think that this concern is indifferent.

Another statement that has divergence is QS3 and QM3, where the first has a response average of 3.56, while the second has response 1. Demonstrating that the servants partially agree that the organization fails to recognize any extra effort from them and from another turning the manager totally disagrees that

he fails to recognize the individual efforts of his servants. It is concluded once again that there are situations in which the organization believes to provide support and that the server does not feel the way it is theoretically passed on.

In the same level of difference presented in questions three, are QS6 (3.47) and QM6 (1), while the servants partially disagree that the organization would ignore any complaints from them, that is, they partially agree their complaints are taken into account. The manager, on the other hand, says he totally disagrees with the hypothesis of ignoring the complaint of his servants, that is, he totally agrees that they are always taken into consideration. Another case that there is a false perception, because the server does not feel what is theoretically passed on by the organization.

Comparing the QS12 with the QM12, there is a difference in scale of 3.16, where the latter partially agrees and disagrees, thus representing an insecurity for the server, as he feels that if the organization finds a more efficient way to achieve the results that the server offers, it will be replaced. While the manager disagrees, stating that he will not replace his servants with more than he finds a more efficient way to get their work.

When analyzing the QS31 and QM31, it is concluded that the organization agrees that anyone can do the work of the other effectively (answer 5), on the other hand the servants partially disagree with this statement, thus generating false support. While they feel that their work is valued, the organization has the stance that they are replaceable.

Within the observations made in table 9, there are two statements that had almost the same answer, regardless of QS or QM, being they QS2, QM2, QS16 and QM16, all were indifferent in their answers. So, both the servants and the manager do not agree or disagree that if the organization could hire someone to replace a server with one with a lower salary it would do and even though the organization offers few opportunities for its servants to be promoted. In view of this indifference in the responses, we can see that there is no investment on the part of the organization with regard to the progression of salaries and not even in relation to a guarantee of employment, making the server work a little dissatisfied and with no prospect of professional growth.

5 Conclusions and insights

The study of the Theory of Organizational Support begins with the premise of the influence of the behavior of employees on the results of the organization. Over the years, this premise began to be based on the way that employees felt they had support from their supervisors. In the course of the theory, it is observed that there are three main methods to identify the perceived organizational support, namely: justice, work awards and conduct and supervisor support. However, in addition to these supports, there are also personality and demographic characteristics such as age, education and time of organization, which acted as moderators for this perception.

Based on this theoretical contribution and the results achieved, we can conclude that in the statements analyzed directly, the servants and the manager presented responses within the same quadrant (QS - 4.59 and QM - 4.33), both between indifferent and partially agree with the presence of organizational support. Another aspect that can be concluded is that in the questions analyzed directly, the servants have

a higher POS than the manager believes to offer. In the questions that are analyzed inversely, we find a greater divergence, since the response of the servants had an average of 3.56, which represents partially agree, while the general average of the Manager was 2.11, that is, he agrees. In this difference of 1.45 in the average response, it appears that the manager believes that he offers greater support than that effectively perceived by the employees.

Another aspect that can be concluded with the research is that the employees are unaware of the importance of their activities, not even how much they reflect on the sustainability and the result of the Public Policy for the Management of Essential Expenses, that is, they cannot measure that the bureaucratic work that is performed by them is directly linked to economics, social and environmental issues. Among the assumptions included at the beginning of the research that was proven is the partial existence of an effective organizational support perceived by the employees, with that offered by the agency.

It should be noted that the research found the limitation while the Superintendent initially made himself available to answer the questionnaire, but did not do so, therefore, the positioning of the Managers started from the statements of the Executive Director. Therefore, we cannot limit this study to the objectives specified in this research, and the comparison of the results achieved with the Public Policy of Essential Expenses and the governance style present in each manager who passed through the Superintendence is a suggestion for future research.

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Perceived Performance of Cooperating Schools: Gearing Towards Future Policies

Rosanna D. Gonzales, Marjorie M. Collado, Cherrie Dianne M. Mila

Pangasinan State University

rosanna_gonzales0906@yahoo.com

Abstract

Part of providing quality education is the quest to continually improve one's service delivery since competition is now the essence of time. In the academic field, inputs in the life of pre-service teachers are considered to be of utmost significance. These include the cooperating teachers as well as the cooperating officials who may directly or indirectly influence the future would-be-teachers, the learners who may inspire them more and the learning environment that may significantly affect their desire to enter the world of teaching upon completion of the internship.   This study determined the performance of the cooperating schools as perceived by the selected elementary and secondary education students enrolled during the second semester of the calendar year 2019 in one of the higher education institutions in the Philippines offering a teacher-education program. Employing the quantitative (descriptive) research design, the results revealed that the cooperating schools' over-all performance was excellent. However, the performance rank of the indicated factors along the cooperating schools' selected variables (i.e. cooperating teachers, cooperating officials, learners, and learning environment) vary. In general, among all the factors included in the four main elements in the cooperating school; the learning environment particularly on functional, medical and dental facilities gained a very good rating.

Keywords: *cooperating school, performance, pre-service teachers, quantitative research, Philippines*

INTRODUCTION

Part of becoming a successful Teacher Education Institution is being able to strengthen one's coordination, collaboration and cooperation with partners particularly the business industries, agencies, individuals and stakeholders (Evjen, 1967). It is a fact that the as a higher education institution offering teacher education programs, part of the system already is to take into consideration the crucial and great role of cooperating schools that provide a link between theory and practice (Ash, et al. 2012). It is in these cooperating schools where the pre-service teachers are expected to put into practice the bulk of knowledge, attitudes, skills and values that they have learned from their subjects that include general education, professional education, concentration areas and specialization areas. The successful attainment of the student teaching program lies in the full support of every entities involve in the activity (Libao, 2010). In other words, the cooperating teachers, the cooperating officials, the learners, and the learning environment are of high significance in making or breaking the future of a soon to be the professional teacher. It makes sense if we use as a working

framework the 17 sustainable development goals wherein the 4th to be considered is the provision for a quality education (UN, 2017). Providing quality education will prepare the practice teachers of today a better, competent and competitive individuals in educating the next set of learners. Thus, it implies that the kind of education that they receive now will have an impact to them upon the completion of their respective degree programs.

Pangasinan State University (PSU)-Infanta is one among the thousands of campuses/institutions catering the needs of students dreaming to be a part of the teaching profession. As a committed service provider who has the end-goal in mind to produce graduates capable of educating the future generations of their time, it is just proper to conduct such study in order to meet the fast-changing needs of the time in the teaching field. Hence, such study.

Objectives of the Study

The study sought to determine the:

1. over-all performance rank of the cooperating schools' selected variables as perceived by the pre-service teachers?

2. perceived level of performance and rank by the pre-service teachers along the indicated factors in cooperating schools':

a. cooperating teachers,

b. cooperating officials,

c. learners, and;

d. learning environment?

METHODOLOGY

Research Design

The quantitative descriptive-evaluative research design was applied in the study wherein the focus was on the performance of the cooperating schools as a training ground in order to determine whether or not the said Teacher-Education-Institution counter possess the minimum qualification standards so that the best experience can be gained by the pre-service teachers and to develop within them the desirable characteristics that they may live in as an individual and as a future professional (Alharbi, 2015).

Respondents

The respondents of the study were the fifty-three (53) practice teachers enrolled in the Student Teaching Program of the Second (2nd) Semester, Calendar Year 2019 wherein thirty (30) of them were from the Bachelor of Elementary Education program while the remaining twenty-three (23) were from the Bachelor of Secondary Education -major in Social Studies.

Locale of the Study

The study was conducted in the District of Infanta, Pangasinan, Philippines where the practice teachers were deployed. Said cooperating schools (Infanta Integrated School, Cato National High School, Cato

Elementary School and Bamban Elementary School) are recognized and have executed a corresponding Memorandum of Agreement between the teacher education institution-PSU and the Department of Education (DepEd).

Instrument

The main instrument used in data gathering was the Evaluation Checklist for Cooperating Schools (FM-AA-PPT-09) provided in the Quality Management System (QMS) in conformity with the requirements of ISO 9001:2015). Included in the questionnaire were the cooperating schools' selected variables specifically these were the cooperating teachers, the cooperating officials, the learners and the learning environment. Each identified variable is composed of specific indicators applicable to such and are rated as 5-always observed, 4-often observed, 3 sometimes observed, 2-rarely observed, and 1- not observed (QMS Manual).

Procedure

The instrument was personally administered by the Practice Teaching Supervisor to the Practice Teachers after conducting their student teaching course at their respective cooperating schools.

Data Analysis

The data gathered was analyzed by the use of mean, average weighted mean (AWM) and ranking. The performance level of cooperating schools was verbally described as Very Poor (1.0-1.80); Poor (1.81-2.60); Good (2.61-3.40); Very Good (3.41-4.20) and Excellent (4.21-5.0).

RESULTS AND DISCUSSION

The succeeding discussions and table presentations contain the detailed results in order to answer the specific questions posed in the study.

On Over-all performance rank of cooperating schools

The cooperating schools are those public elementary and secondary schools duly acknowledged and accredited by the DepEd to serve as the partner agency of higher education institutions (HEIs) in producing professionals of tomorrow. Undeniably, the graduates of the HEIs will soon be the applicants of the said agency, that is why a close monitoring and 100% support from said institutions are guaranteed and secured to fully comply with the rigorous requirements of the teacher education program. These cooperating schools are therefore marked as "the cooperative schools" all for the sake of achieving the desired characteristics to be developed within the practice teachers and further to showcase the positive attributes of a cooperating school worthy of emulation and thus will encourage the practice teachers to continually study and work hard by playing multi-faceted roles.

Table 1 revealed that along the selected cooperating schools' selected variables such as the cooperating teachers, cooperating officials, the learners and the learning environment were perceived to be "excellent" with an average weighted mean (AWM) of 4.52. This implies that the components of the cooperating

schools where the practice teachers conducted their student teaching activities had at par meet the expected standards set by the DepEd and HEIs to deliver the service needs of the practice teachers.

It was also shown in the table that among the components of the cooperating schools, the cooperating officials' performance ranked 1ˢᵗ, followed by the learners, and both the cooperating teacher and the learning environment received the same rank.

Table 1. Over-all performance rank of cooperating schools' along selected variables

Variables	BSE			BEE			AWM
	Mean	VD	Rank	Mean	VD	Rank	
a. Cooperating Teachers	4.61	Excellent	2	4.39	Excellent	3.5	4.5
b. Cooperating Officials	4.72	Excellent	1	4.53	Excellent	1	4.62
c. Learners	4.47	Excellent	4	4.50	Excellent	2	4.48
d. Learning Environment	4.56	Excellent	3	4.44	Excellent	3.5	4.5
AWM	**4.59**	**Excellent**		**4.46**	**Excellent**		**4.52**

On Perceived performance of the Cooperating Teachers

During the practicum phase in the life of a practice teacher his/her ideals, beliefs, attitude, skills and values are subjected to change. This can be attributed to the significant person who may bring positive influence in the many ways of facing the challenges and prospects of becoming a future teacher – this is no other than the "cooperating teacher" who is expected to discover, mold and enhance the potentials of the assigned intern in to him/her (Anderson, 2009). A great number of professional teachers measure success through their academic achievements and more on large number of lives they had touched and transformed through teaching the pupils/students and practice teachers assigned to them. Much of their matured role as a mentor are being shred to the practice teachers whom they are honing the necessary experiences to overcome the challenges that might come across their way once they are already called as a full-fledged teacher who may also serve the same role once they meet the set requirement (Clarke, et al., 2014).

The table below showed that the cooperating teachers' performance across all the indicators were "excellent" wherein top three (3) on the list were on checking and re-checking the lesson plans, providing the practice teacher with necessary background about individual pupil in the class, and maintaining consistent standards of classroom behavior and environment of mutual respect. It implies that for the cooperating teachers extra care and effort was given attention in lesson planning since this will serve as the main guide of the practice teacher in making the class stay attentive and for him/her not to be lost once she is teaching (Nesari and Heidari, 2014). This confirms the result of the study conducted by the Department of Education and Science (2006) wherein they found out in their evaluation on Learning to Teach that a little over half (58%) of the student teachers received excellent, very good or good on planning for integration and 75% of them planned satisfactorily in the use of resources. Second and third in rank will help the practice teacher promote a relaxed, safe and secured classroom atmosphere that may make the

pupils/students feel the sense of belongingness and become an active and more responsive to the class activities (Singh, 2014; Salayog, et.al. 2019).   On the other hand, the least in rank were holding regular conferences with the practice teacher's strong and weak points, initiating practice teacher's activities within the bounds of officially-approved program, and observing the actual performance of the practice teacher.

Table 2. Performance of the Cooperating Teachers

Variables	BSE		BEE		AWP	VD	Rank
	Mean	VD	Mean	VD			
a. The Cooperating Teachers							
1. Maintain consistent standards of classroom behavior and environment of mutual respect.	4.75	Excellent	4.45	Excellent	4.6	Excellent	3
2. Check and re-check the lesson plans of the practice teacher.	4.68	Excellent	4.7	Excellent .	4.69	Excellent	1
3. Observe the actual performance of the practice teacher.	4.59	Excellent	4.2	Very Good	4.39	Excellent	8
4. Hold regular conferences with the practice teacher on his/her strong and weak points.	4.56	Excellent	3.95	Very Good	4.25	Excellent	10
5. Initiate practice teacher's activities within the bounds of officially-approved program.	4.59	Excellent	4.15	Very Good	4.37	Excellent	9
6. Provide a relaxed atmosphere and encourages a friendly working relationship with the practice teacher.	4.65	Excellent	4.45	Excellent	4.5	Excellent	6
7. Provide the practice teacher with necessary background about individual pupil in the class that he/she gains more insights in teaching all members of the class.	4.62	Excellent	4.65	Excellent	4.66	Excellent	2

8. Guide the practice teacher in the preparation of various school forms.	4.53	Excellent	4.5	Excellent	4.51	Excellent	4.5
9. Guide the practice teacher in administering examinations, scoring, recording, and computing grades of the pupils/students.	4.53	Excellent	4.5	Excellent	4.51	Excellent	4.5
10. Evaluate objectively the performance of the practice teacher at the end of the program.	4.62	Excellent	4.35	Excellent	4.48	Excellent	7

On Perceived performance of the Cooperating Officials

The cooperating officials play a significant role not only for their teachers but to the practice teachers as well. The strong support given to both will boost the power of team effort which will produce a more positive atmosphere and will encourage the cooperating teachers to assist more the practice teachers. Likewise, the practice teacher's spirit will be more delighted in performing their tasks at their cooperating school.

It can be gleaned in table 3 that cooperating officials' orient the practice teachers on the operational program of the school, the structure of leadership and management pertinent data related to the program, however; monitoring and observing practice teacher's performance was ranked fifth (5th) which coincides with the result gathered in table 2. This means that top in consideration the cooperating officials is to make the practice teachers aware on the "background" of the cooperating school in order for them to be properly guided on the school's set-up and abide with its guiding principles, philosophy, rules and regulations.

Table 3. Performance of the Cooperating Officials

Variables	BSE		BEE		AWP	VD	Rank
	Mean	VD	Mean	VD			
b. The Cooperating Officials							
1. Orient the practice teachers on the operational program of the school, the structure of leadership and management pertinent data related to the program.	4.84	Excellent	4.7	Excellent	4.77	Excellent	1
2. Implement existing rules and regulations of the Dep-Ed with	4.68	Excellent	4.7	Excellent	4.67	Excellent	2

regards to curricular program on practice teaching.							
3. Observe a class conducted by the practice teachers during demonstration and as the need arises.	4.75	Excellent	4.45	Excellent	4.6	Excellent	3
4. Monitor and observe practice teacher's performance.	4.65	Excellent	4.35	Excellent	4.5	Excellent	5
5. Discuss with the cooperating teachers' problems related to the performance of the practice teachers.	4.68	Excellent	4.45	Excellent	4.56	Excellent	4

On Perceived performance of the Learners

The learners are known to be the focus of the prime movers (teachers) in a teacher-centered learning environment. The learners' top-rated performance as reflected in Table 4 was on responding to the strategies and approaches used by the practice teachers. As pointed by the study conducted by Ganyaupfu (2013) student-centered strategy/method motivates pupils/student's goal-oriented behavior while they rated last the values and attitudes anchored on the vision, mission and core values of Dep-Ed possessed by the learners.

Table 4. Performance of the Learners

Variables	BSE		BEE		AWM	VD	Rank
	Mean	VD	Mean	VD			
c. The Learners							
1. Possess the values and attitudes anchored on the vision, mission and core values of Dep-Ed.	4.53	Excellent	4.15	Excellent	4.34	Excellent	5
2. Are physically, socially and academically active.	4.46	Excellent	4.55	Excellent	4.50	Excellent	2
3. Have the facility to use verbal and non-verbal communication skills.	4.37	Excellent	4.5	Excellent	4.43	Excellent	3
4. Respond to the strategies and approaches used by the practice teachers.	4.53	Excellent	4.75	Excellent	4.64	Excellent	1
5. Observe rules and regulations of the school.	4.34	Excellent	4.4	Excellent	4.37	Excellent	4

On Perceived performance of the Learners

As stated in the paper of Andersone (2017) the new learning environment is holistic and integrated which promotes opportunities for lifelong learning which according to Laal (2011) aids in the acquisition of skills for survival. The cooperating schools' learning environment reflected that there the principal's office is accommodating, the canteen is managed by TLE teacher and the classrooms are conducive for learning, however; least in the rank were the functional medical and dental facilities, guidance/counseling facilities and services, and library with books and other learning resources for pupils/students' use.

Table 5. Performance of the Learning Environment

Variables	BSE		BEE		AWP	VD	Rank
	Mean	VD	Mean	VD			
d. The Learning Environment							
1. Has enough classrooms conducive for learning.	4.78	Excellent	4.55	Excellent	4.66	Excellent	3
2. Has library with books, and other learning resources to be used by the pupils/students.	4.5	Excellent	4.05	Very Good	4.27	Excellent	8
3. Has technology like computer, DLP, camera, laptop, television set.	4.75	Excellent	4.3	Excellent	4.52	Excellent	5
4. Has guidance and counseling facilities and services.	4.37	Excellent	4.05	Very Good	4.21	Excellent	9
5. Has sports and recreational activities.	4.34	Excellent	4.4	Excellent	4.37	Excellent	7
6. Has functional medical and dental facilities.	3.81	Very Good	3.9	Very Good	3.85	Very Good	10
7. Has canteen managed by TLE teachers, dietician or nutritionist.	4.59	Excellent	4.75	Excellent	4.67	Excellent	2
8. Has clean comfort rooms.	4.25	Excellent	4.65	Excellent	4.45	Excellent	6
9. Has room/office for holding conferences.	4.46	Excellent	4.55	Excellent	4.50	Excellent	4
10. Has Principal's office with accommodating ambiance.	4.87	Excellent	4.85	Excellent	4.86	Excellent	1

CONCLUSION

The cooperating schools' exceeded the performance required to holistically develop and bring out the best characteristics and potentials of the practice teachers through the presence of the cooperating teachers who attend to the priority need areas of the practice teachers in order for them to execute properly the subject matter for the pupils/students through a well-prepared lesson plan with consideration of the nature of the learners in a sound and friendly environment. On the same manner, the cooperating officials do consider the vital role of making the practice teachers knowledgeable about the cooperating school's information. The cooperating schools' learners are classified as active, are diversified in learning styles and are responsive to various teaching approaches. Likewise, the learning environment is characterized by value-driven in dealing with their customers as reflected in the office of the principal. Such performance should be sustained.

RECOMMENDATION

The cooperating teachers and cooperating officials may enhance their monitoring scheme in close supervision and observation to the practice teachers. The cooperating schools' learners must understand the DepEd values and attitudes by integrating it within their subjects and for them to instill at their early age the core values of the agency. A more functional and evident medical-dental facilities can be considered in all cooperating schools to promote higher health access for the pupils/students.

A follow-up study using a wider scope can be conducted by taking into consideration the profile of the cooperating school, the cooperating teachers, the cooperating officials and the learners. The extent of the service/s received from the various facilities, equipment and physical structures provided by cooperating schools can be a priority research area of interest.

The problems encountered by the practice teachers towards their student teaching activity can be included as an objective.

The evaluation of the significant others on the performance of practice teaching program, and practice teachers can help the teacher education institutions address the present needs and demands of the cooperating schools can be another research aspect so as cope with the set criteria by the DepEd.

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Disruptive Environmental Technologies of High Population Impact Aimed at the Disposal of Recyclable Materials[1]

Uilmer Rodrigues Xavier da Cruz*

Doctoral student in Geography at the Federal University of Minas Gerais (UFMG), Doctoral scholarship holder from the Minas Gerais State Research Foundation (FAPEMIG)

uilmer@ufmg.br or uilmer_rodrigues@hotmail.com

Prof. Dr. Ricardo Alexandrino Garcia*

Associate Professor at Department of Geography, Geosciences Institute, Federal University of Minas Gerais

alexandrinogarcia@ufmg.br or alexandrinogarcia@gmail.com

Abstract

Technology has been occupying more and more space in the daily lives of people in big cities, which ends up giving rise to the current discussions on sustainability. Thus, this study aimed to make a theoretical literature review at the beginning of the discussions on the first "green" technologies, their development and patents, as well as on Brazilian inventions aimed at the processing of solid waste. In addition, concepts of innovation of information and disruptive technologies for commercial purposes were addressed, thus presenting two technological tools given their high educational content and great ability to change the way people think and their consumption habits. Finally, it was emphasized the importance of studies focused on the behavior of technologies in the face of contemporary issues such as sustainability and environmental preservation.

Keywords: Disruptive Technology; Green Patent; Intelligent Garbage Can; Recycling Scoreboard.

1. Introduction

Technology has been gaining more and more space in everyone's lives over the years, especially in large cities. Few people do not resort to applications or functionalities on their smartphones for some daily activity, whether to order food, calling a car, or even quantifying the mileage and time of morning rides.

Institutionally, companies have also become dependent on technology, with their integrated databases of high scalability and interoperability stored in VPS or clouds, whose information is necessary for any service. In short, this database ends up being the company's most precious asset because, without it,

revenue and profits cannot be accessed; for this reason, the servers are protected by various firewalls, fixed IP, and backup routines to preserve such information.

In this way, the rise of capitalism, increased industrialization, increase in consumption, including technologies, combined with the purposeful low durability of this type of product, generates a large amount of waste, resulting in the current discussions on sustainable development.

"Sustainability", or "Sustainable Development", is basically the balance between attitudes towards social and economic development based on environmental preservation measures. It radically changes the decision-making process by government officials, entrepreneurs, consumers, and workers who, for a long time, took only economic criteria into account. However, currently, they also need to consider social and environmental aspects.

Therefore, the sustainability theme began to be considered relevant for business in recent years, due to the possibility of a more fluid production process, with no obstacles, from the raw material to the final consumer, including the reverse movement of this process, which comprises the return of leftovers after consumption [1].

Thus, it is important to establish a historical context on this theme, emphasizing the concepts of sustainability and environmental preservation in the Capitalist System. In this way, initially, it will be approached the starting point of these discussions and the development of the first technologies focused on a greener perspective, giving some examples of technologies based on which Cardozo and Murarolli [2] discussed in their text "Green Information Technology: Technological Sustainability. The Advancement of Technology in Relation to the Environment: Technology and Sustainability".

Subsequently, it will be discussed how technologies are used as "green patents", which are instruments that allow industries to include more appropriate and alternative methods into their production processes, as they are less polluting, mitigating environmental degradation and bringing competitive advantages to these companies. Specifically, at this moment, it is established a dialogue with Santos *et al.* [3], based on the text "A model of management information system: competitive advantage in the process of reverse logistics of cooking oil", which deals with the application of a Management Information System (MIS), as an information technology tool for reverse logistics of residual vegetable oil from industries, using a franchise of a fast-food chain in São Paulo, Brazil, as a case study.

Finally, the third text will address the invention and utilization patents developed in Brazil directly related to alternatives for the disposal, reuse, and/or recycling of products for non-environmental degradation. The case study by Silva *et al.* [4] addresses the Brazilian civil construction sector, which concentrates more waste disposed per inhabitant per year in comparison with domestic waste, as argued in their study entitled "Mapping of technologies associated with the reuse of solid waste and recycling of used materials in the Brazilian civil construction sector", which also shows data that contribute to

understanding how we are in terms of technological measures to be used in companies directly linked to the recycling industry and the reuse of solid waste.

In the second chapter, it will be addressed, according to Christensen [5], the concept of disruptive technologies, which can be considered innovations in products, services, or processes, which seek to be alternatives to technologies in force and are also focused on another type of consumer. In short, for this author, disruptive innovation is intended to cause changes in social practices and the ways of living, working, and relating, causing a disruption in standard models related to the field of consumption and business.

Moreover, two technological tools, which can be considered disruptive, will be presented, due to their high educational content and great ability to change their users' thought and consumption habits. These tools cause an imaginary disruption of high population impact since they are aimed at the masses and can cause permanent changes in the consumer's subconscious.

Thinking about it, why do we not use technology as an ally to more sustainable practices? This is intended to be reflected in our work, which sought to understand the current role of technologies and how they can contribute to changing society's thoughts and habits.

2. Materials and Methods

This study was performed using a qualitative method, as it "involves a universe of meanings, reasons, aspirations, beliefs, values, and attitudes, which corresponds to a deeper space of relationships, processes, and phenomena that cannot be operationalization of variables" [6].

In addition, it is based on a theoretical review of articles found from a survey on the Google Scholar platform, between March 20th and 21st, 2020, using the following keyword combinations: (1) Information Technology and Recycling and (2) Disruptive Technology and Recycling. The survey was carried out in order to find papers most appropriate for the research subject, published by the Brazilian and international scientific academic community in journals and other means of dissemination, such as annals of events.

The main studies on Information Technology found in the review were conducted by (1) Cardozo and Murarolli [2], which deals with green information technologies and cites Cloud Computing and Virtualization as a representation of this type of innovation; (2) Santos *et al*. [3], which proposes a discussion on the disposal of effluents in water resources; and (3) Silva *et al*. [4], which addresses green patents and their main aspects.

The following studies on disruptive innovations and technologies were also found: Theis and Schreiber [7], Gilioli [8], Carvalho, Pereira, and Assis [9], among others, which are based on the ideas defended by

Christensen [5], main researcher on "disruptive technologies".

Finally, a case study of two green patent technologies (Intelligent Garbage Can and Recycling Scoreboard) was also performed. The method used for the Recycling Scoreboard comprised PHP programming language, Mysql database, and a video already edited, rendered, and containing the information to be shown on the screen (Figure 7). The Intelligent Garbage Can comprised development in C++ on the printed circuit board, PHP, Html, Java Scripts, and Mysql database. Regarding the server environment, Java servlet (UDP), fixed IP, VPS virtualization environment, and insertion in the MySQL database were used.

3. Green Information Technology and Environmental Concern: Reuse of Materials and Recycling in Industry

According to Cardozo and Murarolli [2], a commission for the establishment of developmental and environmental measures for all countries in the world was created, in a conference of the United Nations Organization, in the 1980s. During this event, there was a discussion on issues related to environmental impacts generated by the excessive exploitation of resources, as well as on measures to mitigate these impacts, such as reduction of energy consumption, environmental preservation, and recycling.

From 1987, the Our Common Future Report, also called the Brundtland Report, was instituted, bringing the need for a real change to support global progress (sustainable development). Also, according to its authors, this document criticized the measures adopted by central capitalist countries. These measures, based on this report, were unlikely to be applied in peripheral capitalist countries.

In 2005, the term "Green Information Technology" was implemented, which, according to Cardozo and Murarolli [2], is quite recent but has gained considerable space in discussion and implementation of alternatives such as virtual storage (e.g. clouds). According to such authors, companies realized the importance of their virtual assets, thus increasing investment in Information Technologies (IT).

From then on, it has been strengthening, since globalization is intrinsic to the development of information technologies, and the continuous and permanent transmission of information is essential. Some developed technologies are directly related to Green IT such as cloud computing (1) and virtualization (2).

Cloud computing consists of a virtual storage space (in clouds), in order to eliminate the use of physical storage memory. Cardozo and Murarolli [2] argue this method has been adopted by several companies that want to save time and costs in the maintenance of equipment. However, in the beginning, it generated suspicion because of the idea that the storage could be lost, deleted, or invaded, no longer remaining in the company's sole possession.

Therefore, companies currently hire servers with known security certificates and there are four possible

types of cloud computing: public, community, hybrid, and private clouds [2].

Public clouds, still according to the authors, are a standard model of cloud computing, free of charge or pay-per-usage. Community clouds are accessed by a specific group with common interests. The hybrid ones are two or more clouds, which offer the benefits of the other clouds in a single one. Finally, private clouds are storage services aimed only at a specific organization or company.

In a dialogue with Dâmaso [10], Cardozo and Murarolli [2] claim that it is possible to exemplify companies that currently use this storage method, such as Google Drive, Dropbox, SkyDrive, and iCloud. All these companies offer storage options, obviously with specific differentials, according to the interests of their customers. Furthermore, cloud computing is an alternative for reducing CO_2 emissions, energy consumption, and waste generation; for this reason, they are considered as a green technological alternative.

To understand the concept of virtualization, intertwined with this notion of clouds, it is necessary to distinguish the real, as something palpable, the material, and what simulates what is real, i.e., the virtual. According to Cardozo and Murarolli [2], virtualization is a "virtual environment that seeks to imitate a real environment, being able, in this way, to use all systems and programs, even if they are not installed in the virtual environment". In other words, virtualization proposes to optimize the use of physical equipment as much as possible. Thus, there are three manners of understanding virtualization: hardware virtualization, presentation virtualization, and apps virtualization.

The hardware virtualization is defined by the use of several operating systems on a single machine, whose data of their components are "copied" through softwares to be read and used by the different operating systems.

The presentation virtualization consists of accessing a computational environment without the need for physical contact with it. Therefore, this type of virtualization is similar to remote access; however, it can be accessed by several users at the same time. Its advantage is the possibility of access, from any location, using the operating system's tools, without the need to install them on a physical computer.

Finally, apps virtualization is an important tool to avoid software incompatibility on certain operating systems. Thus, by installing an application on a remote desktop, the user can access it from any area, using any operating system.

Cardozo and Murarolli [2] emphasize this form of technology is important in terms of saving energy consumption, as well as physical space, generating no waste from equipment acquired and used in excess. The standards by which green information technologies are regulated are defined by the International Organization for Standardization (ISO) 14000, which is an Environmental Management System. These authors also argue that this ISO is defined by the Environmental Management System (EMS), auditing,

environmental labeling, and life cycle of the product.

According to Almeida and Real [11], the above-mentioned ISO is defined by several documents, as follows: SGA (ISO 14001 and ISO 14004), Environmental Audits (ISO 19011), Ecological Label (ISO 14020, 14021, 14024, 14025), Environmental Performance Assessment (ISO 14031 and 14032), Product Life Cycle (ISO 14040, 14041, 14042, 14043), and Terms and Definitions (ISO 14050).

However, it is valid to say that ISO 14000 is optional, despite the supporting documents. The argument for non-mandatory applicability of this regulatory standard is relating to the investment companies would have to make to adapt their production and products as "green". This issue contributes to non-alignment with the ideal of sustainability.

In addition, the Brazilian laws directly related to the sustainability proposal are also discussed. It is worth mentioning Law No. 12,305, of August 2010, which provides guidelines for handling and disposal of solid waste, concerning environmental preservation and public health quality improvement. According to Cardozo and Murarolli,

> For Green Information Technology, specifically, Article 33 of this law deals with electronic waste, in which the companies themselves are responsible for the appropriate disposal of materials, in order to reduce the impact directly caused by them on the environment and human health. This Law describes in great detail the correct way of what to do with solid waste, thus becoming essential nowadays. [2]

In a dialogue with Smaal [12], Cardozo and Murarolli [2] explain that electronic waste does not refer to spam sent to e-mail boxes, but to waste produced from the obsolescence of electronic products. According to these authors, since the beginning of production until the disposal of the product, there is a high environmental impact. Thus, it is necessary to implement a project to reduce the production of these pollutants, whose environmental damage is incalculable.

These authors also mention that the government has a virtual platform, which was developed through an initiative by the Environment Department of the state of São Paulo (2008), in which the Zip Code of a municipality can be inserted to found out the nearest place for proper disposal of electronic waste. The website (www.e-lixo.org) is maintained by crossing data with Google Maps. They also emphasize the importance of the correct disposal of this kind of waste because it contains heavy metals, which can easily contaminate the soil and water, causing diseases to humans.

Cardozo and Murarolli [2] argue that the environmental management policies and the measures for relocating electronic wastes, correctly disposing them, recycling, and reinserting in the production chain what would be disposed in the environment, mean a new and important step in the environmental conservation and concept of sustainability. According to these authors, in dialogue with Baio [13], it is

estimated that 5% of the waste generated by human beings on the planet is electronic, which corresponds to about 50 million tons per year. The appropriate disposal of this waste also means to collaborate to reduce this number.

In another way, but contemplating the topic of this section and the proposals on the need for the correct disposal and destination of solid waste, Santos *et al*. [3] address alternatives to make feasible the correct disposal of these residues. In addition to electronic waste, cited by the authors mentioned so far, the disposal of effluents in water resources is one of the major concerns regarding pollution.

According to Santos *et al*. [3], large cities are the main responsible for the disposal of waste in water resources and, consequently, for their pollution. Archela *et al*. [14] explain there are two types of disposed effluents, which differ from each other by their origin (domestic and industrial). Cooking oil is in the group of domestic waste, being an organic compound with a high contamination rate of water resources when disposed incorrectly. Santos *et al*. [3] argue that, according to the Environmental Management Program of the Federal Public Ministry, 1 L of cooking oil is enough to contaminate about 1 million L of water, which is enough to be consumed by one person for 14 years.

These authors claim there is still no exact data on the oil reused by industries, the one that returns to the production cycle. However, according to them, work has been done to raise the population's awareness of its correct disposal, as this process does not require high investment, but only changes in habits.

Regarding the disposal of industrial waste, Santos *et al*. [3] explain that, in the state of São Paulo, control and inspection are strict, supported by Law 997/76, based on which, through environmental licensing and inspection of activities, companies are analyzed by the Environmental Company of the state of São Paulo (CETESB), a delegated body of the state government.

On a national scale, there is the CONAMA Federal Resolution (No. 430 of 2011), responsible for the classification of water bodies and environmental guidelines, establishing standards for the discharge of effluents. According to Santos *et al*. [3], for vegetable oils, there is a limit of 50 mg/L of effluent compounds.

Thus, based on these data, these authors are also concerned with defining the concept of Reverse Logistics, which is an important tool for controlling the flow and return of products and inputs to the means of production. Logistics is the "management of a duly structured and planned supply chain, involving the storage, transportation, and control of materials or products" [15].

They also argue that logistics contributes to improving efficiency in relation to the substantial gains of a company since the production flow occurs from the correct and necessary amount for the sale and return of the product.

According to Leite [16], there are four characteristics related to logistics: supply logistics, manufacturing support logistics, distribution logistics, and reverse logistics. Each one has its importance in the production cycle. The first characteristic is necessary for the supply of inputs and materials for the company's production; the second one for planning, storing, and controlling the company's internal flows; the third, for product distribution; and the last one for the return of post-sale and post-consumption products.

The discussion by Santos *et al*. [3] focuses on this last characteristic: reverse logistics. The post-sale reverse logistics is characterized by the return of products with quality problems and/or errors in their distributed quantities. The post-consumption reverse logistics is characterized by the return of the product after consumption by the customer, so that in some way it is reused, through reuse, manufacture, or recycling.

Cooking oil is an example of a product returned to the industry through post-consumption reverse logistics. This oil has a variety of uses such as for saponification, the composition of paints, production of putty, production of flour for animal feed, burning in a boiler for biodiesel production and consequent generation of glycerin as a final product, among other purposes, as pointed out by Reis, Ellwanger, and Fleck [17], cited by Santos *et al*. [3].

Therefore, in order to discuss the advantages of using Information Technology in the production process as a competitive differential, Santos *et al*. [3] define "Information Systems (IS)" as:

> [...] Interacting and interdependent parts of a set that form an organized whole, and aim to generate accurate and auxiliary knowledge regarding decision making, analysis, and transformation of information, generating value through the data presented in a meaningful and useful way. [3]

Thus, the use of IS in companies directly involves information technologies for the development of services, products, and capabilities so that they can develop competitiveness among other companies and on a global capital scale.

The management information systems (MIS) are an example of information technology used internally in the production process of a company. These systems contribute to organizing a sparse volume of data, which can be a big problem for controlling the flow and return of products, logistically, such as in the case of reverse logistics for cooking oil. The MIS are implemented as instrumental technologies in business intelligence (BI), giving the company a competitive advantage over others, when it comes to process optimization.

To exemplify the use of MIS in companies as a competitive advantage technology in the market, Santos *et al*. [3] cite a database structured to contain information on the collection of used vegetable oil

(post-consumption) and its return to the production process – regardless of its later use.

To this end, the system's architecture, produced for this purpose, initially consisted of a form filled out by organizations that collect the residual oil from other companies, whether NGOs or other collection points. This form is later modified and supplies a database, which stores information in an analytical Data Mart, specifically for this context. Finally, the produced database is used to design reports, which will be green marketing instruments to structure the company's image as being environmentally responsible.

Thus, the initial form used by the initiatives, which were organized based on vegetable oil collection points, is filled out through a standardized interface, linked to a website, being a transactional database. In this way, important information is stored and used in a mapping of the entire reverse logistics process of this oil.

From the primary characteristics that structure this MIS, after filling out the initial form, information is screened by an Extract, Transform, and Load (ETL) system. In dialogue with Kimball and Ross [18], Santos *et al*. [3] explain that this system consists of three stages: "[...] a desktop, instantiated data structures, and a set of processes. This system deals with the systematization of treatment and cleaning of data from different organizational systems for insertion in a Data Mart".

Using some metrics obtained from this system, it is possible to create cartograms, for example, which will illustrate the company's ability to return residual oil and transform it into other products, which, as previously mentioned, is an instrument for increasing the company's green marketing, which also establishes a "healthy" sphere of competition among companies and, of course, emphasizes the value of reverse logistics of this oil.

Based on the MIS used as an example, Santos *et al*. [3] affirm the importance of this method, not only for the company's green marketing but also for socio-environmental responsibility. For this purpose, one of the franchises of the McDonald's fast-food chain (São Paulo), which uses an MIS for the reverse logistics of cooking oil, has been used as an example.

The results obtained from the database of oil collection and transformation showed that the aforementioned company collected about 6 million liters of oil in a year, thus preserving 150 billion liters of water. This means, according to the company's data, a number close to 12 thousand million m³ of avoided CO_2 emission, which is equivalent to about 70 thousand trees planted. Moreover, almost 6 million liters of biodiesel can be produced from the return of this cooking oil post-consumption.

Based on the mentioned case study, the use of information technology applied as MIS in the control of reverse logistics proves to be an important tool, not only in the competitive advantage among companies but also in the partnership between these institutions, when environmental preservation and financial saving are a common interest in the production process.

4. Solid Waste and Green Patents

This section specifically addresses the solid waste issue in the Brazilian civil construction sector, from the perspective of Silva *et al*. [4]. This discussion is justified by the fact that civil construction produces more waste, per inhabitant, in comparison with domestic waste production, as argued by these authors.

As shown by Silva *et al*. [4], based on data from the Brazilian Association of Public Cleaning and Special Waste Companies (ABRELPE), in 2014, the quantity of solid waste generated by civil construction was greater than that from domestic activities. It was estimated that each inhabitant produces 1.062 kg of domestic waste per day. Regarding civil construction waste, this number was estimated at 1.5–2.5 kg daily. These authors report that civil construction waste is divided into 63% mortar, 29% concrete and blocks, 7% other components, and 1% organic waste.

Silva *et al*. [4] argue, based on a dialogue with Magalhães [19], that innovation consists of any evolutionary or disruptive change aimed to prolong the life of organizations. In this sense, they claim that the civil construction sector in Brazil has a high ability to innovate and stimulate the economy, through recycling technological innovations, which, however, still lacks a long-term plan.

These authors explain that green patents are technologies focused on their goals of positively interfering with the environment to preserve it and prevent climate change and environmental degradation. They also argue that, in Brazil, the National Institute of Industrial Property (INPI) prioritizes the evaluation and approval of patents related to this purpose. According to the INPI (2013), mentioned by these authors:

> Within the scope of innovation that Green Patents can provide, technologies focused on the promotion of renewable energies, energy conservation, pollution control, reforestation techniques, soil improvement, waste disposal, waste treatment, and waste management stand out. [4]

Green patents in Brazil account for 5% of the total number of registered patents, and they are related to the "efficient processing of materials, composition, and process to obtain products that cause less damage to the environment, and waste recycling processes" [4].

Between 1991 and 2015, according to Silva *et al*. [4], 182 technology patents were registered, which were related to the reuse of solid wastes from the civil construction sector in Brazil, their recycling, and systems and processes towards sustainable practices; 168 of them were invention patents and 14 were utility models. According to these authors, the most significant periods regarding the increase in the number of registered green patents in Brazil were from 2002 to 2005 (an increase from 2 to 12 registrations) and from 2006 to 2009 (an increase from 9 to 21 registrations).

As for the profile of depositors responsible for registering patents, Silva *et al*. [4] report that 74% were natural persons and 26% were legal entities, of which 21 registrations were from Educational/Research

Institutions, 20 from private companies, and 7 registrations resulted from public-private partnerships. The other 134 registrations comprised patents registered by natural persons. Most of the patents registered by educational institutions and/or research centers, private companies, and public-private partnerships are found in the South and Southeast regions; only one was from northeastern Brazil.

According to Silva *et al*. [4], patent applications made to the INPI are classified according to the technological area to which they belong. They explain that 99 of the 182 patents found were classified, as follows: C04B (74 patents), E04C (14 patents), and B09B (11 patents). The other patents were classified into other categories.

The C04B comprises materials such as lime, magnesia, slag, cement and its compositions (mortar, concrete, or building materials). The E04C includes structural elements (construction materials). The B09B classification comprises the disposal of solid waste. In the authors' analysis, 56% of all registered green patents are concentrated in these three classifications.

The three studies that served as the basis for the theoretical review in this section show the lack of correct disposal of solid waste, in addition to a counterpoint through case studies, such as in the second text discussed here, evidencing that the applicability of green technologies to industries and other sectors of the economy results in mitigating and environmental preservation measures.

Another important fact is the advent of information technology and disruptive technology as methods to make feasible the recycling, reuse, and correct disposal of solid urban waste, so as not to degrade the environment, in addition to making possible financial saving and better management of costs in production processes.

5. Disruptive Technologies

Before specifically addressing disruptive technologies and their current behavior, it is necessary to understand how they emerged and what they are based on. To do so, it is necessary to understand the concept of innovation, which Schumpeter [20] *apud* Theis and Schreiber [7] defines as everything that expands, causing a change in the circumstances of economic equilibrium. According to this author, it is possible to cite, for example, the discovery of new forms of production and commercialization or the development of new products, services, and technologies.

Drucker [21], agreeing with Schumpeter [20], emphasizes that innovation is the main tool to awaken the entrepreneurial soul, with which it is possible to find utility for any element in nature capable of generating wealth. Thus, innovation consists of creating solutions for consumption, transforming any and all changes into a great business opportunity [7].

Therefore, applying technology or scientific knowledge to improve processes and products can be

considered a major factor of competitiveness among companies, since they are important aspects regarding the consumption decision-making process [7].

The Oslo Manual, which is an important international guideline document on innovative activities in the industry, establishes four types of innovation, as follows: (1) product innovation, which is the development of a new technological product or service modified by technology; (2) process innovation, which alters and benefits the production process, even if there is no change in the final result of product or service; (3) marketing innovation, which corresponds to those changes made when a new product is launched on the market; and (4) organizational innovation, which are changes in the way of conducting processes in a company, as long as their results can be proven by improving productivity, in sales or profits, for example [22].

In this sense, based on these innovation concepts, the idea of disruptive innovation was also outlined, which is defined by Christensen [5], the main researcher on this topic, as the process in which a product or service enters the base of a market and starts to move to the top of this market until it occupies a position that reduces or completely eliminates competition.

For Christensen [5], disruptive innovation corresponds "to situations in which new companies can develop relatively simple, convenient, and low-cost innovations to promote growth and overcome the sector leaders". This model ensures greater accessibility for people who previously had no access to this market. This characteristic makes developing countries the best niches for launching this type of innovation.

This fact is due to the business model of these countries and the low-income population, following a logic that it is better to enter a market where there is no competition, as there is no consumption, rather than enter directly into global markets, in which there is already a habit of consuming this type of product/service. This system ends up benefiting the population with less purchasing power and has a high potential for growth [23].

Therefore, there is a disruption in the market when an innovation or technology replaces the product commonly appreciated by the public, even if it has lower performance, also reaching a portion of consumers more sensitive to price [9].

However, it is also essential to show how some technologies influence considerably in biopolitical aspects, being able to promote an increase in consumption by storing information in the databases of large companies. Through artificial intelligence techniques and algorithms, a consumption structure can be recreated and make advertising campaigns more accurate according to the target audience [24]. For this reason, one cannot ignore the direct relationship between consumerism and the disruptive technologies that feed it, also contributing to the intensification of calamity situations observed in the current ecological scenario [24].

Christensen [5] considers that disruptive innovation refers to all technological changes used to transform labor, materials, capital, and information into products and services with possibilities to add value [8]. Nevertheless, it is possible to perceive this principle of disruptive innovation in several spheres, not only in the institutional context of generating profits and economic advantages. In other words, disruptive technologies do not need to be practiced solely for commercial purposes [24].

Theis and Schreiber [7] point out that most environmental innovations are currently reactive and motivated by environmental regulations and laws, and cannot be sustained by the simple fact that they are not genuinely honest with the ecological principle. They simply seek to survive the market, respecting the impositions of the government or society.

Thus, it is questioned about the possibility of developing disruptive technologies with educational and awareness-raising goals, with a high capacity to modify their users' thoughts and consumption habits.

These tools could cause an imaginary disruption of high population impact, since they would be aimed at the masses, causing permanent changes in the consumers' subconscious. This is the case of the tools analyzed in the next section, which were developed to quantify the natural resources saved by recycling solid waste generated by consumption, thus making this reality more palpable in the consumers' subconscious.

6. Intelligent Garbage Can[2]

According to Christensen [5], disruptive technologies are those that provide different values in comparison with the main technologies, such as the intelligent garbage can, which aims to educate consumers about the amount of natural resources saved when waste is disposed for recycling.

This garbage can is a green patent because, as explained by Silva *et al*. [4], it aims to bring about positive changes for the environment by raising the population's awareness and improving solid waste recycling processes.

The intelligent garbage can[3] uses advanced technology to identify, collect, and process data from different types of recyclable materials. The machine has programming developed in C++, recorded in a PIC16F877A-I/P microcontroller to identify the collected waste, storing it in compartments ready for selective transport. When consumers dispose the waste into the can, they receive a coupon, informing them about the quantity of natural resources preserved by recycling that material.

The system is basically composed of 5 main blocks. First, the insertion of an object is detected, then the type of inserted material (PET bottle or aluminum can) is identified so that the anti-fraud test can be

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[2]Patent: Privilege of Innovation. Registration No.: MU00251302795267. Title: "Intelligent Garbage Can". Registration institution: INPI - National Institute of Industrial Property. Deposited on April 4, 2013.
[3]More information about the Intelligent Garbage Can at: <https://www.youtube.com/watch?v=PzXHWIt6Dnw>.

performed. If the object does not pass the test, it is rejected, otherwise, it is compressed and then separated. The machine, according to its programming and volumetric capacity sensor[4], gives information about its filling every 20% and when it reaches 100%, a sign is sent to the server, which activates a siren through a Web system developed with the following sayings: "Trash with 20%", "40%", "60%", "80%", and "100%" (full garbage can) (Figures 3, 5 and 6).

When the garbage can is full, a team is activated to empty it and send the materials for recycling, in a reverse logistics process that, according to Santos *et al*. [3], is the return of the leftover product to the production chain, in this case, through recycling.

It is worth mentioning that, for each material discarded into the intelligent garbage can, identified data are sent to the server, using a GSM/GPRS communication protocol, i.e., a cell phone connection APN coupled to the can's electronic circuit (Figure 5). The data sent to the server's fixed IP are received by the Java Servlet socket and inserted in the Mysql database. Thus, the treatment of spatial information is shown in reports generated from each garbage can, developed in the PHP programming language. This resumes the idea of virtualization defended by Cardozo and Murarolli [2].

The reports contain the following information: quantity of product stored per type of recyclable material, the idle capacity of the machine, natural resources saved per consumer, or overall, geographic location of the machine (increasing its security). Any information is obtained in real-time when the system allocated in the domain <www.lixeirainteligente.com.br> is accessed.
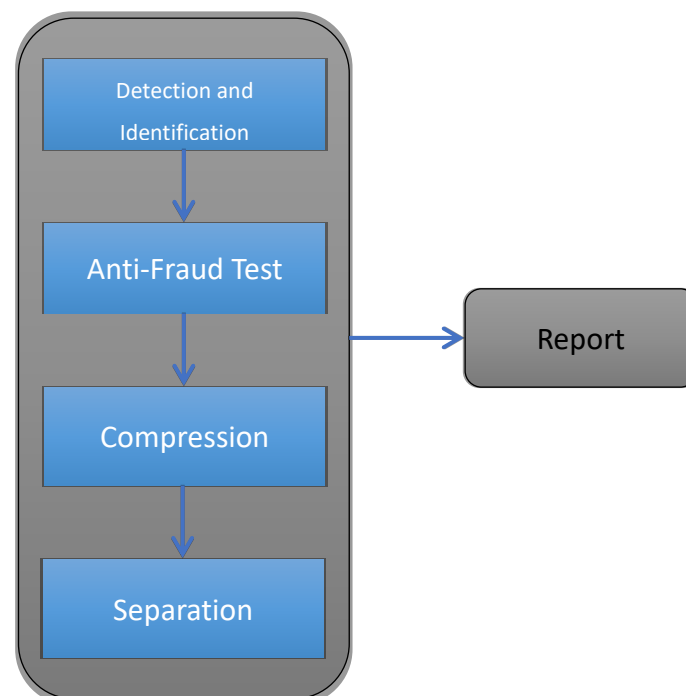
Figure 1. General System Block Diagram. Source: By the author (2020).

The electronic system is shown in Figure 2, in which the interference of the magnetic field is measured

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[4]To measure the percentage of waste that occupies the can, we use an ultrasonic distance sensor, which measures the distance, according to the sound response time. The XL-MaxSonar-AE was used (see Figure 5).

for the object identification if it is made of aluminum. This is also a stage for the anti-fraud test. If the inserted object is a plastic bottle, it will be identified by a capacitive sensor. The weight is measured to verify if the bottle/can was disposed empty (or not) and it is also a variable for the classification algorithm, which, in the calibration process, will be used in several tests, interlinking the collected information to determine patterns.
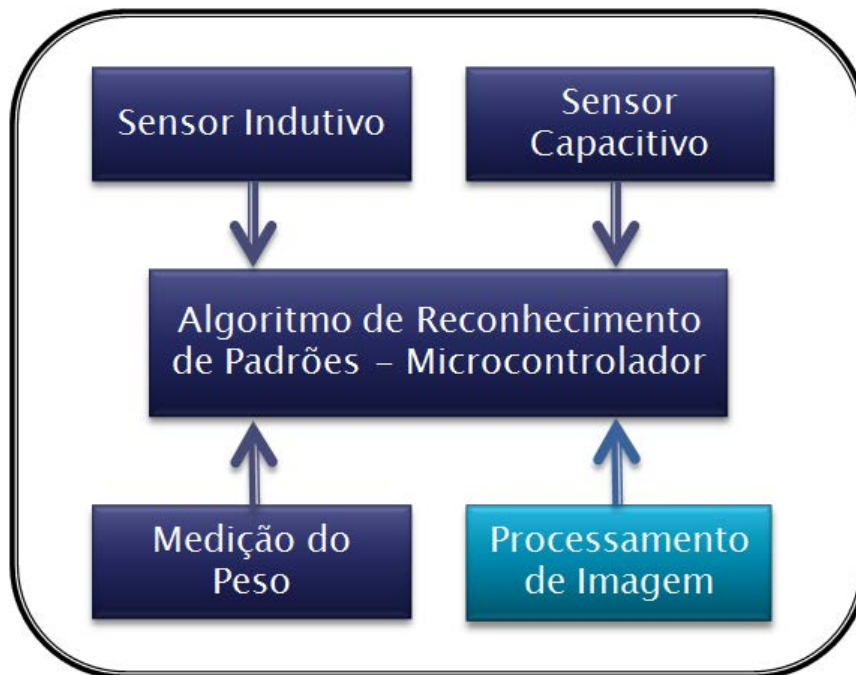
Figure 2. Block diagram of the Electronic Design Architecture. Source: By the author (2020)

The "decision tree"[5] is used as a classification method (Figure 5), which is an artificial intelligence system with a pattern recognition algorithm. This algorithm comprises the classes, which, in this case, are the different types of materials.

An Excel spreadsheet was also created to calculate the amount of resources saved from what is collected/recycled. When filling the spreadsheet with the amount of collected material in tons (e.g. aluminum, metal, paper, plastic, and glass.), the quantities of saved resources are immediately calculated and shown in another spreadsheet and in graphics (Figure 3).

However, the most interesting thing is how people relate to this disruptive technology. At first, they deposit their waste with some suspicion or without understanding the real dimension of that information in their lives, in their daily lives. Then, when they look at the coupon and realize the amount of energy saved by recycling that particular material, for example, the situation takes shape in their imagination and, even if they never use that garbage can again, every time they deposit waste in any can, they will

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[5]The decision tree is a multi-stage decision system in which classes are sequentially rejected, until finding an acceptable class. In the end, the space of characteristics is divided into regions corresponding to the classes. The decision sequence is applied to individual characteristics, checking if a certain characteristic is above or below a certain threshold. Each decision node contains a test on an attribute, each descending branch corresponds to a possible value of this attribute, each leaf (represented by the rectangle) is associated with a class and each path in the tree (from root to leaf) corresponds to a classification rule.

remember the experience they had with the intelligent garbage can. It is as if what they learn from that information is permanently impregnated in their subconscious, thus causing a disruption, which occurs from this change of thought and attitude towards the garbage/waste.

The discussion on this type of disruptive technology, of green patent and with educational and non-profit goals, differs from that common academic discussion, which addresses disruptive technologies from the point of view of labor precarization such as in the case of drivers and deliverers who use mobility and food apps, respectively.

Through these innovations, it is intended to address the change in the look by the information, the ability to disseminate awareness-raising information, through very low-cost tools that can even generate a policy to include everyone in discussions on ecology, and education on environmental preservation and anthropogenic activities.
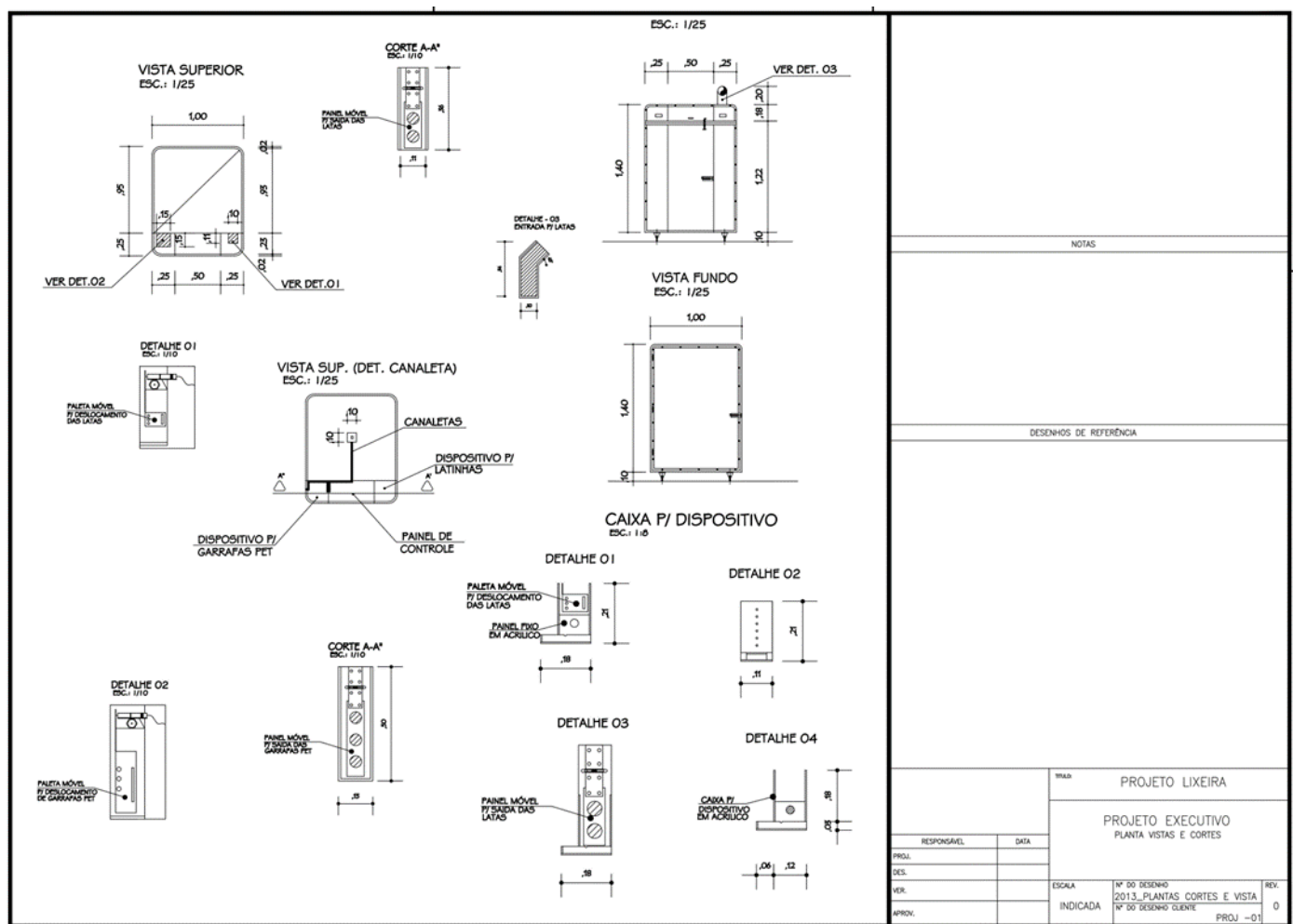
Figure 3. Intelligent garbage can: Section and Views. Source: By the author (2020).
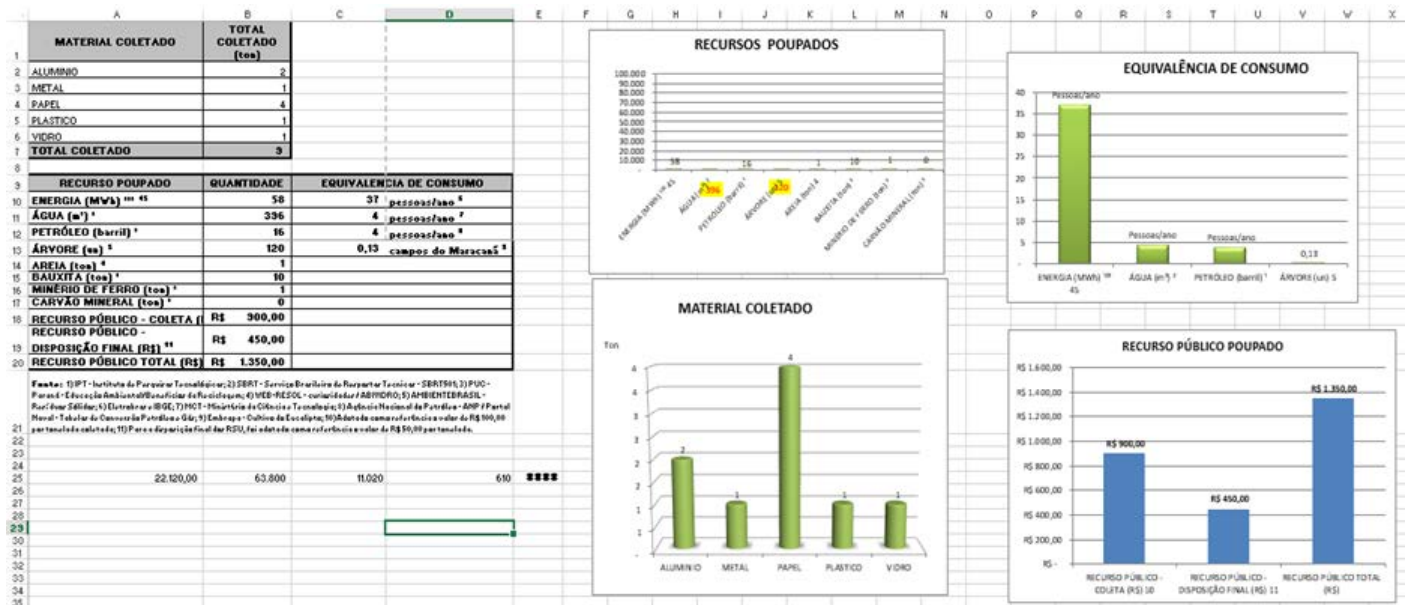
Figure 4. Natural resource calculator[6]. Source: By the author (2020).
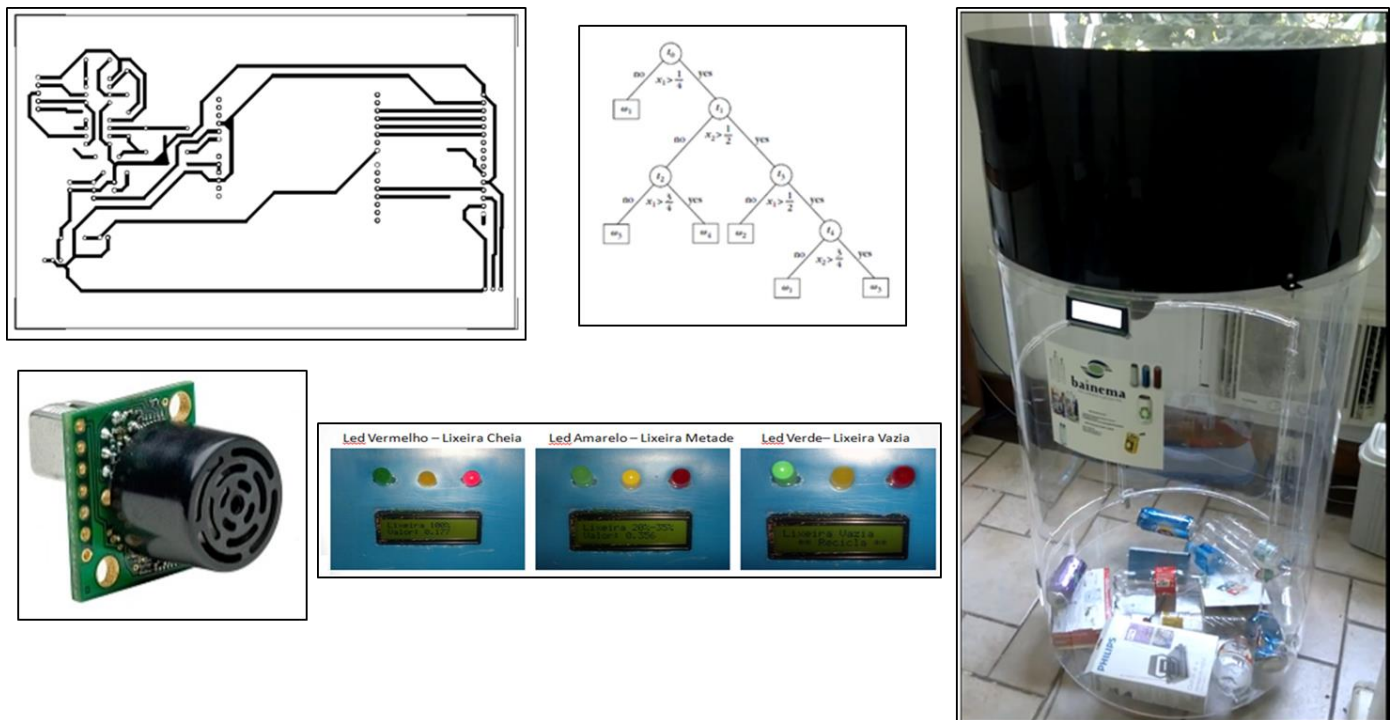
Figure 5. Intelligent garbage can: Printed electronic circuit board, 128x64 Graphic LCD Display, 40KHz Ultrasonic Sensor (RX and TX Pair), Decision Tree. Source: By the author (2020).

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[6]Source: (1) IPT - Technological Research Institute; (2) SBRT - Brazilian Technical Response Service - SBRT501; (3) PUC - Paraná - Environmental Education/Benefits of Recycling; (4) WEB-RESOL - curiosities/ABIVIDRO; (5) AMBIENTEBRASIL - Solid Waste; (6) Eletrobrás and IBGE; (7) MCT - Ministry of Science and Technology; (8) National Petroleum Agency - ANP/Naval Portal - Oil and Gas Conversion Tables; (9) Embrapa - Eucalyptus Cultivation; (10)The amount of R$38.00 per ton was adopted as reference for the final disposal of USW. The calculations used by the author for developing the Intelligent Garbage Can were based on this source.
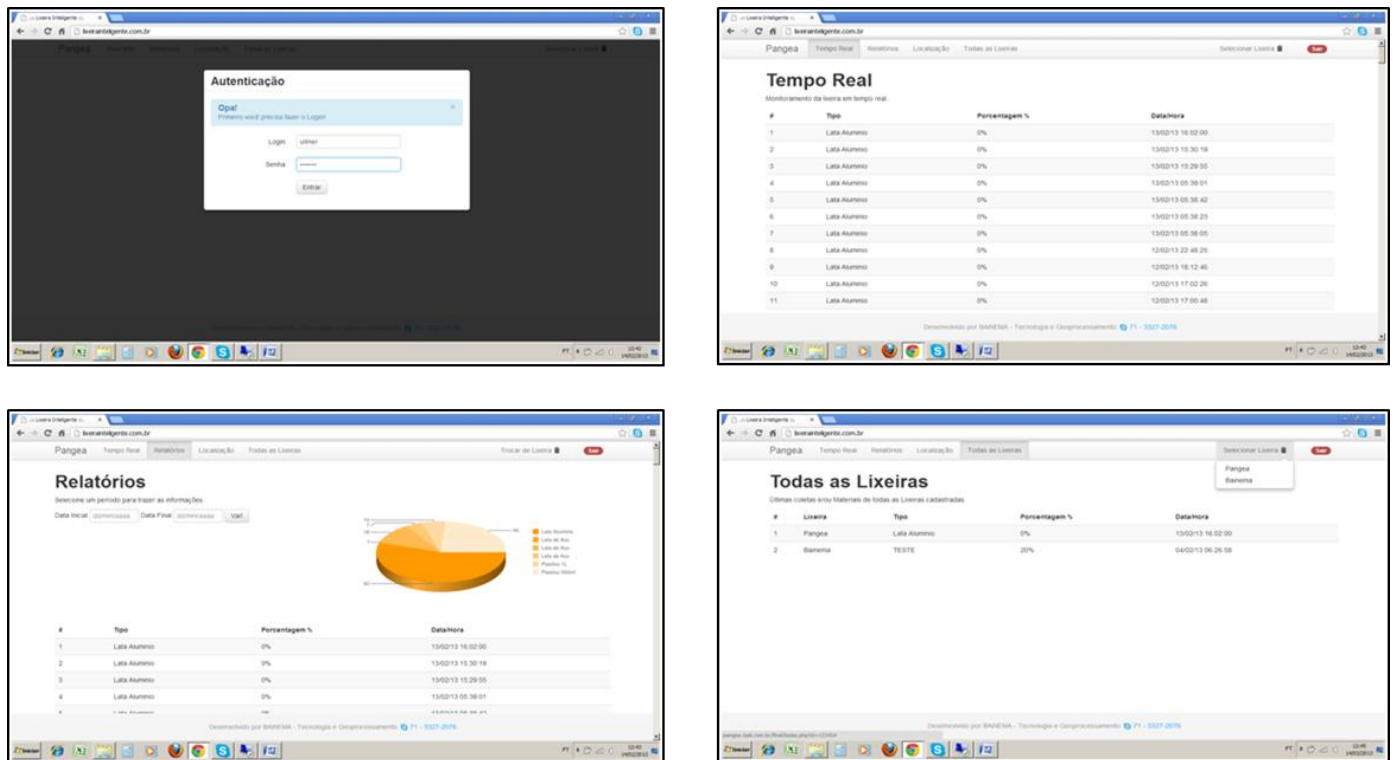
Figure 6. Web system: Intelligent garbage can. Source: By the author (2020).

7. Recycling Scoreboard[7]

The recycling scoreboard[8] was developed to record all recyclable materials collected during the Carnival held in São Paulo and Recife (Brazil), in 2020. Through this technology, the public knew what types and quantity of materials were collected, as well as the volume of natural resources saved with the appropriate final destination of these materials. This tool operates similarly to the intelligent garbage can, as it uses online management reports and the natural resources calculator. This also resumes the concept of virtualization by Cardozo and Murarolli [2], as the virtual environment represents reality. The difference is that the recycling scoreboard seeks to reach a higher number of people in less time, since it is seen in major events, such as Carnival, soccer games, World Cup, and Olympic Games, and can, therefore, be considered a disruptive technology tool for environmental awareness of high population impact.

The recycling scoreboard mainly aims to raise carnival revelers' awareness and, consequently, reach the other layers of civil society. The process comprises the following steps: (1) the recyclable material collected by collectors during the events is weighted; (2) the scale immediately makes a connection via a communication protocol and inserts the data into the MySQL database; and (3) the dynamic data are shown every weighing and in real-time on a video screen (4 m high and 3 m wide) (Figure 7), which shows data related to environmental preservation associated with the population's daily tasks, as shown in

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[7]Computer Program. Registration No. BR512013000238-9. Registration date: June 20, 2012. Registration institution: INPI - National Institute of Industrial Property.

[8]More information about the Recycling Scoreboard at <https://youtu.be/fVE81fJAknY>, <https://youtu.be/MXHruRHK0As>, <https://youtu.be/sRqTJ55qss0>, <https://youtu.be/YWjdbEWlwp8>, <http://porumcarnavalsustentavel.com.br/>, <http://domeulixocuidoeu.com.br/carnaval/index.php>. The dynamic video watched by the public during the Recycling Scoreboard is available at <http://recado.eco.br/recife/meulixo/video.php?infodados=0>.

Table 1.

Table 1. Quantity of material and equivalent saved resources.

Collected Material	Quantity	Saved Resources
Aluminum cans	648,769	Energy Consumed by 71,169 people
Glass	2	Saves sand when building 0 (m^2) of popular houses.
PET - Plastic	3,099	Saves gasoline to run 4,927 Km.
Paper	1,503	Saves 67,635 liters of water
Total collected	13 tons of waste	Equivalent to 181,030 liters of water, so it saves an average of 302 hours of bathing.

Source: By the author (2020).
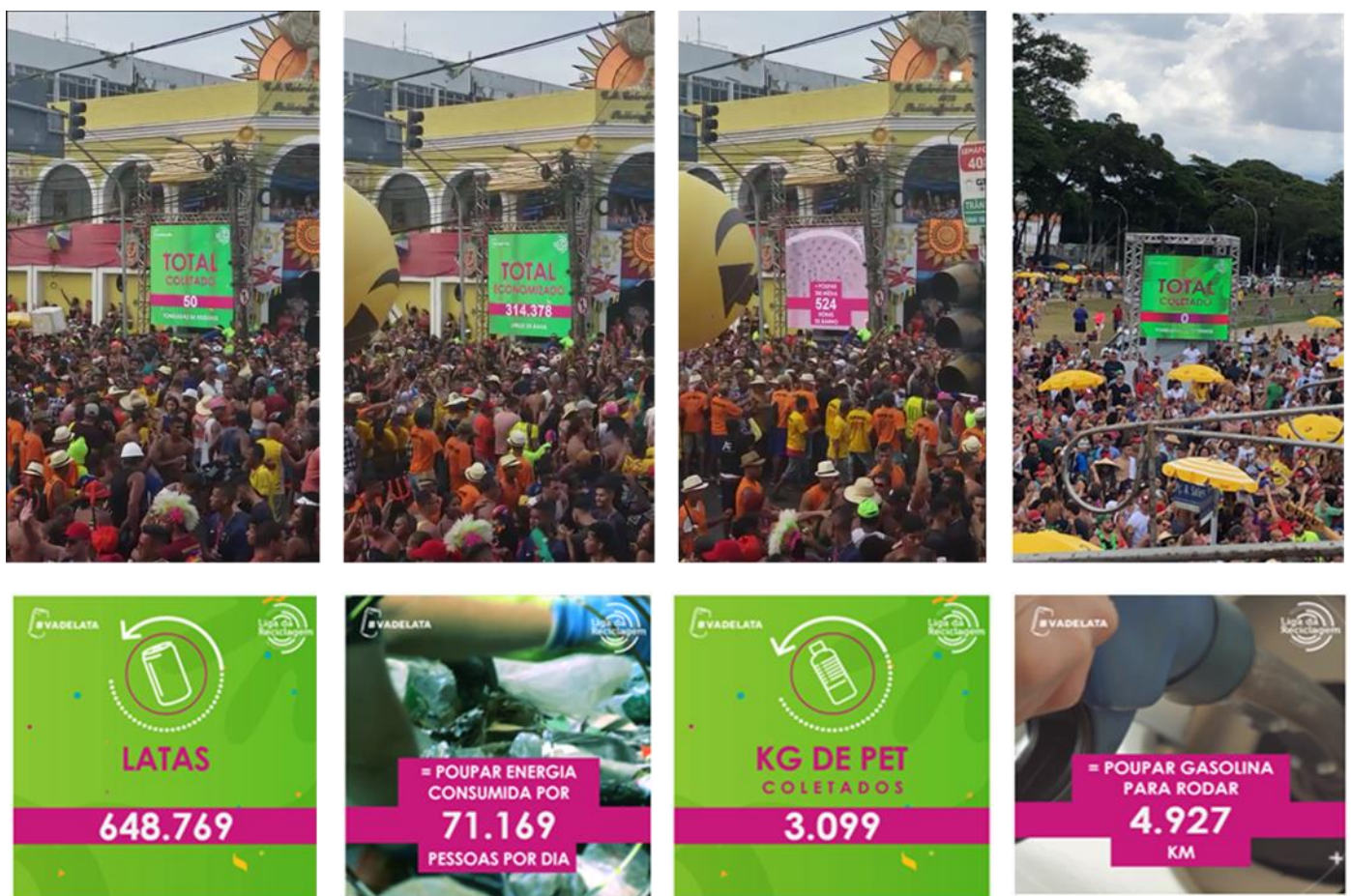
Figure 7. Video screen image of the Recycling Scoreboard. Source: By the author (2020).

The recycling scoreboard, from the perspective of meeting the legislation requirements, combined with socio-environmentally correct initiatives, reached around eighty thousand people in Recife, in the "Galo da Madrugada", which is a party that concentrates nearly one hundred thousand people, per night of the parade, which leads to significant waste production.

It also directly reached 120 thousand people in São Paulo and, indirectly, it reached an incalculable

number of people through the mass media, such as TV reports (Globo, Record, SBT, etc.), and news publicized on several websites.

The Carnival in Recife, particularly, had a different action promoted by the partnership between two companies (Ball and Novelis), which gave the event incentives and support, in compliance with what is determined by the National Solid Waste Policy – Law 12.305/2010 – PNRS:

> Art. 7 The objectives of the National Solid Waste Policy are:
>
> XII - integration of collectors of reusable and recyclable materials in actions involving shared responsibility for the products' life cycle;
>
> Art. 8 The instruments of the National Solid Waste Policy are, among others:
>
> - solid waste plans;
>
> III - selective collection, reverse logistics systems, and other tools related to the implementation of shared responsibility for the products' life cycle;
>
> IV – incentive for the creation and development of cooperatives or other forms of association of collectors of reusable and recyclable materials. [25]

The recycling scoreboard, combined with the precepts of the Sectoral Agreement, favored the participation of recyclable material collectors in the selective collection process, both in technical tests and in the "Samba" Schools parade days, ensuring environmentally correct actions for waste disposal, as well as job opportunities in the perspective of socio-productive inclusion for a significant number of waste collectors.

It is worth mentioning that the disruptive technologies considered in this article are related to the capitalist model of "environmentally sustainable" marketing; being, in this sense, aimed at the high population impact event frequent audience. The entrepreneurial modus operandi, which imaginatively suggests that the garbage collector dresses with personal protective equipment and high tax rates, can even feel "joy" during the exercise of their profession, hidden and silent in the daily reality of workers in cooperatives, streets and dumps. Exposed, therefore, a media service that "aggregates values, representations, ideas and guidelines on social reproduction services, guided by a competent ecological discourse dedicated to reproducing all the once 'only' ecologically correct world view". Del Gaudio [26].

The garbage collector, in these great events, escapes his dull and precarious daily life. This is because these events always take place in places belonging to the bourgeois ruling class, such as the Olympics, the World Cup, Carnival, Rock in Rio, Lollapalooza, etc. The recycling scoreboard, in this segment, appears to inform and change society's thoughts in relation to conventional dumps. However, in a critical analysis, the disruptive technologies shown in this article fulfill the function of "announcing a lot and silencing those who, in fact, made the decisions, made the choices, the discursive construction of this silencing through much saying, being silencing". Del Gaudio [26]. There is here a clear attempt to elucidate the environmental payment for the services provided at that time to society and to hide, historically, what was

not paid in the day-to-day life of the Brazilian recycling network in which a domination strategy is carried out and it generates a very efficient "ideological smoke wall", since the mainstream media is responsible for promoting it on their websites and open / closed channels.

Finally, it is concluded that, similarly to the intelligent garbage can, the recycling scoreboard can also be considered a disruptive technology due to its ability to cause and establish changes (disruptions) in the consumers' thoughts, resulting in a new behavior in their everyday activities. This technology is also a green patent because it aims to preserve the environment through innovation [4].

Moreover, it is worth mentioning the social issue, which leads to a paradigm shift in the waste collectors' lives and in the way people see them, realizing how their work is important and valuable to society and the environment.

8. Conclusion

It is undeniable how much technology has occupied considerable space in people's lives in recent decades. This is the result of large-scale industrialization caused by capitalism, which consequently increased consumption and the amount of waste, leading to routine discussions about ecology and sustainability. Inevitably, one thing leads to another.

In this sense, why not think about technology as an ally in the practice of sustainable development? How can it facilitate and improve people's lives and care for the environment, at the same time? These are fundamental discussions nowadays because, despite the advantages of technologies and globalization, there are also disadvantages due to the overuse or misuse of natural resources.

Thus, it was observed in this study that sustainability is the balance between social, economic, and environmental factors. For this reason, Green Information Technologies are such a promising market, as they allow companies to combine innovations, financial, and ecological interests. This can be exemplified by the database information storage in VPS or "clouds", making almost all transactions and processes virtual.

The resolutions and patents related to the disposal of industrial waste and civil construction solid waste were also addressed.

Furthermore, it was possible to understand the concept of disruptive innovations, coined and considered by Christensen [5] as all technological changes/disruptions aimed at transforming products, services, information, etc. However, this idea of disruptive innovation can be seen in several spheres, or rather, it does not need to be practiced solely for commercial purposes.

Therefore, two tools were presented here – the Intelligent Garbage Can and the Recycling Scoreboard –

which can cause an imaginary disruption of high population impact, since they aim at the masses, causing permanent changes in the consumers' subconscious. They were developed to quantify the natural resources saved by recycling solid waste generated by consumption, making this reality more palpable for the consumer.

Finally, given the above, it is concluded that information technologies have the potential to significantly contribute to the fight in favor of the environment, both through changes and disruptions in the way companies operate in the market, even if these changes aim at financial returns, and through applications or systems with educational and awareness-raising functions.

Thus, it is emphasized the importance of studies focused on the behavior of technologies faced with contemporary issues such as sustainability and environmental preservation. Technology must continue to be seen as having a facilitating role in the process of overcoming and solving problems, which are often also the result of modernity and globalization.

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Optimization of soybean outflow routes from Mato Grosso, Brazil

Souza Matheus M.ª, Rocha Marcus P. C.ᵇ, Farias Valcir J. C. , Tavares Heliton R.ª,

ª Institute of Technology of the Federal University of Pará

ᵇ Institute of Exact and Natural Sciences of the Federal University of Pará

Abstract

The purpose of this work is to apply a transshipment model, based on the theory of linear programming in a problem of optimization of the flow cost of soybeans from the State of Mato Grosso. The model consisted of analyzing the cost of transportation through the current transportation infrastructure, proposing two new options, being waterway and railway, as well as maintaining the port capacity of Arco Norte. 2018 production and projections for 2025 and 2030 were also considered. The results showed that the greatest reductions in transportation costs in 2018 occurred in the flow of production through Arco Norte. In addition, the new intermodal routes have significantly changed the transportation matrix, contributing to Brazilian competitiveness in the foreign market and assisting in the development of the North and Northeast regions.

Keywords: Linear Programming; Transshipment problem; Logistics.

1. Introduction

Brazilian agribusiness corresponds to 21.1% of the country's Gross Domestic Product (GDP) [3]. Exports in 2019 reached 82 million tons, with the Midwest region responsible for 45% of the total [19]. Brazil, then, is the second largest producer of soy in the world, and the state of Mato Grosso is configured as the largest producer state. However, inconsistent with the positive impact of agribusiness on the Brazilian economy, the country has an ineffective logistics infrastructure, which increases transport costs and contributes to greater environmental impacts.

Logistic service providers respond to the tension between transport demand and transport supply by dynamically adapting their services and strategies, ensuring that producer, product, and client are met. They make strategic decisions about the selection of the right modes of transport, the location of distribution centers, and the connections between distribution center locations and modes of transport, in an effort to continuously reduce generalized logistics cost [12]. In terms of cost, transportation represents around 60% of logistics costs, which makes it a strategic activity for any production chain [6].

For producing regions more distant from exporting ports, such as Mato Grosso, the transportation cost represents up to 27.5% of the soybean price that arrives at the final importing port, with internal transport responsible for up to 23% of these costs [24]. In 2018, Brazil's logistical costs were estimated at 12% of the Gross Domestic Product (GDP), the amount invested by the federal government in infrastructure was only 0.16% of GDP, and the cost to solve deficiencies in the infrastructure of transportation and logistics

was estimated at US$ 3.3 billion, in all modes [4].

Brazilian soy is transported to the foreign market mainly through the ports of the South and Southeast regions, with Santos, in the State of São Paulo, Paranaguá, in the State of Paraná, and Rio Grande, in the State of Rio Grande do Sul being the main exporting ports of the Brasil [19]. These ports, despite having better port infrastructure in terms of productivity, will soon be unable to keep up with the increased demand [18]. With the growing expansion of production in the Midwest, Northeast and North, the lack of port infrastructure in these regions drives exports through ports in the South and Southeast [26].

Within this aspect, the state of Mato Grosso stands out because it is the only one that exports cargo to all the main ports, and many counties have more than one destination port. In Brazil, 27 cities export more than 500 thousand tons of soy and corn and have more than one port as destination. Of these, 15 are in Mato Grosso, which makes it beyond the largest producing state, also the state with more options for transshipment terminals. However, most of the soy from mato grosso is transported by roads, totalizing 3042 km, of which 1647 km are unpaved and 1395 km are paved and the investment to adapt the infrastructure to agribusiness exports is at least US$ 67.50 million, of which US$ 10.36 million in conservation and US$ 57.14 million in [8, 14].

In this paper we set the soybean transportation cost as the research object, based on linear programming model, we optimize the soy logistics distribution for the ports. We adopt the transshipment problem (TP) to model the cost of the routes, considering the current routes and proposing two new routes, the Ferrogrão Railway and the Araguaia-Tocantins Waterway. Calculations of the models are implemented on General Algebraic Modelling System (GAMS) [2] and it will be made an analysis on cost reduction and change in the transportation matrix in the current and proposed scenarios.

2. Agribusiness and cargo transportation infrastructure

Agribusiness continues to emerge as a segment of significant relevance in the Brazilian economy and can be defined according to data from the Center for Advanced Studies in Applied Economics (CEPEA) in a set of four segments: inputs, basic or primary agricultural production, agribusiness and agroservices. Its participation in Brazil's Gross Domestic Product (GDP) in 2017 was 21.6%, with an average of 24.63% when considering the period from 1996 to 2017 [20].

The significant increase in soybean production in the last decades is due to five factors: 1) an important product for human and animal food, as it has a significantly high protein content, around 40% of its composition; 2) potential for the production of oil products by extracting its oil and bran, mainly for food and biodiesel production; 3) the characterization of soy as commodity, that is, it is standardized and uniform, with wide possibility of cultivation; 4) the presence of liquidity and high demand in the global market and 5) increased supply due to productive technological advances [14].

The concentration of soy production is mainly in the Brazil's Midwest region (see Figure 1), being responsible for 45% of production in the 2018/19 and 2019/20 harvest, with 52.6 and 54.5 million tons

respectively and the main producing state is Mato Grosso, with 33 million tons, about 27.5% of all national production. The southern region is the second most productive, concentrating about 32% of soy production, corresponding to 40.0 million tons. The Northeast has the third largest production in the country, with 10.5 million. Finally, the Southeast and North regions, with respectively 8.8 and 6.2 million tons [5].
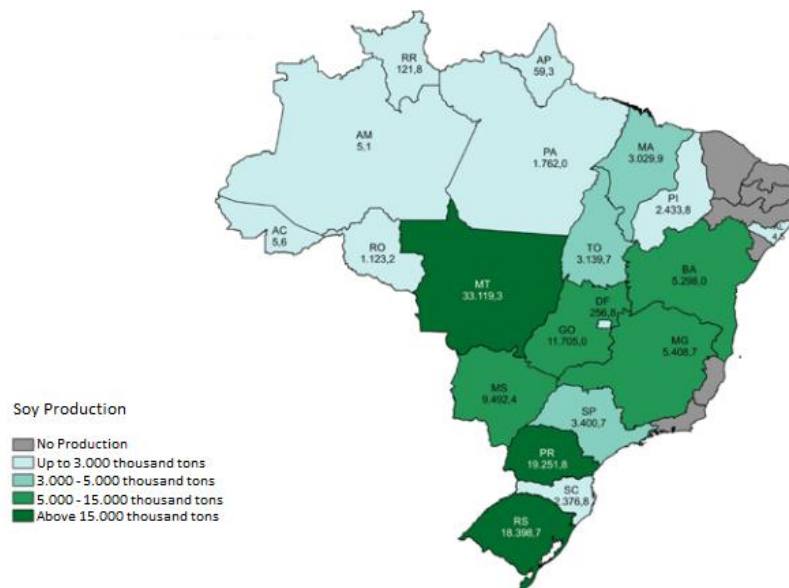
Figure 1: Agricultural production - Soybeans (2018/2019 harvest)

2.1 Soy transportation logistics

The flow of agricultural production occurs in different stages. One is sent directly from crops to public warehouses, rural properties, cooperatives or tradings characterized by fragmented road transport and high costs. The other is for transporting products from crops to processing industries or directly to export ports [4]. Figure 2 illustrates the process of transporting from origins to destinations.
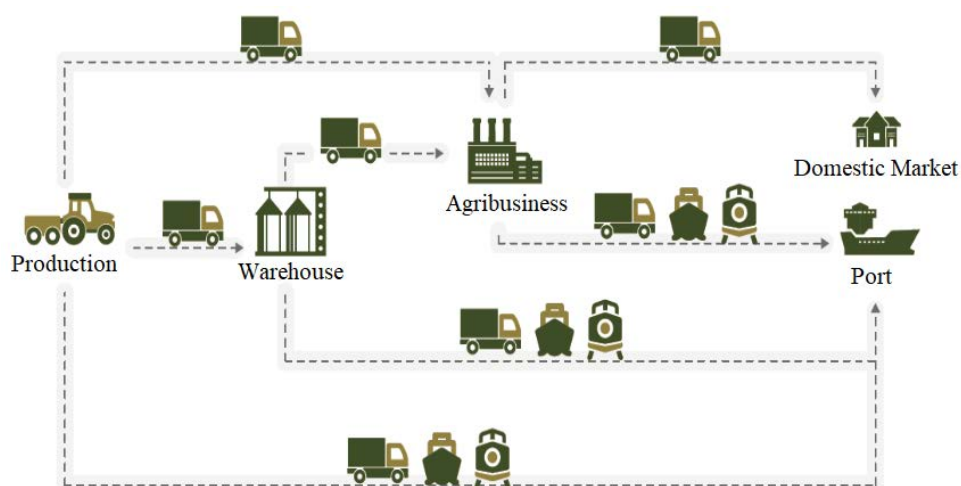
Figure 2: Logistics of the distribution of grains and derivatives in Brazil

The outflow of soy production is carried out mainly by road, and according [11] the problem with the road transport of most of the soy is the load capacity, which is extremely reduced in relation to the rail and

waterway modes. The distribution of production destined to the processing industries and later the domestic consumer market is carried out by road. The cargo destined for export ports is transported by highways, railways and waterways, and in some cases by the combination of modes [4].

In addition to implications for fuel consumption and emission of polluting gases, soy transportation takes place over long distances on poorly maintained roads [15]. The infrastructure for the flow must consider not only the modes of transport, but also the existence of warehouses for the maintenance of harvests and port infrastructure for cargo transshipment or export on long-haul vessels. Currently, the growth estimate for grain production exceeds the capacity to expand national infrastructure with direct consequences on transportation, breaches of contract, delays in delivery and loss of significant portions of international markets [4].

2.2 The Arco Norte

With the presence of the largest producers in the northern region of Mato Grosso, an option would be the flow of production through ports in the North and Northeast. Thus, the search for new alternatives became a priority due to the geographical expansion of the agribusiness frontier [4]. From this analysis, flow via Arco Norte emerged as a possible alternative. The same was defined as the export zone by the Porto Velho (state of Rondônia) and Miritituba (state of Pará) terminals destined for the ports in the North and Northeast of the country, bringing together the ports of Itacoatiara (state of Amazonas), Santarém (state of Pará), Vila do Conde (state of Pará), Itaqui (state of Maranhão) and Santana (state of Amapá) [9, 26].

Within the infrastructure investment aspect, especially in Arco Norte, a project stands out for the possibility of increasing Brazil's competitiveness in the face of international trade and establishing it as the world's largest soy exporter in the coming years, the Ferrogrão railway. The project, has an extension of 933 km, connecting the grain-producing region of the Midwest to the State of Pará, ending at the Port of Miritituba, later reaching the port of Santarém. The projected demand for the year 2020 is 25 million Useful Tonnes (TU) and 42 million TU in 2050, with a concession term of 65 to the private sector. The project is currently under public consultation [21].

Another opportune enterprise for the logistics of Arco Norte is the Araguaia-Tocantins Waterway. The project defines the capacity of transport in trains in 108 meters in length, 16 meters in breadth and draft of 1.5 meters. The 43 km stretch of Pedral do Lourenço, which lies between Ilha da Bogéa and Santa Terezinha do Tauri, includes trains 150 meters long and 32 meters wide, with a minimum draft of 2.1 meters [7] Currently, there is a project to demolish the Pedral do Lourenço, which seeks to facilitate commercial navigation on the waterway throughout the year. According to [22] this initiative is in the environmental licensing phase and the completion of the work is scheduled for October 2022.

The use of waterways in the Amazon basin, as well as railroads, combined with the shortest distances between producing regions and ports, drive the reduction of logistics costs and increase competitiveness. However, there are still major obstacles, such as the lack of investments in port facilities and road access, in addition to the expansion and integration of the rail network with other modes. Figure 3 illustrates the Arco Norte, with the projects of Ferrogrão Railway and Araguaia-Tocantins Waterway.
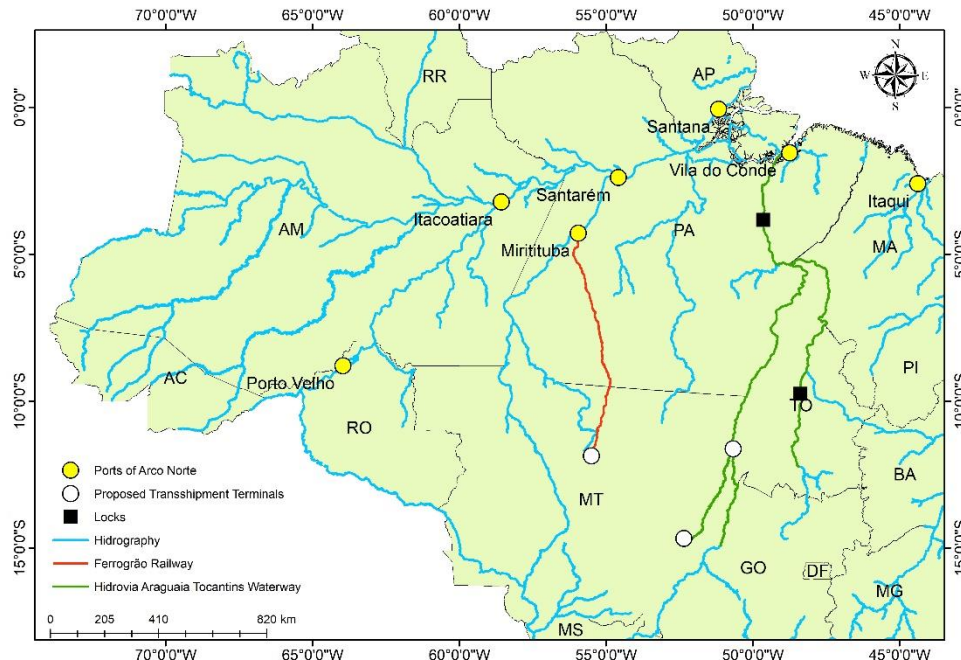
Figure 3: The Arco Norte

3. Case study

For the collection of data related to road taxes, intermodal freight and port taxes, the values were taken from [25], where secondary sources are also used to survey other data, namely the Brazilian Institute of Geography and Statistics (IBGE) and National Supply Company (CONAB) for production and Ministry of Agriculture, Livestock and Supply (MAPA) for production projections; System of Freight Information (SIFRECA), for rail freight and waterways; and the Ministry of Industry, Development and Foreign Trade (MDIC), for export. Inflation projections were taken from the Fiscal Monitoring Report, carried out by the Brazil's Federal Senate.

To quantify the supply of soybeans in Mato Grosso, data from Municipal Agricultural Production from the Brazilian Institute of Geography and Statistics was used. To quantify the production projections for 2025 and 2030, data from Ministry of Agriculture, Livestock and Supply (MAPA) was used [19]. Eight centroides were considered responsible for concentrating all state production and considering all four micro-regions. To standardize the analysis, some regions had more than one producer centroid, such as the North region, while other regions concentrated production in only one region, such as Northeast and Southwest-Center-South, as shown in Table 1.

Table 1: Projection of Municipal Agricultural Production 2018/2030 - IBGE / MAPA

Mesoregion	Centroid	Production (t)		
		2018	2025	**2030**
North	Brasnorte	1,441,854	1,872,808	**2,097,785**
	Campo Novo dos Parecis	6,736,102	8,8749,446	**9,800,505**
	Sorriso	7,810,388	10,144,824	**11,362,507**
	Sinop	4,053,449	5,264,979	**5,897,453**
Northeast	Querência	5,961,411	7,743,248	**8,673,433**
Southwest-Center-South	Tangará da Serra	1,149,866	1,493,548	**1,672,966**
Southeast	Primavera do Leste	2,382,233	3,094,250	**3,465,958**
	Itiquira	2,073,233	2,692,899	**3,016,393**
TOTAL		**31,608,562**	**41,056,000**	**45,988,000**

In the quantification of demand, we considered the volume of exports from the State of Mato Grosso through the main ports, which concentrate more than 90% of exports, namely: Santos, State of São Paulo; Paranaguá, State of Paraná; Rio Grande, State of Rio Grande do Sul; São Francisco do Sul, State of Santa Catarina; Santarém, State of Pará; Vila do Conde, State of Pará; Vitória, State of Espírito Santo; Itaqui, State of Maranhão and Itacoatiara, State of Amazonas.

In this work, three years were considered in the analysis, 2018, 2025 and 2030, taking into account the respective production (2018) and projections (2025, 2030) in the cities and demand in the Brazilian ports. In the scenarios 2018.1, 2018.2, 2018.3 and 2018.4 the values of road freight, intermodal freight and port tariffs remained the same with respect to the of the modeling. In the scenarios 2025.1, 2025.2, 2025.3, 2025.4, 2030.1, 2030.2, 2030.3 and 2030.4, the production and demand values were corrected taking into account the projections according. Table 2 illustrates the analyzed scenarios.

Table 2: Scenario analysis proposed

Scenarios	Routes	Port Capacity
2018.1	Current	**Current**
2018.2	Current	**+50% Arco Norte**
2018.3	Current + Railway + Waterway	**+50% Arco Norte**
2018.4	Current + Railway + Waterway	**+100% Arco Norte**
2025.1	Current	**Projected**
2025.2	Current	**+50% Arco Norte**
2025.3	Current + Railway + Waterway	**+50% Arco Norte**
2025.4	Current + Railway + Waterway	**+100% Arco Norte**
2030.1	Current	**Projected**
2030.2	Current	**+50% Arco Norte**
2030.3	Current + Railway + Waterway	**+50% Arco Norte**
2030.4	Current + Railway + Waterway	**+100% Arco Norte**

For modeling, the scenarios 2018.1, 2025.1 and 2030.1 represent the base scenarios and the scenarios 2018.4, 2025.4 and 2030.4 are considered the optimal scenarios. The scenarios 2018.3, 2018.4, 2025.3, 2025.4, 2030.3 and 2030.4 include Ferrogrão Railway and Araguaia Tocantins Waterway. Figure 5 shows the current soybean logistics and the proposed routes.
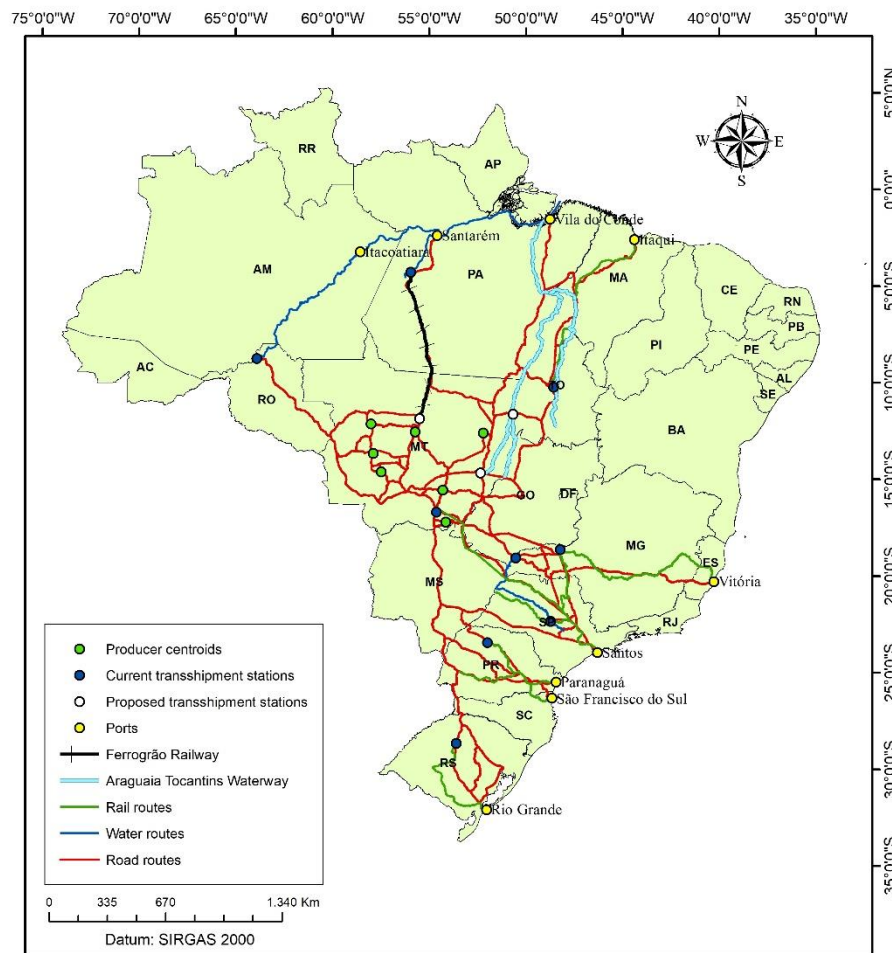
Figure 4:The flow of soy from Mato Grosso, Brazil

The basis for calculating values such as port taxes and road and intermodal freight was based on the Fiscal Monitoring Report (RAF) which details the projections of the macro-fiscal variables in the months of May and November. Table 3 shows the values in three scenarios: base, optimistic and pessimistic and was published in November 2019.

Table 3: Macroeconomic projections - Federal Senate of Brazil

RAF	Base scenario			Optimistic scenario			Pessimistic scenario		
	2018	2020	2023-2030	2018	2020	2023-2030	2018	2020	**2023-2030**
IPCA (%)	3.7	3.5	3.5	3.1	3.4	3.3	3.3	4.4	**5.0**

Regarding road freight, the values were based on [25], which estimated the freight curves by logistic corridors. The query database was the Freight Information System (SIFRECA). Table 4 shows the freight per corridor.

The data for transshipment, rail freight and water freight rates used in this work come from [25], as shown in Table 5, obtained through the collection of information from the agents involved in the respective operations. The capacity was considered sufficient for the flow of production in all terminals, in all scenarios.

Table 4: Freight by corridor type

Corridor type	Destination	Angular coefficient	Intercept	Estimated freight (US$/t)		
				200 km	1000 km	2000 km
Railway	Rondonópolis (SP)	0.0214	7.1561	11.43	28.53	49.91
Railway	Maringá (PR)	0.0224	3.2674	7.74	25.64	48.01
Railway	Araguari (MG)	0.0231	5.8835	10.50	28.95	52.02
Railway	Cruz Alta (RS)	0.0241	2.0565	6.88	26.17	50.29
Railway	Porto Nacional (TO)	0.0302	1.9883	8.03	32.18	62.38
Railway/Waterway	Sinop (MT)	0.0211	5.4912	9.70	26.56	47.63
Waterway	São Simão (GO)	0.0273	4.5676	10.03	31.89	59.21
Waterway	Miritituba (PA)	0.0237	25.7223	30.46	49.43	73.14
Waterway	Porto Velho (RO)	0.0136	16.2660	18.99	29.90	43.53
Waterway	Nova Xavantina (MT)	0.0211	5.4912	9.70	26.56	47.63
Waterway	S. Félix Araguaia (MT)	0.0211	5.4912	9.70	26.56	47.63
Port	Santos (SP)	0.0216	10.4616	14.78	32.03	53.61
Port	Paranaguá (PR)	0.0205	8.7569	12.85	29.22	49.69
Port	Vila do Conde (PA)	0.0172	16.3612	19.81	33.60	50.85
Port	Santarém (PA)	0.0172	16.3612	19.81	33.60	50.85
Port	Rio Grande (RS)	0.0196	5.0052	8.92	24.60	44.19
Port	São F. do Sul (SC)	0.0201	7.7836	11.81	27.92	48.06
Port	Itaqui (MA)	0.0164	10.8295	14.10	27.20	43.57
Port	Vitória (ES)	0.0188	11.1003	14.86	29.88	48.65

The ports chosen in this research correspond to more than 90% of the soy flow through Brazilian ports and the data regarding export capacity refer to the largest annual flow per port between the years 2014 and 2018, which were obtained from the Ministry of Industry (Table 6), Development and Foreign Trade [19].

3.1 The transport model

Optimal selection of transportation-transshipment routes is a challenge faced by many vendors and inability to select the right combination of paths can cause a big dent to profit margins [1]. Transshipment points are defined as points with zero inventory i.e., whatever is transported to such points are not stored for long, rather transferred to next locations [16]. It is important to use warehouses, select acquisition paths, allocate to inventories and target distribution points in an economical way and with a higher response rate, as delivery based on time is appreciated by customers [10].

Table 5: Intermodal freight

Terminal	Port	Intermodal freight (US\$/t)
Rondonópolis (SP)	Santos (SP)	28.20
São Simão (GO)	Santos (SP)	19.54
Maringá (PR)	Paranaguá (PR)	15.31
Araguari (MG)	Vitória (ES)	19.14
Miritituba (PA)	Vila do Conde (PA)	12.62
Miritituba (PA)	Santarém (PA)	7.05
Cruz Alta (RS)	Rio Grande (RS)	8.06
Porto Nacional (TO)	Itaqui (MA)	12.09
Porto Velho (RO)	Itacoatiara (AM)	12.09
Sinop (MT)	Santarém (PA)	25.12
Sinop (MT)	Vila do Conde (PA)	31.15
Nova Xavantina (MT)	Vila do Conde (PA)	16.56
S. Félix Araguaia (MT)	Vila do Conde (PA)	16.56

Table 6: Port capacity and taxes

Port	Port capacity (in 1000t)	Port Taxes (US\$/t)
Santos (SP)	9,065.656	6,79
Paranaguá (PR)	1,494.180	5.55
Rio Grande (RS)	285.174	5.24
São Francisco do Sul (SC)	758.866	5.49
Vila do Conde (PA)	3,932.242	4.62
Santarém (PA)	1,974.208	4.62
Itaqui (MA)	1,333.275	5.24
Vitória (ES)	1,680.144	5.68
Itacoatiara (AM)	1,747.305	4.87

Based on the theory of Linear Programming [13], in particular the transshipment problem [17], a linear optimization model was developed, with the objective of minimizing the total cost of transport. The data considered in the model, as shown above, were road costs, intermodal and transhipment costs, as well as port taxes.

$$
\text{Cost} = \sum_{i=1}^{n}\sum_{j=1}^{m} R_{ij} * FR_{ij} + \sum_{i=1}^{n}\sum_{j=1}^{r} P_{ik} * FP_{ik} + \sum_{i=1}^{n}\sum_{j=1}^{r} P_{ik} * CT_{k}
$$
$$
+ \sum_{i=1}^{r}\sum_{j=1}^{m} I_{kj} * FI_{kj} + \sum_{i=1}^{n}\sum_{j=1}^{m}\sum_{k=1}^{r} (R_{ij} + I_{kj}) * CE_{j} \,,
$$

(1)

subject to

$$\sum_{j=1}^{m} R_{ij} + \sum_{k=1}^{r} P_{ik} = OFT_i, \qquad \text{for all I} \tag{2}$$

$$\sum_{i=1}^{n} P_{ik} = \sum_{k=1}^{r} I_{kj}, \qquad \text{for all k} \tag{3}$$

$$\sum_{k=1}^{r} I_{kj} + \sum_{i=1}^{n} R_{ij} \leq DEM_j, \qquad \text{for all j.} \tag{4}$$

where:

OFT_i : Supply of grains for export to centroide i in tons per year.

DEM_j: Demand for shipping from ports j in tonnes per year.

FR_{ij} : Road freight in reais per tonne i originating from the centroid producer i and destined for the exporting port j.

FP_{ik} : Intermodal freight in reais per ton originating from the centroid producer i and destined for the transshipment terminal k .

FI_{kj} : Intermodal freight in reais per ton originating at the k terminal and destined for the j exporting port.

CT_k : Cost to carry out the transfer at the terminal k in reais per ton.

CE_j : Cost of port elevation at the exporting port j per ton.

R_{ij} : Road flow in tons originating from the centroid i and destined for the port j.

P_{ik} : Road flow in tons originating from the centroid i and destined for the transshipment terminal k.

I_{kj} : Intermodal flow in tons originating at the k transhipment terminal and destined for the exporting port j.

i: soybean producing centroid.

j : soybean exporting port.

k : intermodal transhipment terminal for soybeans, with the possibility of being a railroad, waterway or roadway.

n : index referring to the total number of producing centroids.

m : index referring to the total number of ports.

r : index referring to the total number of transshipment terminals.

The objective function has five components. The first component represents the road costs directly to the

ports. The second component represents the cost of transportation between the producer centroids and the transshipment terminals by road. The third is related to the transshipment cost to the intermodal terminals and the fourth represents the cost of transportation between the intermodal terminals and the ports by roads, waterways or railways. The last component represent the cost of transfer the cargo between the road or intermodal routes and the ports.

Constraint (2) determines that all the cargo produced in the centroids is delivered to the terminals and the ports. Constraint (3) is the balance between the soy produced that enters the terminals and the soy that goes out of these terminals and is shipped to the ports. Lastly, Restriction (4) concerns all cargo that is sent by road directly to the ports and the cargo transported from the intermodal terminals to the ports is less than or equal to the export demand at the ports. The processing of information for the model only was done using the computer program General Algebraic Modelling System (GAMS) [1].

4. Results

Among the 12 scenarios evaluated in this research, the scenario that presents the lowest transport cost (internal transport and port fees), is the 2018.4 scenario. The total savings presented in relation to the base scenario for the year in question (2018.1) is 23.54%, which represents about US$ 234.6 million. It is worth remembering that the scenarios 2018.4, 2025.4 and 2030.4 maintain the capacity of the ports in the South and Southeast and increase the port capacity of Arco Norte, as well as the implementation of the Ferrogrão Railway and Hidrovia Araguaia Tocantins Waterway.

Figure 5 illustrates the transport cost savings proposed by the model applied in the scenarios 2018.2, 2018.3, 2018.4, 2025.2, 2025.3, 2025.4, 2030.2, 2030.3, 2030.4 in relation to the scenarios, 2018.1, 2025.1 and 2030.1, the what are the bases of the study.
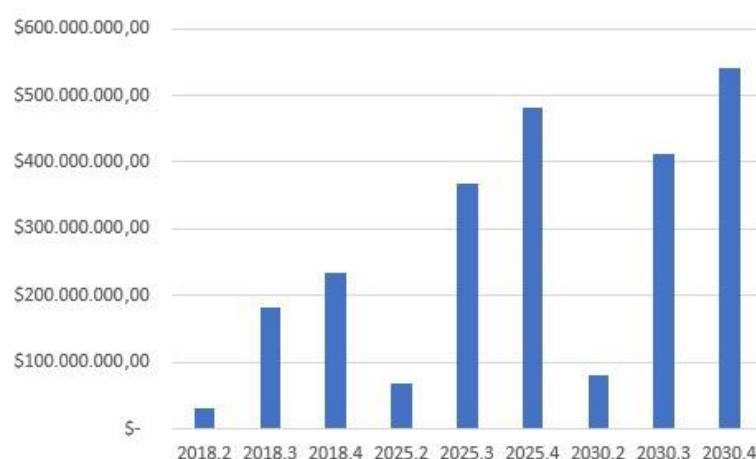
Figure 5: Economy proposed by scenario

Analyzing Figure 5, it is noted that between the scenarios 2018.3, 2025.3 and 2030.4, which promote the expansion of the port capacity of Arco Norte by 50% in addition to the implantation of Ferrogrão and Hidrovia Araguaia Tocantins, the scenario that stands out is 2018.3. Thus, it promotes savings of

US\$ 180.97 million or 18.15%. In relation to the scenarios 2018.2, 2025.2 and 2030.2, which only propose the maintenance of the port capacity of Arco Norte, the biggest cost reduction belongs to the scenario 2030.2, the economy reaches 3.36% or US\$ 80.19 million.

The analysis of the base years found that the road transport was responsible for 38.7 to 39% of the cargo transport directly to the ports, with Vila do Conde and Santarém being the main destinations. The port of Santos was the most used in all base scenarios, with values between 43 and 45%. The Port of Santarém and Itacoatiara together account for almost 20%, which demonstrates the opportunity to reduce costs through the ports of Arco Norte, even with deficient infrastructure. Table 7 below illustrates the participation of each port in the outflow of soybeans in the base scenarios.

Table 7: Export share of base scenarios – 2018.1, 2025.1 and 2030.1

Ports	Export Tax (%)		
	2018.1	2025.1	**2030.1**
Santos	45.8	44.2	**43.4**
Vila do Conde	19.9	19.2	**18.8**
Itacoatiara	8.8	8.5	**8.4**
Santarém	10.0	9.6	**9.4**
Itaqui	6.7	6.5	**6.4**
Paranaguá	5.0	7.3	**7.1**
Vitória	0.0	1.1	**2.9**
São Francisco do Sul	3.8	3.7	**3.6**
Rio Grande	0.0	0.0	**0.0**

In relation to scenarios 2018.2, 2025.2, 2030.2, 2018.3, 2025.3 and 2030.3 (Table 8), only the increase in the port capacity of Arco Norte reduced the participation of the Port of Santos by 15% in the flow of production. In addition, the ports of Paranaguá and São Francisco also stop exporting soybeans. With the insertion of Ferrogrão Railway and Araguaia-Tocantins Waterway together with a same increase in the port capacity of Arco Norte, all cargo transported by road was absorbed by rail and waterway modes, therefore, intermodal transport corresponded to 100% of the transported cargo. In this scenario, the receiving ports remained the same, but the routes showed cost reduction.

The scenarios 2018.4, 2025.4 and 2030.4 (Table 9), considered the optimal scenarios by the model, in relation to cargo distribution among ports, the port of Vila do Conde, in Pará, becomes the main exporter of soybeans in the State of Mato Grosso, varying between 30 and 40%, followed by Itacoatiara, in Amazonas, draining from 17 to 21% of the entire load. Santarém, in Pará and Itaqui, in Maranhão, are also established as major exporters of soy from Mato Grosso to the international market, thus consolidating the Arco Norte.

Table 8: Export share – 2018.2, 2025.2, 2030.2, 2018.3, 2025.3 and 2030.3

Ports	Export Tax (%)		
	2018.2/3	2025.2/3	**2030.2/3**
Santos	31.9	34.3	**35.5**
Vila do Conde	29.8	28.7	**28.2**
Itacoatiara	13.2	12.8	**12.5**
Santarém	15.0	14.4	**14.2**
Itaqui	10.1	9.7	**9.6**
Paranaguá	0.0	0.0	**0.0**
Vitória	0.0	0.0	**0.0**
São Francisco do Sul	0.0	0.0	**0.0**
Rio Grande	0.0	0.0	**0.0**

Table 9: Export share of optimum scenarios – 2018.4, 2025.4 and 2030.1

Ports	Export Tax (%)		
	2018.4	2025.4	**2030.4**
Santos	31.9	34.3	**35.5**
Vila do Conde	29.8	28.7	**28.2**
Itacoatiara	13.2	12.8	**12.5**
Santarém	15.0	14.4	**14.2**
Itaqui	10.1	9.7	**9.6**
Paranaguá	0.0	0.0	**0.0**
Vitória	0.0	0.0	**0.0**
São Francisco do Sul	0.0	0.0	**0.0**
Rio Grande	0.0	0.0	**0.0**

Table 10 presents transport costs in all scenarios in US$/t. In this context, it can be concluded that the average cost to transport a ton of soy from Mato Grosso internally in the base scenarios is US$ 50.35 in 2018, and will be US$ 51.53 in 2025 and US$ 51.97 in 2030. In the optimal scenarios of 2018, 2025 and 2030 the savings will be US$ 11.85, US$ 11.71 and US$ 11.75.

Therefore, it is possible to observe that in all scenarios, with the exception of the base scenarios, the cost of transportation reduces as the port capacities of Arco Norte and the intermodal routes are expanded, decreasing the soybean transportation cost.

5. Conclusion

A measure that increases soy production, leading mainly to spatial redistribution, studies pointed to the need to optimize or use the rational logistic of the structure, in an attempt to reduce costs, providing an increase in the use of soy on the world stage in the coming years. For this, the mathematical model based

on linear programming associated with the transport cost components used seems adequate to the objectives.

Table 10: Total cost by scenario

Scenarios	Total Cost (US$/t)
2018.1	50.35
2018.2	48.80
2018.3	41.21
2018.4	38.50
2025.1	51.53
2025.2	49.86
2025.3	42.57
2025.4	39.82
2030.1	51.97
2030.2	50.23
2030.3	43.03
2030.4	40.22

Through the analysis of the scenarios, it was observed that the ideal year for the implementation of the Ferrogrão and Hidrovia Araguaia Tocantins projects would be 2018, considering, mainly, the cost reduction of the transport values and port taxes. In a horizon of 5 to 10 years, proposed by this research, the percentage of cost reduction decreases, but it still proves valid for the implementation of the new routes.

The modeling confirmed the need for investments in transport infrastructure, in addition to encouraging intermodal transport, especially in the Arco Norte region. Only the increase in port capacity of ports in the northern region can represent a reduction of up to US$ 77.6 million in 2030, demonstrating the great opportunity of the region. Therefore, the establishment of states in the North region as major exporters through new routes can bring government and private investments, encourage more sustainable means of transport, as well as the generation of jobs for the population, contributing to the establishment of Brazil as a major producer and soy exporter in the international market.

This present research had as main objective to contribute with the studies that serve as base for investments in transport infrastructure in Brazil. However, in addition to transport cost studies, models are needed that consider the technical-economic-operational feasibility of implementation, as well as the capacity of the transshipment terminals and the quality of the routes. Therefore, it is suggested for future work the considerations of these variables in models of transportation cost of Brazilian soy, as well as, it performs an economic analysis considering an economic optimization using fuzzy logic [23].

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Challenges of collaborative education and academic learning in engineering higher education

Patricia Guedes Pimentel, Marcelo de Jesus Rodrigues da Nóbrega2, Flavio Maldonado Bentes3

1 Master student in Environmental Engineering (UERJ), Rio de Janeiro, Brazil. E-mail: engpatriciapimentel@gmail.com

2Post-Doctor in Civil Engineering (UERJ), Doctor in Engineering (PUC-Rio), Master in Technology (CEFET/RJ). Professor at UNIGAMA, CEFET-RJ and Santa Úrsula University, Rio de Janeiro, Brazil. E-mail: engmarcelocefet@terra.com.br

3Doctor in Mechanical Engineering (UFRJ), Master in Mechanical Engineering (UnB). Senior Researcher (FUNDACENTRO), Rio de Janeiro, Brazil. E-mail: flavio.bentes@fundacentro.gov.br.

Abstract

The focus that will be given in this article, is the relevance of collaborative teaching in the academic environment, with emphasis on higher education in engineering, considering the professional relationship between educating agents and students. To assist in the higher education process, the main challenges encountered will also be addressed, as well as to point out possible increasingly necessary solutions. Raising such important educational issues is necessary since the reference of an institution of higher education is based, among other aspects, on the qualifications of the teacher and his professional training, as well as on his ability to deal with everyday problems. Thus, seeking to achieve the proposed objectives, a bibliographic review was carried out on the theme presented and its consequences in relation to higher education, focusing on engineering courses. In addition to defining concepts related to collaborative teaching, this study links the relationships between higher education professionals, to the institution's growth and improvement. Finally, it was possible to verify that some of the problems listed in the present study are related to the way in which education professionals deal with everyday matters.

Keywords: Collaborative Teaching. University education. Professional Relationship.

1. Introduction

Considering the various problems found in school practices, Parrilla and Daniels (2004) comment that, as the difficulties present themselves in daily life, teachers seem to feel a lack of support, resulting in the lack of initiative to seek new solutions. In this way, habitual behaviors are adopted with no hope that they will work and, although the authors refer to the Spanish education system, this account is similar to the reality of Brazilian schools.

It is observed in more depth, the existence of possible flaws in the teaching-learning process, such as the emphasis given to the memorization of exercises and difficulties in the development of critical and self-

critical skills, of the knowledge that is passed on and learned. Therefore, it is important that all educational action is connected to the decisions made by members who are part of the school community.

Understanding that the collaborative teaching practice is an action dependent on foundation, mutual student/teacher participation, adaptation of classes for positive and more effective methodologies, among other experiences addressed in this study, it is necessary to seek commitment to quality educational actions, in order for new studies to increasingly stimulate the improvement of teaching mechanisms. Thus, in the search to improve teaching mechanisms and collaborative practices, a bibliographic review is made based on research published in books, journal articles, theses, dissertations, and other traditional documents in the area, from Brazil and other countries.

In its structure, first, the present study directs attention to conceptualize collaborative teaching, focusing on higher education in engineering courses, differentiating collaboration from cooperation. Following, arguments are brought up that involve the positive potential of collaborative work in the academic environment.

Finally, some of the challenges of academic learning in higher education courses are listed, in addition to demonstrating the relevance of scientific research as an instrument of significant and amplifying motivation, of the contents learned in the classroom, in the search to arouse the interest of students and develop critical thinking in the most diverse segments.

2. Development

2.1 Concepts and Definitions

According to Parrilla (1996, apud ARNAIZ, HERRERO, GARRIDO and DE HARO, 1999), the definition of collaborative groups is one in which all components share the decisions made and are responsible for the quality of what is produced together, according to their possibilities and interests. To qualify studies related to group work, terms that are like the theme such as collaboration and cooperation are used.

Damiani (2008) informs that, despite having the same prefix denominating joint action, the terms are different. While cooperation is related to practices of operation, execution, and operation of the system, on the other hand, collaborating is interpreted as work, production, and development of the appropriate activities.

Thus, the author makes it clear that, in cooperation, mutual assistance in carrying out tasks is verified, even though their purposes are generally not the result of a negotiation agreement prepared by the group. Therefore, it is admitted that there are unequal and hierarchical relationships between its members. However, the collaboration suggests that the members of a group help each other, in the search for reaching common goals adjusted by the collective. Thus, collaboration establishes non-hierarchical relationships, with shared leadership, mutual trust and co-responsibility for the conduct of actions.

Fullan and Hargreaves (2000), when studying the characteristics of the cultures of working together in schools, describe alternative forms of collaboration that do not constitute collaborative cultures, only occasional joint actions or actions regulated in a manner guided by the direction of the institutions.

Nevertheless, Torres, Alcântara and Irala (2004) argue that collaboration can be understood as a philosophy of life, while cooperation would be seen as an interaction used to facilitate the achievement of an objective or final product. The authors start from two premises: the rejection of authoritarianism and the promotion of socialization.

In research developed by Dearnley and Matthew (2007, p. 378, free translation), academic success is related to the "development of skills, knowledge and motivation required for independent and autonomous learning throughout professional practice".

However, the definition of academic success is given by Tavares (2000, p. 8), in which it is understood that:

> "By academic success we mean not only school or educational success, but also the personal, social and community success that the university student must achieve during his life inside the academy, which cannot be measured only by the classifications or grades of his school performance, but above all by the development of relational skills and competences, of discernment, of initiative, of a critical spirit and of common sense (...)" (TAVARES, 2000, p. 8).

Regarding the institutional point of view, Franco (2000) highlights that the teacher "is the one whose work plan has hours for research, but is also the one whose teaching hours are so many that there is no room for investigations sometimes, nor even to prepare your classes". From a situational point of view, the teacher:

> "(...) is one who works at a large and complex Brazilian university, whether public or private, with a solid postgraduate system and with the presence of consolidated research groups. It is also what works in an isolated higher education institution and in which teaching is the very reason for being. It is both what works at the market-oriented university and what works at the community institution anchored in its environment" (FRANCO, 2000, p. 63).

Finally, the Pedagogical Coordinator is one of the main actors involved in the educational processes of higher education. It is the one involved in educational practices, not only in pedagogical planning, but also committed to the difficulties of teachers and students, always seeking to assist in whatever is necessary.

2.2 Positive characteristics of collaborative work

Knowing that the learning mechanisms are related to interpersonal relationships, the teacher starts to represent a bond, which can be considered favorable or not. Thus, it is observed that in certain cases, some students do not learn the discipline, as they classify it according to the relationship they have with the teacher (SEDUC, 2020).

Thus, according to SEDUC (2020), "the mutual respect that is established, guarantees the harmony of interpersonal relationships at school and in the classroom, and is characterized as a true social phenomenon". Considering also that there are several pedagogical groups in higher education, each composed of teachers with diverse opinions and individualized teaching practices, it is admitted that collaborative work is an important tool to promote student-teacher interaction.

When we check certain practices performed in the school context, interpersonal relationships are linked to the way the manager conducts the actions developed. For Lück (2005), the importance of implementing participatory and democratic actions in the social unit is clear:

> "The participatory approach in school management demands greater involvement of all those interested in the school's decision-making process, mobilizing them, in the same way, in the realization of multiple management actions. This approach expands, at the same time, the collection of skills and experiences that can be applied in the management of schools, enriching, and improving them" (LÜCK. 2005).

According to Martins (2002), teachers are, for the most part, dispersed. Even considering the moments of organization, like the meetings in the teachers' rooms and meetings throughout the semester, such moments end up being consumed in an unprofitable way, for the elaboration of bureaucratic activities and the resolution of emergency problems. In this way, the author highlights a gap, which should be filled with the creation of "a space for reflection, planning and transforming your educational practice into humanized activities for yourself and your students" (MARTINS, 2002, p. 233).

Amid these arguments, it is worth emphasizing the ideas put forward by Góes (1997, p. 27), who considers:
> "(...) the dialogical game between subjects does not tend to one direction; on the contrary, it involves circumscription, expansion, dispersion and stabilization of meanings. A certain knowledge (intended, in the intent of the other; or predicted, in the perspective of an observer) may or may not be constructed by the individual" (GÓES, 1997, p. 27).

In a detailed survey of collaborative work between teachers and the long-awaited school success, Damiani (2008) warns about the benefits of collaborative culture in the school environment:

"(...) it has low rates of repetition and dropout among its students (when compared to the averages of the city's schools) and a high degree of satisfaction and investment in continuing education for its teachers" (DAMIANI, 2008, p. 220).

Finally, it is possible to note the benefits of discussion groups and collaborative work between teachers, demonstrated in works such as those by Passos (1999), Magalhães and Celani (2000), Dickel et al. (2002), Detsch and Gonçalves (2002) and Silva (2002). Therefore, through the set of evidence verified in the literature, regarding the relevance of collaborative work in the academic environment, Figure 1 highlights some of the activities related to cooperative learning.

Figure 1. Activities related to cooperative learning
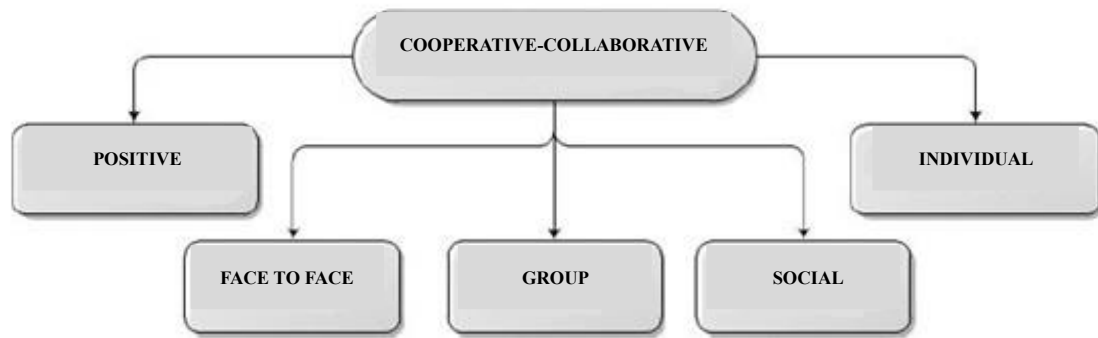
Source: FURTADO et al, 2014.

2.3 Academic learning challenges

Although there are professionals from various backgrounds, each with their unique values and characteristics of transmitting knowledge, it is necessary to respect this diversity of thinking, so that the higher education institution can develop beneficial actions in favor of students and education as a whole.

The teacher's posture in the classroom and his ways of transmitting certain theoretical content, together with more dynamic activities and a more modern and updated approach are undoubtedly fundamental questions to be discussed in order to address the problems evidenced by students, both disciplinary and academic performance during the course.

Considered crucial for the development of the student's critical thinking, the complementary methodology is given using laboratories and experimental classes in engineering courses. However, many disciplines seeking not to considerably increase the proposed workload, end up integrating experimental laboratory classes as extension classes of the theory / exercise of the discipline itself. The laboratories must be focused on the didactic application in the disciplines to which they are linked and also serve as support for research work.

Therefore, providing practical classes can help in the development of scientific concepts, and return a subject already addressed in the classroom with other approaches, leaving the student to have a new view on the same topic. In this way, the ability to broaden the reflection on a given subject can consequently generate discussions during classes and, with that, bring up critical thinking (OLISKOVICZ & PIVA, 2012).

According to Liberali (1999), the reflection that the teacher must provide about his own work, consists of verifying four actions: describe, inform, confront, and reconstruct. Cortez (2003), supported by Liberali (1999) exemplifies these four actions. According to the author, the moment to describe, consists of the act of the teacher reporting in writing his actions in class, to carry out a self-criticism of his strategies and objectives outlined for a certain content. About informing, the author defines for this stage that the teacher is looking for theories to support and base the planned class. "The way I teach demonstrates the power

relationship that exists in the classroom" (CORTEZ, 2003, p. 225).

Confronting consists of an analysis of posture and attitudes when teaching. Thus, the teacher will be able to conclude if his teaching is being carried out in such a way as to provide the true knowledge and growth of his students. And finally, rebuilding it, treated as the phase in which it is important to face with maturity and humility that we are not ready / finished, that we are always growing / changing (Cortez, 2003, p. 225).

Therefore, the rebuilding phase is considered in the present study as one of the most important, which aims to elucidate the teacher that continuing education is essential to achieve better academic performance, that is, that there are gaps in our daily practice that can be improved / filled, as we understand and learn new ways of acting (Cortez, 2003, p. 225).

Considering that professional development corresponds to both teacher training courses, as well as the sum of knowledge acquired throughout life, it is necessary to ensure quality school management, in addition to the use of various pedagogical practices. For Romanowski (2007):

> "Continuing education is a requirement for current times. Thus, it can be said that teacher training takes place on a continuum, starting with basic schooling, which is then complemented in initial training courses, with instrumentalization of the teacher to act in social practice, to act in the world and in the labor market. work" (Romanowski, 2007).

According to Rausch and Schlindwein (2001), the effects of discussions by groups of teachers who sought to reflect on their practices were investigated. The authors explain that:

> "For teachers to reframe their practice, it is necessary to theorize it. And this movement to theorize the practice is not only effective with training, lectures, seminars, expository classes, but much more, when there is a dynamic relationship with the practice of this teacher from a collective reflection" (RAUSCH and SCHLINDWEIN, 2001, p 121).

The authors also highlight the importance of the relationship between teachers:

> "It is necessary to unleash procedural, collective, dynamic and continuous training strategies. Reflecting with other teachers and sharing mistakes and successes, negotiating meanings and confronting points of view appears as something that stimulates a compromised pedagogical practice" (RAUSCH and SCHLINDWEIN, 2001, p. 121).

In addition to good salaries and adequate training, it is necessary to ensure competent school management, where the isolation of the classroom is ended. In this sense, Schôn (1997, p. 87) informs:

> "The development of an effective reflective practice has to integrate the institutional context. The

teacher has to become a browser attentive to bureaucracy. And school leaders who want to encourage teachers to become reflective professionals must create spaces of peaceful freedom where reflection is possible" (SCHÔN, 1997, p. 87).

When it comes to teaching methodology, it appears that most university professors recognize the importance of teaching planning, but not everyone creatively prepares their classes. Many teachers simply follow the textbook chapters (GIL, 2012, p. 94). Thus, it is necessary to plan in detail the activities that will be practiced in the classroom. In addition, the intended objectives must be defined, what resources will be used, if there are execution times and the evaluation of the learning process.

According to Gil (2012, p. 95), educational planning can be defined as a systematic process through which educational activities can be made more efficient to achieve the established goals within a given period. Regarding the reflexive posture of a coordinator, Lima, and Santos (2007) state:

> "(...) with the practice and the teacher's view as a reference, the coordinator faces the challenge of building his new professional profile and delimiting his space of action. Their contribution to improving the quality of the school and the conditions for the professional practice of teachers will depend on the success achieved in this task" (LIMA E SANTOS, 2007, p. 06).

In these terms, one of the roles of the pedagogical coordinator is to assist with the anguish and difficulties faced by the teaching staff, in the search for establishing a dialogical relationship, always attentive to the changes that occurred at the university, being that:

> "(...) the pedagogical coordinator, needs to act to face these issues, with the possession of an educational proposal that has a clear concept of planning, objectives, contents, methodology and evaluation" (VASCONCELOS, 2002 p. 104).

It is also the responsibility of the coordinator to combat individualistic pedagogical practices (RAPOSO; MACIEL, 2005), assisting teachers in combating isolated actions. In addition, the relationship that the teacher promotes in the classroom is fundamental to a successful job.

According to Freire (1996, p. 103) "The climate of respect that arises from just, serious, humble, generous relationships, in which the teaching authority and the students' freedoms are ethically assumed, authenticates the formative character of the pedagogical space". Maintaining a respectful environment is vital to good practices in the teaching and learning process.

2.4 Scientific research as an instrument in higher education

Research is fundamental for any area, mainly for Engineering, in which the student must be encouraged to produce academic works, capable of developing a set of skills in the field of his future professional performance. Therefore, it is through a greater understanding between the practical reality and the theory

learned in the classroom, that we can conclude that the production of knowledge cannot be dissociated from the research practice.

Considering that young researchers arouse their interests and build their knowledge during the course at the University, a space surrounded by scientific data, by investigating the way in which research becomes relevant in higher education, we can correlate the information acquired and its contribution to training professional and personal development of young people and their academic development.

Therefore, it is during graduation that students of higher education courses must begin their academic productions, being inserted in research and extension projects guided by their respective teachers, who are able to build the bridge between classroom theory and practice. It is also important to mention that, according to the Law of the Education Guidelines and Bases 9.394/1996, it is established in its Art. 52:

> "Universities are multidisciplinary institutions for the training of professional staff with higher education, research, extension and mastery and cultivation of human knowledge, which are characterized by: I - institutionalized intellectual production through the systematic study of the most relevant themes and problems, both from a scientific and cultural point of view, as well as regional and national; II - one third of the teaching staff, at least, with academic master's or doctorate degrees; III - one third of the teaching staff on a full-time basis. Single paragraph. The creation of specialized universities by field of knowledge is allowed" (BRASIL, 1996).

The practice of researching and analyzing data, proposing solutions, as well as work aimed at public presentation, is a determining factor in the student's professional career in the future. Therefore, it is evident by Bridi (2010, p.184) that contributions from scientific initiation practices, "[...] can be a space for creative production with educational and pedagogical value".

There is also the relevance of research groups, which increasingly encourage and encourage young people and adults in higher and postgraduate courses, to carry out scientific studies to improve the knowledge acquired so far. Therefore, the growth of consolidated research groups is related to the National Council for Scientific and Technological Development (CNPq). It is worth remembering that, by definition, a research group consists of:

> "(...) a group of individuals organized hierarchically where the organizing foundation of this hierarchy is experience, prominence and leadership in the scientific or technological field, with professional and permanent involvement in research activities; where the work is organized around common lines of research; and where, to some degree, facilities and equipment are shared" (CNPq, 1999).

Thus, it is important to emphasize that the preparation of documents and technical reports reflects the professional who prepares them, as well as the mirror of his training as an engineer. The person who experiences a research practice, collaborates with a job market whose professionals are considered

autonomous, curious who seek to understand a situation experienced, its challenges and, in turn, find explanations and solutions to overcome each obstacle that they may possibly encounter in their career.

3. Conclusion

Considering that there are still many challenges to be faced, the literature review carried out in the present study, made it possible to understand how collaborative work in the academic environment should work, indicating that the development of certain activities, jointly and dialogically, can create an environment rich in academic and social learning.

From the reflections made during the research, some collaborative approaches were observed, demonstrating their relevance in the teaching-learning process in the area of education. Collaborative work, in addition to making it possible to rescue important values of our society, such as sharing and solidarity, seeks to assist in facing the various challenges present in higher education in engineering. In addition, it is a determining factor for the teacher education process, as it contributes to the creation of strategies that can break the barriers that hinder the development of activities.

The present research also verified that the collaborative practice helps in the creation of necessary rules and procedures for group work. Therefore, the strengthening and promotion of the use of such a practice should be encouraged, so that one can positively collaborate in the construction of knowledge, both in the training of teachers and in the evolution of students' learning.

Given the above, it is understood that collaborative actions generate beneficial results, which can assist teachers and the university. On the other hand, it was evident that in order to get productive classes, there must be mutual respect between those involved in the educational process. Among the difficulties faced by teachers today, the most important are the overload of activities and the lack of infrastructure and personnel to develop their tasks with quality. Both situations point to the consequent devaluation of the teacher, reflecting on the failures and problems of the institutions.

Another issue raised was in relation to the responsibilities of the pedagogical coordinator, because when it is possible to define points of convergence between those involved in the educational process, it is possible to observe the success that leads to the collective construction of knowledge. Although the present study did not address all the beneficial characteristics offered by collaborative work in such a detailed way, it is believed that through the evidence presented, and the literature review performed, this practice is extremely relevant in the academic environment, especially in programs continuing education.

Finally, based on the studies covered, it is possible to state that scientific research is a fundamental practice that generates questions, which expands knowledge and adds benefits in the professional life of the engineer. In addition, this study clearly demonstrates the relationship between research and collaborative work, in which the results are increasingly satisfactory.

Acknowledgement

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Teachers' primary concerns in a case of educational innovation introduction in primary schools in Greece

Dr. Charalabos Psaras

Organizational Coordinator of Regional Educational Planning Center of South Aegean, Greece G. Mavrou 2, 85100 Rhodes, Greece (+306943616669 psaras@rhodes.aegean.gr

Abstract

By converting all-day primary schools of suburban and urban areas in Greece into schools that implement the Comprehensive Reformed Educational Programme (CREP), a set of innovations were implemented, significantly altering the Greek school. The purpose of this study was to investigate the effect of selected variables over concerns of teachers who work at such schools. Additionally, this research asked the teachers to identify the professional development support and interventions required to enable them to make better use of the Book-reading Advancement (Philanagnosia) Activities innovation. Teachers' administrative and pedagogical guidance executives, based on the above, will design the necessary interventions to positively address teachers' concerns and implement the specific innovation in the most effective manner. Overall, the study found that higher teacher concerns were task related, with a significant record of information and self-concerns, which may indicate that the introduction of the innovation was not properly designed to address teachers' primary concerns.

Keywords: Innovation management; book-reading advancement activities; Philanagnosia; Stages of Concern (SoC);

1. Introduction

Book-reading Advancement Activities (*Philanagnosia*) in Greece primary schools during the reform effort of 2010.

The design of the new curriculum by the Ministry of Education of Greece was made with the aim of addressing with a holistic approach the dysfunctions of primary education and the modernization of structures and content. With the beginning of the reform effort in the school year 2010-11, both the New Curricula were piloted, which focused on the student and the learning process and highlighted the active role of the teacher, as well as the operation of schools that implement the Comprehensive Reformed Educational Programme (CREP). The declared goal of the reform was the gradual transformation of the primary school through the enrichment of resources and means (human and material) in the direction of an open and creative learning community.

In 2011, new Curricula for the teaching of Modern Greek Language and Literature were prepared for the primary school, with the aim of implementing pilot program in 99 of the 961 CREP primary schools. These programs gave impetus to the development of practices and activities related to the literary book and

highlighted the inspiring role of the teacher who will promote these processes, to restore a relationship between the students and the book. This role is also related to the operation of the school library. This pilot program was implemented with many obstacles and in a negative climate on the part of the educational world, did not yield the expected results and essentially abandoned the idea of diffusing any positive conclusions that could have been drawn. The planning and the implementation strategy and the effectiveness of the reform efforts made by the Ministry of Education during the three years 2010-2013 could be the subject of special research.

The creation of CREP primary schools was a large-scale reform, which would unfold with the simultaneous introduction of a set of innovations that would change (according to the designers' intention) for the better the Greek educational system to its mandatory levels. They brought changes to the curricula, to the weekly schedules but also to issues of technological support for the implementation of these innovations. These schools will have a mandatory schedule of 35 hours per week (daily 08:00 - 14:00) for all students and an optional two-hour afternoon program (14:00-16:00).

This package, according to the wording of the Institute of Educational Policy (I.E.P), contained innovations, including the introduction of the teaching of Book-reading Advancement Activities (*Philanagnosia*) as an independent course of the Curriculum, the introduction of computer science by the first grade of Primary School (6-7 years old), the introduction of an experiential activities, increasing gym hours in all classes, introducing art and teaching classroom drama and theatre, expanding English language teaching starting from first grade, and health education, the environmental - sustainability education and traffic education.

In the set of innovations that teachers were invited to introduce in their teaching work, they included the teaching of Book-reading Advancement Activities (*Philanagnosia*) in a distinct teaching hour in the schedule. The aim of this innovation was to cultivate the Book-reading disposition of students with Book-reading Advancement activities and reading inspirations. The guidance on the part of the Ministry of Education and the I.E.P. it was limited to laws and orders that outlined the innovations at a technical and operational level and were informative about the type of changes and goals that teachers had to achieve.

In particular, "Philanagnosia" is another expression of the love for reading books in general, or specifically, for literary books. This love is related to reading practices, which develop a communication framework. This love of reading, that is, *Philanagnosia*, has been recognized as an important parameter of wider human cultivation and particularly beneficial in helping children to go through the developmental stages of childhood and adolescence safely. The term "*Philanagnosia*", although relatively new in the Greek language, can become a carrier of what is referred to as "reading culture", which will inspire respect and love for reading and books. As a term, it can be differentiated from corresponding foreign language terms, both conceptually and ideologically (literacy, literatie), but it manages to unilaterally condense some foreign language constraints ("love reading", "aimer lire" etc.) which contain a positive identified relationship of the reader with the book. However, the main scope of reading is cognitive and is used in school-type activities or programs, regardless of context. The reality of modern Greek education (competitive cognitive approach, non-supportive environment, stressful program, lack of libraries, rapid devaluation of equipment, etc.) turn reading from a natural, dynamic process into an artificial, forced and one-sided dimension.

This fact quickly emerged as a potential source of difficulty and / or stress for teachers, who would have to

form the appropriate teaching material on their own, in order to systematically teach *Philanagnosia* and to cover the teaching objectives of the course. This obligation required the relevant knowledge and experience of the Curriculum regarding the teaching of literature and the production of material (for example, lesson plans with goals, predictions for teaching and evaluation of learning outcomes), an act for which the vast majority of teachers were not trained, nor did they have experience of organized and systematic production of teaching materials.

In order to support teachers and facilitate the systematic teaching of *Philanagnosia*, educational institutions must respond with programs and incentives related to teachers' concerns about the adoption of innovation. They must also formulate an understanding of the obstacles (such as the lack of administrative and pedagogical support for the systematic teaching of Philanagnosia) which emerge in participants as they implement innovation.

Understanding teachers' concerns during the implementation phase can help management and pedagogical executives to support teachers by providing them with appropriate professional development activities. Approaching the teaching of *Philanagnosia* at CREP primary schools with a user-centered approach, the Concern Based Adoption Model concept highlights change as a developmental process that is experienced individually within an organizational context and recognizes the personal aspects and feelings of change, highlighting the perceptions of those involved in the process of change.

Understanding the different concerns of teachers when examining the teaching of *Philanagnosia* in the CREP primary schools is useful for understanding the experiences that teachers experience when adopting innovation. This process will help in the targeted planning of appropriate professional development activities to support and survive innovation in the school environment. In particular, exploring how the combination of personal, Book-reading Advancement Activities and organizational characteristics influences the greatest intensity (or peak) of concerns can help design professional development and intervention programs to properly address the main characteristics that appear to affect intensity of unrelated concerns, concerns for the individual, for the project and for the effects on students.

This study, which seeks to understand teachers' concerns about the systematic teaching of *Philanagnosia* in CREP primary schools, will be valuable for understanding possible ways of adopting similar innovations that have been or will be introduced in school units of this type (or similar). As mentioned above, the centrally designed educational policy, trying to reform the compulsory education units, establishes changes and introduces innovations in the operation of the school units at a more frequent pace and with greater intensity. Therefore, the understanding of teachers' primary concerns about the teaching of *Philanagnosia* in CREP primary schools is important, so that management and pedagogical executives can provide the appropriate programs, resources, and initiatives to support and maintain the teaching of *Philanagnosia* in CREP primary schools.

The theoretical framework of this study is mainly based on the Concerns Based Adoption Model (CBAM) and on Stages of Concern (SoC) that have been developed by George, et al., (1979, 2008) and Hall & Hord, (1987, 2011) (https://www.air.org/resource/stages-concern). This model refers to the intensity of users' concerns about the implementation of innovations. This model was considered appropriate for the initial framework of examining the concerns of teachers implementing a range of educational innovations, due to its widespread acceptance in educational research and focus on understanding an individual's attitudes,

perceptions, thoughts and assessments. when using an innovation.

The literature identifies a large amount of studies that have been supported by the Stages of Concern (SoC) of the Concerns Based Adoption Model (CBAM) and which have examined various innovations in educational environments, providing researchers with a way to explore emotions, feelings and perceptions of those who have been involved in a process of change, and in some cases, certain characteristics, such as years of innovation have been identified, which may affect the intensity of a particular stage of concern (Hord & Roussin, 2013; Hall & Hord, 2011; George, Hall & Stiegelbauer, 2008; Long & Constable, 1991; Strawitz & Malone, 1984).

Based on the theory of Stages of Concern by Hall and Hord (2011), a person's concerns change as the user evolves and becomes more specialized with the use of an innovation, moving successively from unrelated concerns to those that refer to himself, then to management concerns and finally to those about innovation impact. User concerns (for example, their feelings, perceptions and attitudes) related to the adoption of teaching innovations seem to be of a developmental nature, because the former concerns must be dealt with first (to "lower" the intensity on these) before higher stage concerns arise (which have a positive sign, both for the successful implementation of the innovation and for its consequences on children).

Table 1: Stages of Concern (SoC)

Stages of Concern		Stages of Concern About the Innovation: Paragraph Definitions
IMPACT	**Stage 6 – Refocusing**	The focus is on the exploration of more universal benefits from the innovation, including the possibility of major changes or replacement with a more powerful alternative. Individual has definite ideas about alternatives to the proposed or existing form of the innovation. **Expressions of Concern:** I have some ideas about something that would work even better.
	Stage 5 – Collaboration	The focus is on coordination and cooperation with others regarding use of the innovation. **Expressions of Concern:** I am concerned about relating what I am doing with what my co-workers are doing.
	Stage 4 - Consequence	Attention focuses on impact of the innovation on "clients" in the immediate sphere of influence. **Expressions of Concern:** How is my use affecting clients?
TASK	**Stage 3 – Management**	Attention is focused on the processes and tasks of using the innovation and the best use of information and resources. Issues related to efficiency, organizing, managing, scheduling, and time demands are utmost. **Expressions of Concern:** I seem to be spending all my time getting materials ready.
SELF	**Stage 2 –**	Individual is uncertain about the demands of the innovation,

	Personal	his/her inadequacy to meet those demands, and his/her role with the innovation. This includes analysis of his/her role in relation to the reward structure of the organization, decision making, and consideration of potential conflicts with existing structures or personal commitment. Financial or status implications of the program for self and colleagues may also be reflected. **Expressions of Concern:** How will using it affect me?
	Stage 1 - Informational	A general awareness of the innovation and interest in learning more detail about it is indicated. The person seems to be unworried about himself/herself in relation to the innovation. She/he is interested in substantive aspects of the innovation in a selfless manner, such as general characteristics, effects, and requirements for use. **Expressions of Concern:** I would like to know more about it.
UNRELATED	**Stage 0 – Unconcerned**	Little concern about or involvement with the innovation is indicated. Concern about other thing(s) is more intense. **Expressions of Concern:** I am concerned about some other things.

(Hord & Roussin, 2013; Hall & Hord, 2011; George, Hall & Stiegelbauer, 2008)

It is possible for a person to express their concerns in more than one stage at a time. For example, a person may have personal concerns about how innovation will affect their daily work, and concerns about the consequences of how innovation will change the way they work with their students or colleagues. Concerns should reduce their intensity on one stage, in order to become more intense on another. Ideally, the intensity of concerns should range from the concerns about the person to the concerns about the consequences. However, it is possible that concerns about the individual may increase during the higher stages of the process of adopting an innovation, causing a setback (Christesen & Turner, 2014; LaRocco & Wilken, 2013).

To understand a person's concerns about an innovation, it is necessary to determine the peak of Stages of Concern by highlighting the stage that is most intense for the individual at the present time, and therefore the focus of their energy and time (Hall & Hord, 2011). By recognizing the various stages of concern (as described in Table 1) and highlighting the feelings, perceptions and questions that individuals have when faced with change, we respond to the emotional part of the change of process, and recognize that change has a personal side, experienced by all those involved in the implementation of an innovation. The introduction of an innovation, such as the systematic teaching of Book-reading Advancement Activities, can be a significant personal change for teachers, challenging established teaching and pedagogical methods.

In a number of studies (Hall & Hord, 2011; Hord, 2006; Hall, et al., 2005) it has been certified that the conceptual framework of Stages of Concern is effective in determining the most intense concern area of those who apply an innovation, in a range of fields, from education to health care. This framework helps

us to understand some of the characteristics of potential recipients of innovation (for example, years of service, gender, professional development, support from the organizational environment, etc.), which may affect concerns with the greatest intensity. As a result, using the information that can be provided to us, the executives of management and pedagogical guidance can design and develop interventions, in order to support the teachers who, participate in the process of adopting an innovation. Other studies report that a person's concerns will differ in their intensity, based on several factors, such as the use of innovation, participation in innovation-related professional development activities (Kyriakides, Charalambous, Philippou & Campbell, 2006; Christou, Eliophotou-Menon & Philippou 2004).

All individuals will experience concerns during the innovation process and, therefore, management and pedagogical guidance executives, acting as facilitators of change, should be aware of the fact that, although they themselves, for example, may have their own their concerns at the impact stage, many other teachers are new to innovation and have their concerns established at the stage of personal concerns. Facilitators of change must not overlook the fact that resistance to change is a natural reaction, and the best they can do is to take the necessary measures to support those involved in change, respecting their concerns, and not just judging them, for example, calling those who have personal concerns about being "resistant" or "laggards" according to Rogers' theory (Nasim, 2015; Christesen & Turner, 2014; LaRocco & Wilken, 2013; Rogers, 2003).

2. Literature Review

One of the topics in the research on the adoption of innovations, which emerges from the review of the literature, has to do with the role of demographic variables (such as age, gender and previous service in education) in relation to the concerns that are being developed. During the examination of the issues that concern those who adopt an innovation, George et al. (2008) report that traditional demographic variables have no significant relation with concern. This conclusion is confirmed by Christou, et al. (2004), who found in their research on the concerns of teachers implementing new mathematics curricula in Cyprus, that there is no correlation between teachers' concerns and traditional demographic variables (years of service or age), but there is a correlation either with the years of innovation or with the previous service.

Hord & Roussin (2013) and Hall & Hord (2011) further note that in an effort to implement innovations, variables that are more predictive than traditional demographic variables (eg age and gender), and should be investigated, are the variables that refer to conditions (eg organizational conditions such as school operation, administrative and pedagogical support) and interventions (eg vocational development programs).

One variable of the organizational framework, often cited as a key primary barrier to innovation spread in education, is the perceived lack of administrative and pedagogical support for implementing innovation, which may affect teachers' concerns. Furthermore, in the literature examining the spread of innovations, the value of influence by colleagues is mentioned as a variable of the framework in which innovation is applied. That is, if a colleague uses an innovation, then the awareness and use of innovation by the one who is not using it systematically can increase (Christesen, E., & Turner, J. (2014).

While some studies examine the relationship between organizational variables and the intensity of teachers'

concerns about innovation, several studies have examined the organizational conditions that may contribute to higher levels of concern (such as previous teaching experience - Todd, 1993) and professional development programs (Adams, 2002. Casey, 2000).

Relevant research (Chen & Jang, 2014; Petherbridge, 2007; Anderson, 1997) examines the effect of personal and technological characteristics and context-related variables on the concerns of faculty members from the introduction of learning management systems in the universities of the United States. However, there is very limited research that combines the relationship between personal and book-reading advancement characteristics of teachers as well as organizational characteristics of the context in their concerns.

3. Methods

3.1. Sample

The population used in this research were 1,920 teachers in 160 schools that implement the Comprehensive Reformed Educational Programme (CREP) of suburban and urban areas in Greece. The samples used in this research were obtained by multi-stage random sampling from 93 elementary schools (Babbie, 2008). The research tool was sent to CREP schools and it was answered by 1035 teachers (response rate 53.9%).

4. Measurement

4.1. Dependent variable: teachers Stage of Concern regarding book-reading advancement

4.2. Independent variable: Personal, book-reading advancement and organizational characteristics. To measure the independent variables, a set of questions and scales was used, which would measure aspects of book-reading advancement and organizational characteristics as well as demographic information.

The teachers' concern for overall respondents is a result of the aggregation of individual data into a profile (https://sedl.org/concerns/admin/) showing the primary mean percentile individual scores of each stage of concern, with the mean responses on the vertical axis. The curve of the overall mean percentile stage score for all respondents revealed that respondents' highest concerns were task concerns (73%), with a slight tailing-up of impact-refocusing concerns (see Figure 1). The second peak was the consequences, followed by other concerns (unrelated, self, collaboration, refocusing) at similar levels. Overall, the concerns show a peak in innovation management concerns, with other concerns moving closer to the average, indicating that management concerns need to be addressed first, so that other types of concerns can emerge. This finding confirms a relevant finding by Van den Berg & Ros (1999).   (Figure 1)

Table 2: overall respondents

Stage 0	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
48%	51%	52%	73%	59%	48%	47%
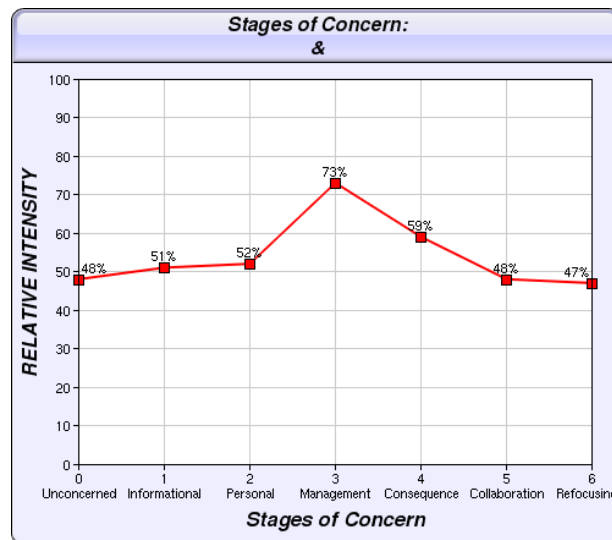
Figure 1

The teachers' concern based on gender is a result of the aggregation of individual data into a profile (https://sedl.org/concerns/admin/) showing the primary mean percentile individual scores of each stage of concern, with the mean responses on the vertical axis. The curve of the overall mean percentile stage score by gender revealed that male highest concerns were task concerns (77%) and female teachers highest concerns were task concerns (73%). This finding indicates that the men in the sample have a higher intensity of management concerns (77%), who also have slightly higher information concerns (Stage 1, 54%, compared to 51% of women). Also, in stages 0, 2, 4 and 5, similar percentages appear, while in stage 6, women excel with a percentage of 52%, compared to 47% of men. (Figure 2)

Table 3: overall mean percentile stage score by gender

Selection	#	stage 0	stage 1	stage 2	stage 3	stage 4	stage 5	stage 6
woman	684	48	51	52	73	59	48	52
man	316	48	54	52	77	59	48	47
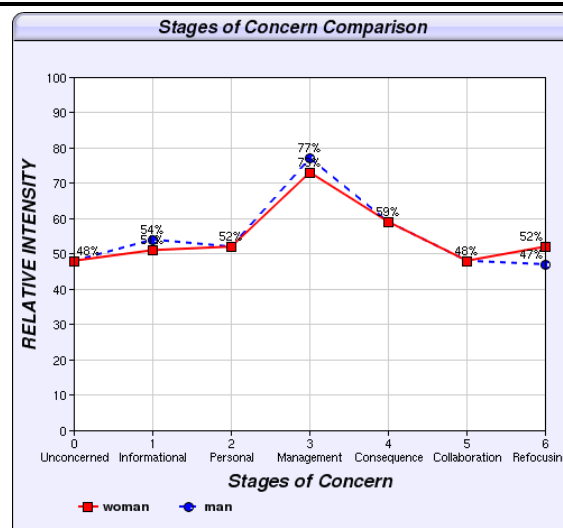
Figure 2

The teachers' concern based on the number of years taught is a result of the aggregation of individual data into a profile (https://sedl.org/concerns/admin/) showing the primary mean percentile individual scores of each stage of concern, with the mean responses on the vertical axis. The curve of the overall mean percentile stage score by years taught revealed that the groups at the ends of the year range have opposite profiles. Those with 1 to 4 years of working experience as teachers have high concerns in the first three stages (unconcerned 61%, informational 63% and personal 63% concerns), while they show lowest concerns in the top three stages (consequence 38%, collaboration 36% and refocusing 34%).

The group of teachers with 21 or more years taught presents the opposite picture. They show lowest concerns in the first three stages (unconcerned 48%, informational 48% and personal 45% concerns), while they have high concerns in the three higher stages (consequences 63%, collaboration 55% and refocusing 52%). The two middle teams in terms of working experience (5 to 10, and 11 to 20 years of working experience) show a similar development of their profile with the highest overall concerns in stage three (management) at levels that show significant intensity of management problems (average peak concerns 80% and 77% respectively). (Figure 3)

Table 4: overall mean percentile stage score by years taught

Selection	#	stage 0	stage 1	stage 2	stage 3	stage 4	stage 5	stage 6
1-4	93	61	63	63	73	38	36	34
5-10	288	55	54	57	80	54	44	47
11-20	392	48	51	52	77	63	52	52
21-more	227	48	48	45	69	63	55	52
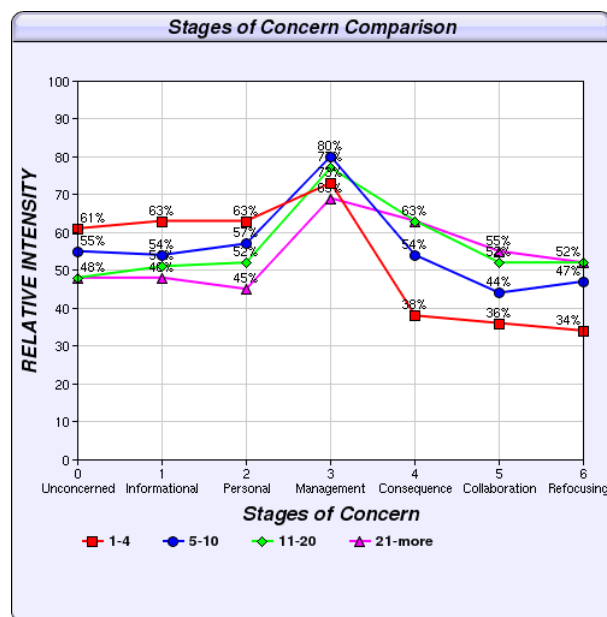
Figure 3

The teachers' concern based in formal training on book-reading advancement activities is a result of the aggregation of individual data into a profile (https://sedl.org/concerns/admin/) showing the primary mean percentile individual scores of each stage of concern, with the mean responses on the vertical axis. The curve of the overall mean percentile stage score based on their participation in formal training on book-reading advancement activities revealed that the overall profile of the teachers (based on the official training for the innovation of book-reading advancement activities, presents the following picture. Teachers who have stated that they have received formal training have very low concerns in the first three stages (unconcerned 40%, informational 45% and personal 41% concerns), and from the stage 3 (management), they begin to rise, to peak in stage 4 (consequences) and to be maintained at relatively high levels in stages 5 and 6 (collaboration and refocusing). On the contrary, those teachers who have stated that they have not received formal training, their concerns peak at stage 3 (management – 77%), and, abruptly, sink to low levels (stage 4-consequences 54%, stage 5-collaboration 44% and stage 6-refocusing 47%). The effect of formal training on book-reading advancement activities is evident in this scheme. (Figure 4)

Table 5: overall mean percentile stage score based on their participation in formal training

Selection	#	stage 0	stage 1	stage 2	stage 3	stage 4	stage 5	stage 6
Yes	230	40	45	41	65	66	59	57
No	770	55	54	55	77	54	44	47
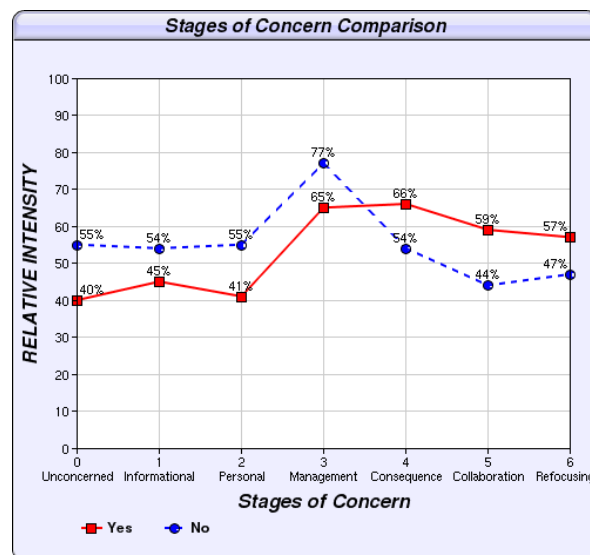
Figure 4

The teachers' concern based on implementation of other innovation programs is a result of the aggregation of individual data into a profile (https://sedl.org/concerns/admin/) showing the primary mean percentile individual scores of each stage of concern, with the mean responses on the vertical axis. The curve of the overall mean percentile stage score by implementation of other innovation programs revealed that teachers who said they were implementing other innovations or programs, in addition to book-reading advancement

activities, had a peak of concerns on stage 3 with a 73% rate with the overall concerns curve of all their stages being smooth and without steep hills or sinkholes. Especially in the three upper stages (4, 5 and 6) we see that it is over 50%. In contrast, teachers who stated that they do not implement any other innovations or programs, other than book-reading advancement activities, also have a peak of concerns in stage 3 with a higher percentage (77%) and with the overall curve of concerns of all their stages being large slopes, especially in the three upper stages (4, 5 and 6) we see to be below 50%. Remarkable is the large difference between stages 3 and 4, which is about 30% (stage 3 has an intensity of 77%, while stage 4 has an intensity of 48%). (Figure 5)

Table 6: overall mean percentile stage score by implementation of other innovation programs

Selection	#	stage 0	stage 1	stage 2	stage 3	stage 4	stage 5	stage 6
Y	741	48	51	52	73	63	52	52
N	259	55	57	57	77	48	40	42
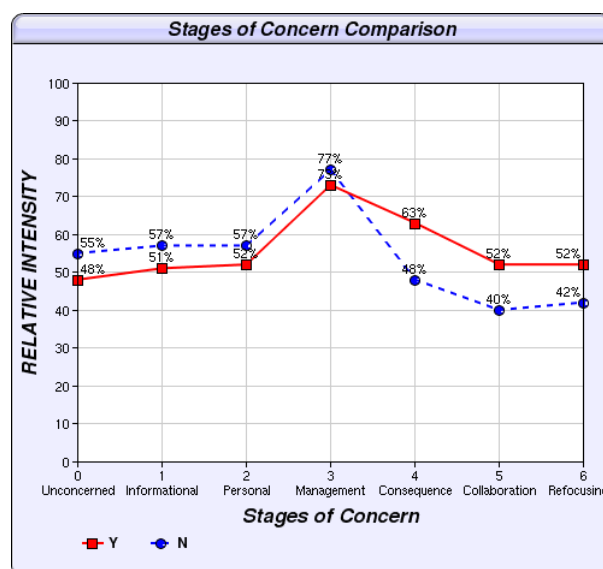
Figure 5

5. Conclusion

Summary of demographic and personal characteristics. The formal participation of teachers, based on the frequency analysis of all personal characteristics of the sample, was a female teacher, with 11-20 years of service, two years of involvement with the innovation of Book-Reading Advancement activities and who consider themselves somewhat experienced in the use of this innovation of Book-Reading Advancement activities, without having received formal training for it. Nevertheless, they implement other innovations or programs (at the time of the Flexible Zone, such as Health Education programs, environmental education, etc.).

The overall profile of Stages of Concern (SoCQ) for all respondents indicates that the peak of respondents'

concerns (73%) were Innovation Management related, with a second peak (59%) of concerns about the Impact - Consequences of Innovation on teachers' students. Very close to this peak are Self - Personal (52%) and Informative (51%) related concerns. The tendency of concerns shows a peak in innovation management concerns, with other concerns moving closer to the average, indicating that these concerns must be addressed first, in order other types of concerns to emerge.

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Authentication In The Use Of Health Sensors To Remote Patients With Covid-19: A Proposal For The Telehealth Center In The Ebserh Network

Alessandro Carvalho da Fonseca[3]

Hugo Vieira Ramos[2]

Igor Domingos de Souza[1]

Eliza Miranda Ramos[1]

[1]Group of Spectroscopy and Bioinformatics Applied to Biodiversity and Health, School of Medicine, Postgraduation Program in Health and Development in the Midwest Region, Faculty of Medicine, Federal University of Mato Grosso do Sul, Campo Grande, Mato Grosso do Sul, Brazil.

[2]Federal University of Matogrosso do Sul, Faculty of Medicine, Campo Grande, MS, Brazil.

[3]Brazilian Hospital Services Company – EBSERH/MS, Dourados, Brazil.

RESUME

Viruses will continue to emerge and bring challenges to the global public health system with emerging viruses through respiratory contagion that cause pandemics. This study aims to propose a way to use constant monitoring during the period of treatment of the patient with COVID-19 and, thus, reduce the negative indicators of death in the Brazilian territory. Methodological techniques were used in meta-analysis and systematic reviews in the selection of included studies when used in the construction of this systematic review. 05 articles were selected for inclusion in this critical analysis.

Keywords: Remote sensor, health monitoring, security, smartphone sensor, COVID-19, telemedicine.

INTRODUCTION

Telemedicine is an emerging technology that has benefits health care areas worldwide and especially the patients. It is considered an application in the medical field through the use of information technology that allow the patient to have control of his/her data outside the hospitalization system and uses this technology (01), for example, through the use of videoconferencing or digitized image (11-17). Therefore, this knowledge required interdisciplinary advances, particularly in the use of telecommunications, computer science and instrumentation for the purpose of exchanging and managing health data (05, 08, 14). Currently, the use of health sensors to monitor patients has attracted considerable attention in research due to the development of new technologies applied specifically to health. Some previous studies have demonstrated that the use of telemedicine applied in a wireless body area network known as the "wireless body area network" allowed continuous and real-time monitoring of the patient favoring assistance multidisciplinary in health (14-17).

For example, in the first coating of the sensor the patient can obtain his vital signs through small wireless sensors used in artificial intelligence and thus, sends them to the second coating known as personal

gateway or smartphones (12), this data transfer is carried out through protocols of small area network such as Bluetooth or Zigbee and WBAN (09). That is, these health data are sent from the level considered secondary to the tertiary level that the health service provider in hospital institutions (03-07), through wide area wireless communication protocols or Internet service (06-08).

Generally, healthcare provider at the third level carry out procedural actions that will generate services that are sent back to the patient in response (14-19). Specifically, the primary and secondary level will represent the patient's side and that patient can receive care through mobile care and the third level is side by side of the server (17, 18).

This health technology is a proficient tool that allows coordinated efforts among health professionals who can improve care and responses in real time (05). In the current days of the COVID-19 pandemic, this technology can be used to train the health team (10, 19), in diagnostics, in carrying out preventive or post-curative verification or monitoring of patients (19-25), in therapeutic procedures and monitoring, in the prescription of medications and in providing services to the patient or user of the SUS network (19, 20). In the world in relation to the last decade, it suffered from three major epidemiological outbreaks in the interval of 100 years and due to the occurrence of these outbreaks it was possible to perform the clinical identification of the action of these viruses, such as COVID-19 (19, 20). In early April, in Brazil (19, 20), severe pneumonia caused by COVID-19 (SARS-CoV-2) hit the country in populous regions such as the cities of São Paulo, Manaus and Rio de Janeiro (19). Due to the ease of transmission and lethality, the virus has reached regions in the interior of Brazil (19, 20). COVID-19 has its transmission similar to other forms of influenza, in short from humans to humans and the aggravation generally occurs according to the patient's previous clinical and immunological conditions that induces the main aggravation such as severe viral pneumonia (19, 20).

In Brazil as well as in other countries, severe pneumonia leads to death and its frequency increases in patients over the age of 60 years after the initial period of infection (19), however, death is largely related to the underlying health of patients and that is why we have highlighted the need for continuous monitoring of patients with COVID-19 mainly with a history of chronic diseases (02, 19, 20). Monitoring is possible because the patient with COVID-19 maintains a constant of symptoms, such as, high fever ($\geq$ 38.0º C), fatigue, non-productive cough, dyspnea and diarrhea (02, 20).

Therefore the guiding question of this systematic review without meta-analysis in relation to the use of sensors in COVID-19 is (19, 20): How to use health sensors to monitor COVID-19 patients remotely in telehealth centers on the EBSERH network? In order to bring new opportunities for patient monitoring and follow-up, this study aims to propose a way of using constant monitoring during the patient's treatment period with COVID-19 and thus reducing the negative indicators of death in the Brazilian territory.

METHODOLOGY

The studies chosen to be included in this systematic review at the first level, were the studies that made use of treatments with hospital monitoring widely considerable in the patients of COVID-19 and in the second level the authors used the filtering of the studies in the respective platforms according to their base security, in this case, PubMed, Medline, Cochrane and EMBASE (Elsevier and Lancet). In order to

achieve a significant sample we use combinations of Keywords groups. In the first research group, the Keywords "hospital system", "tele monitoring", "E-health", "telemedicine", "telehealth", "remote monitoring", "medical-mobile" and "priority" were included which used the Boolean operators "OR", "AND" and "AND NOT". In the second research group, the terms "priority", "priority" and "serious" were included. In the third research group on the platforms mentioned above, only the terms "sensor", "COVID-19" and "Coronavirus" were included. The selected publications included original articles, pre-proof with acceptance, from 2010 to May 2020 (Figure 01) and without language restrictions. 1075 references were identified in four databases or repositories of scientific evidence. We use the "Rayyan - QCRI" manager for initial screening of titles and abstracts and removal of duplicate articles in the bibliographic survey, carried out by two reviewers. At the end, there were five primary studies that supported the conclusion of this review (Figure 01).

Figure 01 - Flowchart of the selection process for studies included in the systematic review

Identification

Studies found through electronic search (n = 1075)

→ Articles excluded for not having full abstracts (n = 256).

Screening

Complete articles included (n = 819).

→ Studies excluded (n = 814)
Studies that did not meet the eligibility criteria were excluded.

Elegebility

Analysis of complete articles (n = 06)

→ Studies excluded (n = 01)
Studies with a score lower than 20 points in Down & Black (1998) were excluded, as the instrument used to assess the quality of studies.

Inclusion

Studies included in the systematic review (n = 05)

Table 01 - Identification and classification of the methodological quality risk of the included studies according to Down and Black (1998).

Article Identification	Reporting (0 – 10)	External validity (0-03)	Internal validity – bias (0 – 07)	Confusion - bias of selection (0-06)	Power (0 – 5)	Total score
Zhang et al (2010)	10	03	04	03	00	20
Ping Guo et al. (2015)	10	03	04	03	00	20
Koch (2006)	10	03	05	03	00	21
Steven et al. (2015)	10	03	05	04	00	22
Michael Marschollek et al (2012)	09	03	04	05	00	21

SOURCE: SARA, H. D.; BLACK, N. The feasibility of creating a checklist for the assessment of the methodological quality both of randomised and non-randomised studies of health care interventions. J Epidemiol Community Health. v.52. p.377–384. 1998.

RESULTS

Remote sensor used in skin

Using remote skin sensors to monitor health parameters would be the ideal method for patients with COVID-19 at the time of epidemiological peaks (08). At the initial moment of the laboratory diagnosis, the patient with COVID-19 would be implanted and would measure continuously and remotely, wirelessly, and report the patient data related to the main clinical signs of the coronavirus and worsening of the disease (08, 12, 14, 25). Without restricting or affecting the patient and maintenance would not be necessary as artificial intelligence such as smartphones would be used (08,12). The only obstacle to the application system would be the excessive energy consumption that would present the need to recharge and maintain the smartphone device more frequently (12, 14). The best proposal for the development of the prototype will be the four axes of mobility, connection, property, measurement and measurement process in order to organize the sensors with the parameters related to health and in the future to develop a more advanced scheme (16). In this study, according to the study included in this systematic review, it defined as a sensor system for skin monitoring for application in the health area the risk assessment of worsening the patient through physiological changes such as respiratory or heart rate and analysis of the patient's thermal function (16), however, the authors emphasize that there are several other advanced designs using other skin monitoring sensors that will be mentioned in this systematic review (12-16).

Assessment of patient worsening with COVID-19 using a sensor

When analyzing the difference in cases of severe death between certain regions in the Chinese province which presented the initial outbreak, it is possible to verify useful information regarding the pathogenicity of the viroses (19). It is possible to observe that in countries like China, Italy and Brazil the patients with the highest incidence are male with a history of one or more comorbidities (19, 20), for example, kidney, cardiovascular, cerebrovascular disease, diabetes and hypertension. But what has been observed in these pandemic days is that COVID-19 has a direct relationship with comorbidities related to immune deficit and an indirect relationship with secondary bacterial infections (02, 20). The cases that presented death as a result occurred in patients with lymphopenia and inflammation secondary to pneumonia, that is, the death complication is directly related to the patient's pre-existing diseases. It is possible to highlight in this process of illness that other patients are able to recover with little or no medical and hospital intervention (19, 20). The main clinical signs for COVID-19 in patients with aggravation are persistent high fever ($\geq 38.0^\circ$ C), constant and excessive fatigue, frequent and dry cough, changes in respiratory rate and the presence of diarrhea (19, 20). In severe cases, the disease progresses to viral pneumonia and quickly in a few days to septic shock that is difficult to treat, metabolic acidosis and coagulation dysfunction which leads to death (19, 20).

Health sensors a new technology proposed to patients with COVID-19 in care at the Brazilian Hospital Services Company

The sensor has resources capable of processing the connectivity offered by smartphones, which allows several health professionals (Doctor, Nurse, Nutritionist and Pharmacist) to be removed from the call center, in this case, the hospital and taken directly to the patient (08, 12, 16, 22, 25). This is due to the possibility of using a combination of microfluidic forms that use only volumes of nano or picoliters of fluids and the use of this technology in microelectronics uses the scanning of sweat (08), blood, saliva, urine, tears and breathing. Using this diagnostic feature improves the convenience of testing by increasing the possibility of entirely new diagnostic features that would be accessible practically in place or time for the patient (12, 16). For example, this technology can be used in various point of care tests with resolutive through microfluidic technology to allow rapid diagnosis of infectious diseases like COVID-19 and these diagnoses can be accelerated with the use of this technology and qualify individual treatment well such as population screening (19, 16, 25). In addition, using genetic diagnostic technologies binds the smartphone by allowing the use of new health technologies that are fast and accurate for n-types of pathogens and thus enable new technological application for clinical measures and clinical research, such as pharmacogenomics in which gene diagnosis will be favored by sensor technology (22, 25).

Steven et al (2015) (22) reports that the use of olfactory technological capabilities similar to that of a dog, known as "electronic nose", associated with the smartphone can offer rapid and remarkable diagnostic capacity for a wide range of conditions including early detection cancer or diseases such as tuberculosis and COVID-19 (22, 25). Also, using high quality lenses from cameras and with smartphone screen resolution, simplifies your optical system for a number of applications, from photometric diagnosis to the resolution of complex medical imaging exams (12, 22, 25). This is due to the recently developed devices that allow the automated determination of refractive error with an individual look coupled to a

smartphone. Other options feature transportable imaging capabilities and involves the possibility of remote diagnosis through the use of a smartphone case with an otoscope which is connected to detect ear infections (22, 25).

Continuous monitoring of heart rate and respiratory rate or blood pressure during the day and with the daily activities of the patient with COVID-19 (19, 20, 22), can help and redefine the complete diagnosis of these changes, such as the increase in respiratory rate through several distinct phenotypes (16, 25). These individual data should propose a critical complement to the development of research programs focused on interdisciplinary and individualized with precision or personalized treatment (22, 25). Therefore, it must expand the evidence base as observed by these examples cited, therefore, there is great potential for the use of mobile health technologies linked to healthcare and this process should have a better meaning in the understanding of human physiology in health and illness (22, 25). The hypothesis of using a sensor to diagnose diseases such as COVID-19 can be supported by forecasts by financial analysts who estimate that the market for the use of sensor technology will grow at an annual rate of almost 55% (20, 25), that is, to 31.5 billions of dollars by 2021 (22, 25). Several studies of systematic review and meta-analysis in Brazil have concluded that there is a lack of high-quality scientific evidence for the use of sensors to effect behavioral changes in Brazilian society or to manage chronic diseases, infectious diseases such as COVID-19 in hospital care or healthcare provision (19, 20).

The use of sensors in the clinical follow-up of the patient with COVID-19 adds a layer of substantial complexity (22, 25), however, starting trials around non-standard care systems brings a substantial percentage of complexity and is significant if informing the health community a roadmap to transform patient care with COVID-19 that will be proposed to EBSERH by our research group (16, 22, 25).

How to use personalized sensor monitoring in patient health with COVID-19

The studies used in this short review to build the proposal to be used in the telehealth center EBSERH, highlights that the sensors for the human body (Body Sensor Network - BSN) (08, 12, 16, 22, 25), are a system that make use of the n-sensor technology, which are interconnected wirelessly and powered by batteries (16, 22, 25). The sensor nodes are made by a processing unit, memory, interfaces and transducers, radio transmitter and receiver with a power and battery circuit (22, 25).

The body sensor network system is useful for monitoring uninterrupted and non-obstructive human health. The system can be applied to electrophysiological monitoring (16, 22, 25). In this case, the sensors are connected to the patient's skin in appropriate positions on the pelvis, thigh and upper limb stem with flexible tape in order to minimize the movement of the sensors (16, 22, 25). Fixing with flexible tape will restrict movements of the knee or pelvis and thus avoid distorted results (22, 25). The calibrations and virtual alignment of the sensors to the bone axes are performed by the temporal synchronization of the three sensory nodes (22).

Transient noises and data deviations from the sensors can be filtered through a bandpass filter using a linear model. To apply for the purpose of supporting the clinical evaluation of the patient with COVID-19 for highly satisfactory results (19, 22, 25), it is possible, for example, to measure walking activities during the daily life of the patient with COVID-19 in home monitoring (16, 22). For example, during daily activity in which the human body requires stability of the lower limb, sensors in the lower limb are able over time to detect changes in activity levels and thus correlate with increased fatigue or tiredness, in addition to detecting compensation movements or gait symmetry. In figure 02, sensor networks in the patient diagnosed with COVID-19 monitor vital functions such as (02, 20, 22): SPO2, ECG, FR, FC and T in the technology that includes health information servers and health professionals (16, 22, 25). The studies highlight information on the use of "Testbeds" platforms, allowing the use of tools for the purpose of scientific and computational experimentation and new technologies in a replicable and ethical manner (12, 16, 22).

The studies included in this short review propose the use of sensors developed in MicaZ technology and Telos Mote, since we can include pulse oximetry, ECG, movement and temperature sensors (12, 16, 22, 25).

Figure 02 - Use of sensors to monitor the patient with COVID-19.
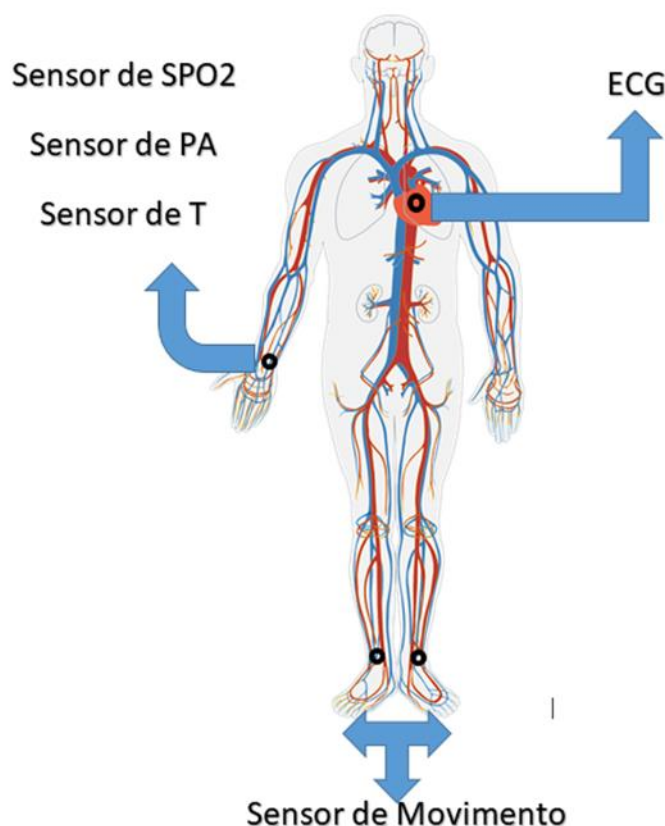
The oximetry sensors will be a non-invasive technology and used to assess heart rate and oxygen saturation (SPO2) and these two parameters are analyzed for the patient with COVID-19 according to the parameters of the World Health Organization (19, 20, 22, 25). The oximeter of the pulse projects infrared light through the process of reflection of the blood vessels. By using the methodology to detect the amount of light absorbed by hemoglobin in the blood in two components of the wave, in this case, 650 nm^3 and 805 nm^3 (08, 12, 16), it is possible to use oxygen saturation in the patient's blood with COVID-19 (19, 20).

To assess heart rate (HR) the literature selected in this short review, proposes the use of the light absorption pattern over time, since blood vessels constrict and expand with the patient's pulse. The electrocardiogram (ECG) is used for clinical care in order to measure the electrical activities of the heart and is considered specific to employ continuous telemetry. The motion sensor is used to analyze the patient's difficulty in moving and thus, relating fatigue to a characteristic symptom of the patient with COVID-19 (19, 20, 16 -25). These sensors are capable of communication wirelessly and transmitting this data to a base station (16, 22, 25). For example, hypertension it is a primary diagnosis in consultations with patients with COVID-19 and it can be used as a model the American technology of home monitoring and thus present an economy of the Brazilian public health system of around 40 million reais (16, 19, 22, 25). Remote sensor monitoring is more convenient than interrupting your routine schedules drawn up in the isolation process to perform a medical consultations (16, 22, 25).

Patients in home control by remote monitoring are more likely to achieve blood pressure control compared to those using current care systems (08, 16, 25, 25). Through hypertensive monitoring, blood pressure levels can be measured, especially in patients with COVID-19 and patients with hypertension (12, 19, 20). Its operation will be based on the detection of heartbeat and employs a simple oscillometric method that determines systolic and diastolic blood pressure (12, 19, 20, 25, 25). Control is carried out by changing the heartbeat amplitude. For your best performance specificity, measurement intervals, maximum pressure, precision and response time are considered (16, 25). For temperature sensors, transducers that modify their physical characteristics through interaction with the medium to which the temperature of the patient with COVID-19 will be used will be used, and these devices must have the ability to convert the physical quantity, temperature, into an electrical signal (08, 12, 16, 25, 25).

In addition, the monitoring of patients with COVID-19 by sensors in relation to the development of the disease, will consider, according to the authors selected in this short review, the time element, and this element is included in the patient's stored historical data (08,12,16,25).

Worldwide, there is uncertainty regarding the regulation of sensor monitoring in patients with diseases such as COVID-19. The patient using a sensor is also concerned with the privacy and ownership of his data related to his well-being in health (22). The included studies highlight the importance of securing health data that is the preferred target for cyber thieves (25). However, it is imperative to develop security methods based on biometrics in the cloud, transferring encrypted and remotely interrupted data, are some solutions that can at least be used to reduce this risk (22, 25). This increase in the use of sensors will enable a series of complex challenges including the need to summarize multiparametric and continuously collected

data in a meaningful and responsible clinical format (22, 25). The COVID-19 patient monitoring system is still in its initial formative stage (19, 20). Take advantage of the use of Moore's law with small circuits and at a lower cost that brings technological advances in practically all Brazilian public health centers (08). The use of this technology has the potential to lower the cost of both research and health care (16).

It should be considered that the cell phone is a health technology in a considerable assisted way, and that implanting this technology in the EBSERH network in clinical trials with patients being monitored at COVID-19 is a considerable promise and may follow the same path as robotics in surgery or therapeutic megavitamin techniques that are used without well-defined support data (08, 12, 16). The use of sensors in the Brazilian public health service, makes its incorporation in the routine care of health professionals so challenging and yet, potentially transformative (16). This assisted technology places the patient at the center of their health services and considers it normal in the context of the health parameter from a population perspective when comparing an individual to hundreds of other COVID-19 patients in a time-based perspective, or comparing an individual yourself before the presence of a sign of the disease or symptoms (12, 16, 25, 25).

CONCLUSION

The use of data sensor technology such as blood pressure, temperature or HR or RF in Brazilian public health, mainly in the EBSERH hospital network, brings a gain in resolving the monitoring of patients with COVID-19, o it incorporates the resolution of more complex cases care in an outpatient setting. The use of this new technological context in Brazil, raises a concern with aspects of security and confidentiality. However, it is imperative to develop a cloud of security methods based mainly on the biometric language that will offer solutions that can at least be used to reduce the risk of data leakage, o it is known that much has to be gained with this new perspective mainly with regard to reducing the number of patients waiting for emergency care only for daily monitoring, thus reducing the risk of infection from human to human.

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Perception of Hospitalized Users About Humanized Nursing Care in a Municipal Hospital of Itaituba, Pará-Brazil.

Dayane Ferreira da Silva

Faculty of Itaituba,

Pará, Brazil.

Iza Rayane Franco couto

Faculty of Itaituba,

Pará, Brazil.

Marcela Cristina Lopes Paz

Faculty of Itaituba,

Pará, Brazil.

Fernando Conceição de Lima

Metropolitan University Center of the Amazon (UNIFAMAZ),

Pará, Brazil.

Daniele Melo Sardinha

Evandro Chagas Institute (IEC),

Pará, Brazil.

Aline Maria Pereira Cruz Ramos

Federal University of Pará (UFPA),

Pará, Brazil.

Darlisom Sousa Ferreira

State University of Amazonas (UEA),

Amazonas, Brazil.

Paula Sousa da Silva Rocha

State University of Pará (UEPA),

Pará, Brazil.

Juliana Conceição Dias Garcez

Metropolitan University Center of the Amazon (UNIFAMAZ),

Pará, Brazil.

Thalyta Mariany Rêgo Lopes Ueno

State University of Amazonas (UEA),

Amazonas, Brazil.

Abstract

Objective: to understand the perception of hospitalized users about humanized nursing care in a municipal hospital in Itaituba, Pará. Field study of exploratory and descriptive type of qualitative approach. Method and Procedures: The research was developed in a Municipal Hospital of Itaituba, Pará (HMI); 23 patients hospitalized in the medical and surgical clinic sector participated in the research. Data were collected by means of a semi-structured interview questionnaire made up of two parts: socioeconomic data from the survey participants and open questions on the perception of the hospitalized user about the humanized care received during hospitalization, which were collected using the saturation technique. The data analysis was performed using the Bardin technique. Results: 78% of the participants were female, 48% married, the prevailing age range was between 19 and 87 years old; 39% of the surveyed had incomplete primary education and 74% had income of up to one minimum wage. With the analysis of content three thematic categories emerged: "user perception of nursing care", "humanized care and its importance" and "evaluation and suggestions on nursing care". Conclusion: The great majority of participants of the survey showed to be satisfied with the care provided by nursing professionals, besides highlighting humanization as an important point for reestablishing health and highlighted the use of communication, attention and empathy for others as a factor of humanization

Keywords: Nursing, Hospitalization, Humanization of Assistance, Nursing Care.

1. Introduction

To humanize the attention is to care for the individual in its totality, repeating his dignity as a human being of value and acting according to his subjective needs in order to offer a resolutive and quality assistance according to ethical assumptions, being necessary that the nurse redeems his human qualities for the exercise of his practice (OVIEDO *et al*., 2020).

The hospital environment is surrounded by technological resources that take away the binomial nurse-client and affects the humanization of care. This scenario breaks down the person-environment relationship, hinders human relations and resigns to humanization as the locus of care. The professional needs to perform skills and abilities to overcome this widespread fragmentation, with supremacy of the technical approach and without sensitivity to deal humanely with the user (Joven & Guaqueta Parada, 2019) and (Lima et al., 2018).

Even with evidence of the need for humanization in health care, the humanized care did not meet the satisfaction of users, professionals and managers due to insensitivity in the organization of work, isolated treatment imposed on the hospitalized client, the authoritarian model of management and wear of physical space and professional relations; for these and other reasons, in 2003 the National Policy of Humanization of Care and Management of the Unified Health System (SUS) (PNH / HumanizaSUS) was instituted, which values the various subjects throughout the process of health production as a way of

humanizing care (Caegari *et al.,* 2015).

Nursing professionals have the skills and scientific technical knowledge to provide care during care that should be used to achieve positive results and quality in the services provided, in order to standardize care with the user's needs and ensure suitability and effectiveness in the development of work (Santos *et al*., 2019).

Therefore, it is necessary to know the perception of the hospitalized user about nursing care from the perspective of qualifying nursing care, because it is necessary to redirect the care, signing the commitment to maintain the dignity and uniqueness of the user, validating his considerations, thoughts and desires to differentiate the care from the simple performance of procedures offered to a human being worthy of attention, commitment and responsibility (Salviano *et al.,* 2016).

This research is based on the following guiding question: what is the perception of hospitalized patients about humanization and the care provided by the nursing staff in the hospital environment? and its general objective was to understand the perception of hospitalized users about humanized nursing care in a municipal hospital in Itaituba, Pará-Brazil, having as specific objectives : to outline the profile of the users served in the medical and surgical clinics sector and describe the perception of hospitalized patients about the humanized care provided by the nursing staff.

2.Method and Procedures

2.1 Design Study
This is a field of qualitative exploratory and descriptive approach.

2.2 Data collection and Study participants
The study was conducted in a Municipal Public Hospital of Itaituba (HMI), which is the main hospital reference of care of the Unified Health System (SUS) in the city, designed to meet the services of Emergency and Emergency, medical and surgical clinics, pediatric, obstetrics and neonatal Intensive Care Unit.

The field research was developed in the medical and surgical clinic sectors of that hospital. This study was conducted with 23 users hospitalized in the medical and surgical clinic sector of the referred hospital in December 2019 who met the following inclusion criteria to participate in the research: be conscious and oriented, over 18 years of age, hospitalization time greater than twenty-four hours, sign the Free and Informed Consent Term and agree to participate in the research.

2.3 Survey instruments
For data collection, the technique of saturation was used, which consists of an instrument used to establish or close the sample size and suspend the inclusion of new participants when the obtained data presents, in the evaluation of the researcher, a certain redundancy or repetition (Lima *et al*., 2020).

To increase the accuracy and veracity of the data collected, a data collection instrument was used, represented by a semi-structured interview, previously prepared and reviewed by the authors, consisting of two parts: the first to characterize the socioeconomic profile of the survey participants: Civil status,

race, education, age, income, and gender; the second pervading seven open questions about the hospitalized user's perception of the humanized care received during hospitalization: "How do you perceive the care provided by the nursing staff?", "Do you know what humanized care is and how important it is?", "Do you believe that the care provided during your hospitalization is humanized? If so, why?", "Do you believe that humane care can help in your recovery?", "What suggestions would you make for humane care?", "Are nursing professionals interested in hearing what you have to say when asked about something?", "What is your assessment of nursing care?".

2.4 Data analysi

In the analysis of the data, the content analysis was used, allowing the construction of categories for the formation of the corpus of analysis, exposing the manifestations of the subjects about their feelings (Bauer & Gaskell, 2015).

Committed to the well-being of the participants and taking care to minimize the risks of the study, the researchers maintained the anonymity of the participating users, using pseudonyms such as P1, P2, P3 and so on in the order of the research to characterize the researched subjects.

2.5 Ethical considerations

The research was initiated after a favorable opinion from the Ethics Committee of a higher education institution in Belém, Pará, under the number 4,099,182 and CAAE 29450220,2,0000,5701. The subjects received information on the ethical aspects of the research, the voluntary participation, anonymity, the possibility of withdrawal without harm, risks and benefits and a copy of the Free and Informed Consent Term after signing, according to Resolution n. 466/2012 of the National Health Council.

3. Results

3.1 Characterization of the interviewees

The interviews involved 23 patients who were hospitalized in the medical and surgical clinic sector of the Hospital Municipal de Itaituba (HMI), identified from E1 to E23.   The study showed the prevalence of female individuals in 78% of cases, with 48% married, aged between 19 and 87 years. As for schooling, 39% of the interviewees had incomplete primary education. Regarding fixed income, 74% of the participants in the study received up to a minimum wage.

In order to organize the information of the study, after reading and rigorous analysis of the content of the testimonies collected, the results were grouped into three distinct categories: "user perception of nursing care", "humanized care and its importance" and "evaluation and suggestions on nursing care".

Category 1: "User's perception of nursing care".

As evidenced in the reports, in relation to user's perception of nursing care, it can be observed that the great majority of interviewees are satisfied with the care provided by nursing professionals:

[...] "They take very good care of me, they give my medicine on time, they take care of us carefully, they

care about our comfort. I like to be taken care of and told words of strength and encouragement" (E8, E13, E23)

[...] "The service is excellent, they are all very helpful" (E12, E21)

[...] "Good, they say good morning, they are kind, they talk and pay attention" (E17)

[...] "I have nothing to complain about, all the professionals have taken me very well" (E3, E4, E5, E6, E7, E8, E9, E11, E14, E15, E16, E18, E19, E20, E22)

However, some clients have controversial opinions about the care received, they consider that among nurses there are those who provide quality health care, but in some cases, the nurses do not meet the needs of the clients and they are treated with carelessness:

[...] "There are some very good nurses, but there are also nurses who treat us very badly" (E1, E2, E10)

Category 02: Humanized Service and its Importance

When questioned about the importance of humanized care, in category 2, it was evident that the interviewees related humanized care as an important point for the reestablishment of health.

[...] "Yes, a lot of people need help and attention so I think it's very important" (E05, E06)

[...] "Yes I think they have to take care of the patient very well because we are already sick and we deserve to be taken care of very carefully" (E7, E10, E11).

[...] "Yes she who sees the patient's need above her limitations, treats with education" (E2, E3, E20).

In accordance with the above statements, it can be identified that clients perceive that the service provided is carried out in a humane manner. The relationship between the nursing team and the client is positive. Furthermore, it was found that communication is an essential tool for the quality of the services provided by the nursing team, as its use, as a work tool, enables the planning of actions according to the needs and characteristics of each client.

It should also be noted that among the findings of the research, it became evident that the knowledge of the term humanization on the part of some hospitalized people proved to be very vague. However, other reports highlight the satisfaction with the services provided related to the good evolution in the treatment received.

[...] "I don't know that term well, but I know that when we are treated well, the evolution of the treatment is better" (E4, E13)

[...] "I can't tell what humanized care is" (E8, E9, E14, E15, E16, E17, E19, E21, E22).

Category 03: Evaluation and suggestions related to nursing care

The speeches found in category 03 showed that most patients positively evaluate the care received by the nursing team during their stay, however, some emphasize that there are factors related to the team and the work environment of professionals that may affect the care with excellence.In addition, clients consider

the adoption of affectionate behavior that shows concern for their needs and feelings to be a key element in making the service provided even more humane. Such evidence can be found in the following statements:

[...] "Note 10, excellent (E2, E4, E5, E6, E12, E13, E15, E16, E18, E19, E20, E21, E22)

[...] "Average score, why does the care need to talk more" (E8, E9, E14, E23).

[...] "You need to improve, because only one has to take care of many and ends up not realizing it" (E11)

[...] "Note 7.0, regular service in front of structures and workload" (E17)

[...] "I don't think they give a damn about the patient, they don't care" (E1)

[...] "For me they continue the way they are, treat the patient with love, ask how we feel. Use communication to help us" (E10, E8, E9)

[...] "to keep the service at the right times, respecting the schedules" (E11, E13)

[...] "I suggest that you continue to be careful, don't take the problems out of the patient and continue to be considerate" (E12)

4. Discussion

A study conducted with the objective of analyzing the client's perception of the immediate preoperative and transoperative care in the surgical center, showed the client's satisfaction related to the assistance and psychological support provided by the nursing team, through the reception and creation of a link (Souza *et al*., 2019).

Similar results were found in a cross-sectional exploratory descriptive study carried out in two hospital institutions in the interior of the state of São Paulo, in which they identified that the patients in both investigated institutions were also satisfied with the care provided by the nursing team (Martins & Perroca, 2017).

In another survey conducted in the medical clinic of wards A and B in a university hospital in São Luiz do Maranhão, it also found positive results regarding the care received by clients during the period in which they were hospitalized(Santos *et al*., 2017).

It is also reaffirmed that the evaluation process aimed at the user is an efficient strategy, since the qualified listening of professionals on the quality of care provided can serve as a basis for the implementation of new working methods in which the services always result in a good service (Souza *et al*., 2014).

Unlike the results of this study, a survey conducted at a Campos dos Goytacazes Municipal Hospital found that clients have some dissatisfactions with the services provided by the nursing team. Among the dissatisfactions, impatience, lack of understanding and efficiency in problem solving stand out (Inácio *et al*., 2013).

It can be observed that the presence of the nursing professional in the hospital environment is of fundamental importance, since the activities developed by him/her are based on scientific knowledge, ability, intuition, critical thinking and creativity and accompanied by behaviors and attitudes of care in order to promote, maintain and/or recover the quality of life of users (Balduino *et al*., 2009).

It is known that the interaction between the team's professionals can cause conflict and hinder the service, so to better meet the health needs it is necessary to have team work in order to organize the practices to ensure comprehensiveness, quality of health care, user and professional satisfaction. (Souza *et al*., 2016).

User satisfaction is related to the quality of care provided and meeting the demands and desires of customers when using the service that is permeated through the pleasant link that the institution establishes with its users, in addition to establishing quality standards, positively evaluated by customers. (Santos *et al*., 2017).

Patient satisfaction corresponds to their expectations regarding the service they expect to receive and the perception of the care already received, therefore the evaluation of care from the patient's point of view not only allows them to measure their satisfaction, but also offers the opportunity to identify and alleviate the fragility of the care in order to qualify the care provided (Vieira, 2019).

Considering the user's perception and participation in health care influences decision making in a guided and informed manner, including the active action of the client in the decision making of the care, including the safety and effectiveness of this care, with active participation and reorientation in the concepts of health care (Figueiredo, 2019).

In the context of the relationship between the nurse-user diary, it is necessary to create bonds, establishing relationships of trust that meet the expectations of users who need more humane interventions in addition to technical care and treatment on the disease, in order to transmit safety, trust with the use of affectionate gestures, attention and respect(Borges *et* al., 2017).

Among the speeches, one important element of humane care is communication. The action of communicating needs to cover more than the simple use of words, it needs an attentive look, a qualified listening and an adequate posture. It is true that hospital environments influence the quality of therapeutic communication, being a challenge for effective care, but the nurse needs to overcome these difficulties in order to effective communication(Branco *et al., 2016)*.

Effecting communication by the nursing team is very important, because these professionals perceive a high workload in the care of users, so the use of this instrument enables a general and quality care.(Hey *et al*., 2016).In addition, providing qualified listening to the user in a hospital environment, provides the systematization of an effective, dynamic and resolutive care(Borges *et al*., 2017).

The humanization of health services must rely on tools such as the qualification of listening to favor the interpersonal relationship between nurse and user, directing this action to improve care and provide beneficial changes in the solidification of bonds, reorganizing the service, reorienting attention to the user as the center of care and active in this process (Costa *et al*., 2016).

Based on the reports of qualified listening as a process transformed in social relations and which is a mechanism of humanization, it appears that to be effective, a joint action of the nursing team is necessary to meet the demands of the users, seeking to strengthen the bond, resignifying the daily systematization of care and overcome the barriers that interfere in co-responsible and participatory care (Silva *et al*., 2017).

These factors together contribute to the focus of the assistance becoming technical, and by emphasizing the fulfillment of tasks at the expense of the human aspects of care, communication ends up being limited to a superficial interaction (Bezerra*et al*., 2017).

Hospitalization is a new process to the reality of the user, family members and their companions; it is seen as something unpleasant, because it involves the rupture of their usual daily life and recreates a new reality with different conformities for the full exercise of their citizenship, either by hospitalization itself and/or by removing the important elements of their life (Proença&Agnolo, 2011). Such findings were also highlighted in this research.

This moment of human fragility can trigger negative emotional reactions marked by feelings such as denial of the disease, anger, guilt, feelings of punishment, anxiety, depression, loneliness and emotional regression that can be projected on the team providing the care, with a demonstration of dissatisfaction with the care received even though it is done properly (Santos *et al*., 2018).

Another important point is that when questioned about suggestions directed to the team for improvements in the care emerges in the speech the desire to receive a care that aggregates affective elements that in the perception of the patient are the basis for a human care, such as love and concern of the professional in knowing about their feelings, the execution of care at the correct times and compassionate attitude of the professional.

The incorporation of humanization into nursing care is related to the implementation of measures to improve the satisfaction of users by their perception of health and through the reflection of professional practice, based on respect, trust and dignity. Humanized care is geared to the subjective needs of users, based on their totality and through an interrelationship between users and professionals (Anguita*et al*., 2019).

5. Conclusion

This survey showed the prevalence of female individuals in 78% of cases, with 48% married, aged between 19 and 87 years. As for schooling, 39% of the interviewees had incomplete primary education. Regarding fixed income, 74% of the participants in the study received up to a minimum wage.

The perception of clients about nursing care, the vast majority of participants in the survey showed that they were satisfied with the care provided by nursing professionals, **the authors of this survey also identified that humanized care is** an essential tool for hospitalized client care and demands from nursing professionals a series of skills in order to provide care that integrates all the needs and desires of clients.

As for the importance of humanized care, it was evident that the interviewees related humanization as an important point for the reestablishment of health. Furthermore, they consider that the care offered by nursing professionals is carried out in a humanized manner.

Regarding evaluation and suggestions related to nursing care, most clients positively evaluated the care received by the nursing team during their period of hospitalization. In addition, among the suggestions for improvement in care, the use of communication, attention and empathy for others were highlighted.

It was found that communication is an essential tool for the quality of services performed by the nursing team, as its use, as a work tool, enables the planning of actions according to the needs and characteristics of each client.

It is hoped that the results of this study will serve as a basis for the promotion of strategies to improve the

quality of nursing care and thus reduce the fragility of the care provided.

6. Acknowledgement

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Digital cartography of the Historic Centre of São Luís, brazil: educational uses and cultural diversity with Google My Maps

MsC. Donny Wallesson dos Santos

Programa de Pós-Graduação em Políticas Públicas, Universidade Federal do Maranhão,
Maranhão, Brazil.

MsC. Maurício José Morais Costa

Centro Universitário Unidade de Ensino Superior Dom Bosco
Maranhão, Brazil.

MsC. Mizraim Nunes Mesquita

Universidade Federal do Maranhão,
Maranhão, Brazil.

MsC. Jailson Antônio Ribeiro Viana

Programa de Pós-Graduação em Cultura e Sociedade, Universidade Federal do Maranhão,
Maranhão, Brazil.

PhD. João Batista Bottentuit Júnior (Corresponding author)

Universidade Federal do Maranhão,
Maranhão, Brazil.

Abstract

This research aims to reveal the educational contributions of digital cartography with Google My Maps aimed at the democratization of cultural goods and apparatus, and exercise of citizenship in the Historic Centre of São Luís. It consists of a qualitative study that starts from the bibliographical research and is based on the documentary and field research for the construction of a map in the digital platform Google My Maps with the main cultural spaces existing in the Historical Centre of São Luís, Maranhão. It discusses the concepts of cultural citizenship as a prerequisite for the recognition of cultural diversity and democratization of its assets, considering the views of authors like Canclini (2015), Santos (2001). It addresses topics about the Historical Centre of São Luís based on Andrès (1998) and Figueiredo (2012). The study culturally maps the Historic Centre of São Luís, emphasizing the need for demarcation of cultural spaces and access to their assets by the population, as well as it reflects on their contributions to education, research, cultural diversity and the exercise of cultural citizenship. It presents a digital mapping of cultural apparatus in the Historic Centre of São Luís and ratifies the importance of technological mediation to increase knowledge and access to the cultural assets at the capital of Maranhão state. It also demonstrates the contribution of Google My Maps both for education and for the effective exercise of cultural citizenship.

1. Introduction

Demarcating places where access to the public and cultural goods are favorable for the individuals to take ownership and exert their citizenship is not an easy task. The lack of information still is one of the major problems regarding access and use of public and cultural places.

Among the places with some of the most remarkable traits of Maranhão state, in Brazil, the Historic Centre of São Luís – the main example in terms of distinct cultural manifestations – is the stage for festivals, artistic expositions, and other cultural events. Recognized by the United Nations Educational, Scientific and Cultural Organization (UNESCO) on the World Heritage List in 1997, it is one of the leading figures when it comes to cultural diversity. For this reason, this is one of the places that must be explored and mapped so people can easily find and enjoy its cultural assets and recognize them as part of their identity.

In a world marked by the intense use of technologies, responsible for fostering the globalization and the accelerated flow of innovations and information, the great network and its resources can contribute to facilitating access to cultural goods to those who should benefit from them. Among the countless applications that move in this direction, there is My Maps, a resource aggregated to Google Maps that allows the creation of personalized and shareable maps with the demarcation of places according to the interest of those who create them.

With that in mind, this research aims to point out the contributions and the educational potential of digital mapping of the Historic Centre of São Luís with Google My Maps. Thereby, it aims to demarcate places of cultural diversity, to promote education and citizenship. Besides that, it discusses how the educational potential, the access, and use of public cultural places can help in the identification, recognition, and appreciation of these spaces and promotion of the extensive educational development and citizenship practice in the capital of Maranhão state, in Brazil.

This is an exploratory and descriptive study and uses as instruments for theoretical grounding the bibliographic and documentary research, collecting previously elaborated materials and documents to discuss culture, cultural diversity, mediation by the use of technologies, based on authors such as Canclini (2015), Santos (2001), among others. Additionally, it elaborates about the Historic Centre of São Luís according to authors as Andrès (1998), Figueiredo (2012) and Silva (2009). It approaches the mapping process with digital technologies, contextualizing and characterizing the Google My Maps and considering the digital cartography of cultural diversity places at the Historic Centre. It also discusses how this mediation could impact on people's relationship with these places and what is its effectiveness for the education and extended practice of cultural citizenship.

2. Maranhão Culture in the Historic Centre of São Luís, Brazil

The Historic Centre of São Luís is nationally known for its beauty and, likewise other cities in Brazilian Northeast, the development was more pronounced in the coastal and port region. According to Fonseca and Barbosa Filho (2017), the capital of Maranhão developed in the region of Praia Grande (Big Beach), a

central area of the city, becoming a commercial center in the colonial period. Masullo and Lopes (2016) highlight that the capital of the state is in the Maranhão Gulf, between Sao Jose and Sao Marcos bays, whose main rivers are Anil and Bacanga.

As reported by Figueiredo (2012), the buildings in the Old Centre of the capital of Maranhão, marked by orthogonal traces, street widths, with fountains and fortifications, express the wealth of the state elite, as well as the Portuguese-Brazilian architecture strongly reinforced in its big colonial houses. Duailibe (2012) notes that the whole architectural arrangement of the Historic Centre of São Luís comes from Portuguese origin and it assembles approximately 3,500 buildings, among them administrative monuments, big colonial houses, commercial buildings, residences, churches, and others.

Cutrim, Costa, and Oliveira (2017) affirm that the Historic Centre of São Luís constitutes a region of great value, not only for its landscape and architectural character but also for its historic and cultural features. As stated by Masullo and Lopes (2016), the Old Centre is located northwest of São Luís, between Bacanga and Anil rivers, covering about 220 hectares, bypassed by an 8km road, namely Anel Viário (Ring Road).

In agreement with the National Historic and Artistic Heritage Institute (IPHAN, 2016a), the Historic Centre of São Luís was submitted to the World Heritage List by the Federal Government in 1955 and, according to Silva (2009, p. 5), "The registrations also occurred in buildings considered characteristic of the time of the state's economic acme and only later in urban complexes in São Luís". The National Historic and Artistic Heritage Service (SPHAN) also registered the Historic Centre of São Luís, on March 13th, 1974. This action was a result of the concern the state had with the area abandonment, as well as the advance of the heritage policies (SILVA, 2009; CUTRIM; COSTA; OLIVEIRA, 2017; REIS, 2010).

In the 1980s, because of its Federal registration, the Historic Centre of São Luís had approximately 200 colonial big houses restored in Praia Grande district. The international listing of the place only occurred on December 4th, 1997, recognizing the center of the capital of Maranhão, with about 60 hectares, as the ninth historic-cultural monument in the UNESCO List of Cultural and Natural World Heritage (Iphan, 2016a, Aires, 2008; Lopes, 2008).

Masullo and Lopes (2016, p. 3) draw attention to the fact that the area affected by this registration "[...] goes from the Cais da Sagração, Palace of the Lions, Deodoro Square, Canto da Fabril in the East-West direction, and the Gonçalves Dias Square to the Madre Deus neighborhood through the Sao Pantaleão in North-South direction". The area protected by UNESCO includes about 1,300 properties, which are the exceptional testimonial of cultural tradition, whose architectural ensemble remains from the 18th and 19th centuries, a period when Maranhão had one with the leading roles in the Brazilian economy. It keeps characteristics and traces of Portuguese colonization, by means of the elements that emphasize the Portuguese connotations in its landscape, similar to the views in the cities of Porto and Lisbon (Carvalho; Almeida, 2018; Iphan, 2016a; Andrès, 1998).

Therefore, it is clear the historic and cultural value of the Historic Centre of São Luís, reinforcing its role as the main locus to reinvigorate the identity of this capital. It is also worth mentioning the symbolic wealth, expressed in its streets, lanes, and intersections, where architectural traces, Portuguese colonial tiles, stonework, among other features, validate its senses and meanings.

3. Google my Maps: characteristics and potential.

Because of the relation between technology and knowledge, allied to the environmental transformations and globalization, different knowledge areas have had their methods and methodologies restructured. The use of new tools might not only equalize access to information, culture, and knowledge but also strengthen education and promote people's understanding of concepts, environment, and the processes that occur on the Earth's surface, contributing to humanity's development.

Technologies have advanced and the internet rethought the access to strategies and use of information. Considering this, Moran (2015, p. 16) understands that "What technology brings today is the integration of all spaces and times". In this context, Silveira, Oliveira, and Junger (2017) note that in the niche of tools available, those aimed at georeferencing have advanced considerably, following the technologies progress. The tools to create graphic mappings and demarcation of geographic points, increasingly more sophisticated and precise, imply more quality, accessibility, and cost reduction to conduct those activities (Silveira; Oliveira; Junger, 2017). The flow of information in the large network favors data provision, especially those from mapping, such as Google Maps, Here Maps, Waze, among others.

According to Rêgo and Serafim (2015), these applications make possible navigation through geographic space, as well as incorporate representations of this space by means of images on different scales.   Oliveira (2012) still reinforces that these representations occur with the use of high definition images, whose varied scales promote a richer navigation experience since it is possible to perceive in greater detail the terrain, hydrography, vegetation, distribution of urban equipment, cultural spots, historical places, and others.

As reported by Eggea (2013), the first version of Google Maps was launched in mid-2005, still in beta version, however, it provided an innovative interface during this period and its functions have not been fully explored.   Kataria (2009) emphasized that in the following years, the next versions of Google tools received some improvements, including zoom, better rendering of maps, and greater capacity with different web browsers.

Rêgo and Serafim (2015, p. 3) state that Google Maps consists of "[...] a free search and visualization software developed by the American company Google; it provides satellite images and maps of all parts of Earth's surface." Oliveira (2012), Rêgo, and Serafim (2015) highlight that the application is a variation of the already known Google Earth, however, it has more sophisticated and modern resources.

Considering the growth in popularity of Global Positioning System (GPS) services, Google made a series of investments in Google Maps. Although it had been projected specifically for basic geographic information, the service Google Maps now has a series of supplementary resources to explore the aspect of "social network" in the application.

It is possible to trace routes, to check traffic jam points, narrated navigations, to save routes and addresses frequently visited, to navigate offline, among other features. However, the greatest highlights go to more complex and powerful tools, such as:

a) Google Street View – it enables the navigation and sharing in 360 degrees of all areas mapped by Maps, with a huge precision scale.

b) Google Indoor Maps – a tool capable of mapping buildings, building directories, with zooms in maps of indoor spaces, with the possibility to change the floors in airports, malls, stadiums, among other locations.

c) Google My Maps – a service available in Maps that enables the user to create personalized maps, where he/she can draw, add specific points, search places previously inserted, import maps, that is, it offers a complex interface for maps customization.

The last service is the one in evidence in this study. Cardozo (2016) notes that "My Maps" allows dynamic cartographic practices, from the creation of personalized maps by users to the insertion of places, markers, lines, routes, cities, neighborhoods anywhere in the world. Thereby people can understand the concept of drawing cartography with technology support. In its interface, keeping the basic concepts of Google Maps, it allows the collaborative construction of maps. A person can finish the creation and save it in the company virtual drive service, Google Drive, and afterward merge it in a website, blog, etc. (Google, 2018).

To personalize the map, the user can add layers that need to be decomposed according to the category to be divided, that is, the type of place specified such as a church, a restaurant, a public building, a school, etc. It is even possible to insert customized icons to distinguish each place. When the user wants to insert another type of place, he/she adds an additional layer so all places can receive different icons. Besides that, the tool also allows people to insert information about the place, such as business hours, a brief description of services, the target audience, contact numbers, pictures, etc. Therefore, "My Maps" offers multiple possibilities to create personal maps and it has great value for the mediation and education of touristic routes, heritage recognition, and others.

In this study, the tool was used not only to map but also to demarcate historic and cultural places capable of retelling the history of the place and instigating knowledge acquisition. Hence the goal was to promote the education and citizenship practice in this locus. In the next topic, the study presents the cartography of places and public and cultural apparatus that people from São Luís could and should recognize, utilize, and take ownership since these environments intersect history, memory, education, and citizenship.

4. Digital Cultural Cartography with Google My Maps and its Educational Potential

The process of demarcating cultural assets in the Historic Centre of São Luís occurs according to the understanding of Oliveira, Maculan, and Gomes (2016, p. 4) who say that these are "[...] spaces designed to cultural practices, such as theaters, cinemas, libraries, cultural centers, film libraries, museums [...]" or any other place for circulation, production, and consumption of material and immaterial goods.

It is worth to mention that the use of technologies for mapping those places is based on the "[...] ease of access to the internet, especially in smartphones; the use of applications is recurrent because they make easier some of people's daily tasks." (Santos; Feitosa; Perinotto, 2017, p. 175). Hence, one of the goals is to make citizens from São Luís more familiar with the spaces with unrestricted access, reinforcing their rights to access information, knowledge, cultural goods, and services offered in the demarcated places. Therefore, it is possible to explore the info-educational potential of the tool presented.

It is noticeable that the creation of routes and organization of cultural information by using mapping technologies benefits knowledge exchange. The application offers services of public interest in an easy interface and accessible language. Perinotto (2013) affirms that the navigation through maps, especially those created in Google My Maps platform, is capable of promoting the establishment of cultural destinations since the availability of information guarantees safety to people and adds value to the places

that might be visited.

Cunha, Silveira Junior, and Perinotto (2014) emphasize the ease these resources provide to identify public heritage and cultural goods, contributing directly not only to stimulate leisure and tourism activities but also to express the educational possibilities about public heritage. Additionally, these tools become sources for studies and researches that deal with how this type of technology can be powerful if used with educational purposes (Morán, 2015).

Based on these characteristics, the map that resulted from this research, entitled Cultural Places of the Historic Centre of São Luís, covers spaces of sociability and cultural citizenship practice such as artistic collectives, artistic occupations of public places, and other sociocultural actions conducted by the community and non-governmental organizations.

In this regard, Oliveira (2012) underlines that the use of digital resources (satellites, applications, three-dimensional screens) implies great advantages for the visualization of places, that is, the products resulting from this intersection represent advances for cartographic language, demonstrating how products can go beyond the simple mapping, becoming rich sources of information, and resources for researchers, professors, students, and citizens. Hence, the individuals have the possibility to get to know places "unknown" so far, and they can finally access them by checking the information on the application.

Based on the assumption that São Luís has different spaces of cultural nature, to demarcate them becomes crucial. This represents more than providing information, also promoting identification and access to these places, enrichment of researchers' formation, and ownership of cultural heritage by educational communities in all their levels. In the first stage of the digital cartography, 10 categories were listed for cultural places split into layers. It should be noted that the tool defines a quantity limit, causing the gathering of similar places in the same layer, what is exposed in Figure 1:
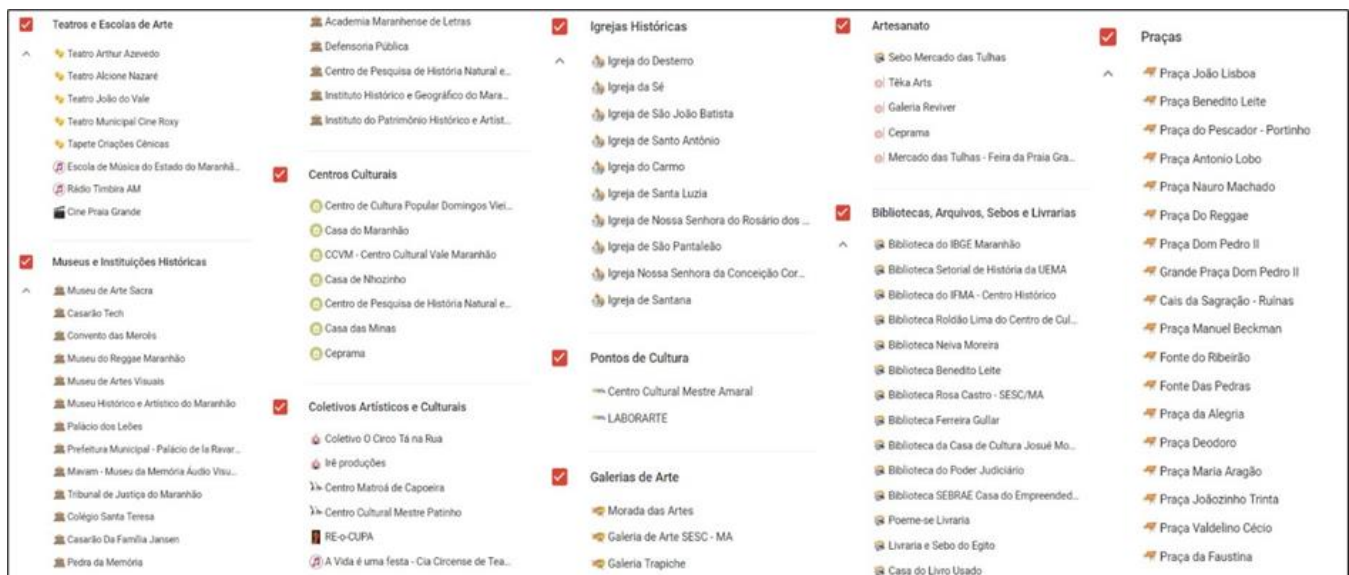
Figure 1. Layers representing cultural assets

From the layers shown in Figure 1, it is possible to recognize an important contribution of the suite for creating custom maps from Google: the possibility to demarcate and inform spaces that favor interactions with public cultural goods, allowing people to autonomously build visiting routes, itineraries mediated by

technological resources (Eggea, 2013). Furthermore, Medeiros et al. (2018, p. 791) explain that "My Maps" can also benefit teachers since "[...] the use of Google Maps serves as an important source for research and it can be used as a teaching strategy in schools [...]".

It is worth to mention, as Cardozo (2016) notes, that "My Maps" platform dynamism allows continuous updating regarding the insertion of new cultural assets and operating information, renovations. These and other functions can be shared with users that have access to the map link, in this case, made available in QR Code format, in the lower-left corner (Figure 2), which can be read in smartphones or tablets with camera and code reading application.

Figure 2. Digital Map Cultural Places of the Historic Centre of São Luís on My Maps

Conti et al. (2018) underline the educational potential of Google Maps and its complementary resource "My Maps". These applications besides allowing spatial representation also awaken students, teachers, and researchers' interests for places that compose the cartography. Medeiros et al. (2018, p. 782) agree with this perspective, affirming that "This platform is an important resource to work with content related to cartography since it enables a complete view of the place to be studied."

Based on the result obtained, it is intended to disseminate the wealth of existing cultural facilities in the Historic Centre of São Luís, contributing to population access to the cultural goods. It is noticeable the use of the application "My Maps" makes the digital access to information addressing Maranhão state history and memory easier and more dynamic, by collaborating with touristic routes, valuing diversity, and potentializing citizenship practice of cultural agents, community, and the general public.

5. Conclusion

The cultural diversity theme has been established as one of the main issues for understanding society, due to the increasing dilution of borders between peoples and their cultures, made possible with the mediation of information and communication technologies. This situation directly affects people's identities since they start consuming the most varied influences of the globalized world.

From this new unstable and borderless ground, emerges the need for creating practices to reinforce people's identity recognition towards their lands, their symbolic values, and their cultural traditions, so they do not get lost in the sea of multiculturalism. It also becomes necessary to enable the practice of cultural citizenship to engage people in social and political decisions, giving new meanings to cultural spaces and considering the progressive intersection of technology and education.

Recognizing the positive integration of technology, education, and culture, the use of Google My Maps as a tool to demarcate cultural assets in the Historic Centre of São Luís has proved to be relevant as it makes easier to access places sometimes unknown to the population, confirming the area as an educational and cultural locus in Maranhão. Thereby, it becomes evident the great concentration of places that produce, reproduce, and circulate the cultural assets of the state.

Ultimately, it is worth to notice the importance of demarcating and mapping cultural places as a strategy to strengthen education, pondering the intense use of technologies as well as the practice of cultural citizenship, to guarantee the unrestricted access of the population to information addressing their history. In this study, the use of technology to demarcate cultural assets resulted in the propagation of places that contribute to protecting the memory of Maranhão state and its cultural practices. Further studies are welcome to investigate and bring forth new results regarding the relationship between culture and technology.

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Content of basil essential oil on a loam texture soil under water regimes and different harvest stages

João Victor Ribeiro da Silva de Souza (Corresponding author)

Universidade Estadual Paulista Júlio de Mesquita Filho, Faculdade de Ciências Agronômicas de Botucatu. Rua José Barbosa de Barros, nº 1780, Fazenda Lageado, 18603970 - Botucatu, SP - Brasil - Caixa-postal: 237, Telefone: (14) 38807150,

email: joao.vrs@outlook.com

Marcos Antonio Liodorio dos Santos

Universidade Estadual Paulista Júlio de Mesquita Filho, Faculdade de Ciências Agronômicas de Botucatu. Rua José Barbosa de Barros, nº 1780, Fazenda Lageado, 18603970 - Botucatu, SP - Brasil - Caixa-postal: 237, Telefone: (14) 38807150,

email: liodorio@hotmail.com

Maria Marcia Pereira Sartori

Universidade Estadual Paulista Júlio de Mesquita Filho, Faculdade de Ciências Agronômicas de Botucatu. Rua José Barbosa de Barros, nº 1780, Fazenda Lageado, 18603970 - Botucatu, SP - Brasil - Caixa-postal: 237, Telefone: (14) 38807161

Email: mmpsartori@fca.unesp.br

James E Simon

Rutgers University, Department of Plant Biology. Rutgers, The State University of New Jersey 59 Dudley Road, Foran Hall Room 396C

New Brunswick, NJ 08901-8520. Tel: 848-932-6239

Email: jimsimon@rutgers.edu

Hector Rodolfo Juliani

Rutgers University, Department of Plant Biology. Rutgers, The State University of New Jersey 59 Dudley Road, Foran Hall Room 396D

New Brunswick, NJ 08901-8520. Tel: 848-932-6240

Email: hjuliani@rutgers.edu

João Carlos Cury Saad

Universidade Estadual Paulista Júlio de Mesquita Filho, Faculdade de Ciências Agronômicas de Botucatu. Rua José Barbosa de Barros, nº 1780, Fazenda Lageado, 18603970 - Botucatu, SP - Brasil - Caixa-postal: 237, Telefone: (14) 38807150,

email: joaosaad@fca.unesp.br

Abstract

The essential oil of basil (Ocimum basilicum L.) has high economic value and is produced in the plant by secondary metabolism. Its quantity and composition tend to vary as a response of the plant to stress situations due to changes in the environment and phenological phase. This work aimed to evaluate the development, the chemical composition, content, and the yield of essential oil of basil rich in Linalool, as a function of the soil water tensions and the harvest stages, in a loam texture soil. The experiment was carried out in a greenhouse and consisted of three harvest times (BF - beginning of flowering, FF - full flowering, and EF - end of flowering) and five values of soil water tension to define when to irrigate (20, 30, 40, 50, and 60 kPa), totalizing 15 treatments. The irrigation in the soil water tension of 60 kPa generated a reduction in the content and the yield of essential oils compared with 20 kPa, only in the FF harvest stage. However, it did not modify the composition of the essential oil. Regardless of the soil water tension to define irrigation, the highest levels and yields of essential oil were found in the EF harvest stage. Harvest stages did not change the composition of the essential oil or the content of Linalool. In turn, the contents of the components Cineol, Camphor, $\propto$-Terpeneol, and Isobornyl acetate increased with the harvesting period from BF to EF. Eugenol had the opposite trend, reducing the content from BF to EF. Linalool, a component in greater proportion in essential oil, showed a higher content in soil water tensions up to 50 kPa, decreasing only by 60 kPa. In loam textured soils, it is recommended that basil producers, who aim to extract Linalool, irrigate when the soil water tension reaches up to 50 kPa, with the harvest at any stage of flowering.

Keywords: medicinal plant; essential oil; hydric stress; linalool; irrigation.;

1. Introduction

Basil is a herbaceous plant present in almost all regions of the world and has several uses, from the consumption of its leaves, in natura or dried, as a food flavoring [1], as a plant for medicinal use [2] and also for the extraction of its essential oil for application in the pharmaceutical, chemical, and cosmetics industries [3]; [4]; [5]; [6].

Basil is considered a medicinal plant due to the presence of essential oil in its leaves and inflorescences, and the concentration may vary according to the variety, climate, region, and harvest stage [7]; [8]. The substances found in the essential oil vary according to the basil genotypes. In Australia, some varieties presented methyl chavicol and linalool as main components, in several concentrations [9]. In India, the varieties were rich in methyl chavicol [10]. In Brazil, some varieties have linalool as the main component [11]; [12], being the Ocimum basilicum the most cultivated lamiacea [13].

The essential oils are extremely concentrated, hydrophobic, and extracted through distillation by steam drag [14]. It is estimated that 250,000 tons of essential oils are produced worldwide [15]. The global production of basil essential oil is in the range of 50 to 100 tons per year [14], having a high market value and generating profitability for the producer. The essential oil of Ocimum basilicum is produced in the plant by secondary metabolism and its quantity and composition

tend to vary as a response of the plant to situations of stress due to changes in the environment and

phenological phase [16]; [17].

The occurrence of stress due to hydric excess or deficiency is one of the major factors responsible for changes in the production and development of medicinal plants, directly affecting height, stem diameter, number of leaves, leaf area and dry and fresh mass, which are the parts used to extract the essential oil. Several authors observed variations in the growth of basil plants when subjected to water stress, resulting in a reduction in the size of the plant and consequently a reduction in the fresh and dry mass of the basil [18]; [19]; [20]; [21]; [22]. [23] observed that nutrition, irrigation, and harvest stage were the factors that most influenced the basil plant development.

The hypotheses of this study were the following: H1- hydric stress increases the content and yield and modifies the basil essential oil composition; H2 - the harvesting stage affects basil essential oil content and composition.

The objective of this research was to evaluate the basil essential oil content, yield, and composition, under different soil water tensions and harvesting stages, in a   loam soil texture.

2. Materials and Methods

2.1 Experimental area

This work was carried out in pots inside a greenhouse whose dimensions were 30 meters long, 7m wide and 6m high at the highest point. The period with irrigation differentiation occurred from September 10, 2016, to January 18, 2017.

The area is located in the Rural Engineering Department of the Faculty of Agronomic Sciences (FCA / UNESP), Botucatu - SP, Brazil, at geographic coordinates latitude 22 ° 51'03 "South and longitude 48 ° 25'37" West, with 786 meters altitude.

2.2 Experimental treatments

The experiment consisted of 15 treatments composed of three harvest stages (BF - beginning of flowering, FF - full flowering, and EF - end of flowering) and five different soil water tensions (20, 30, 40, 50 and 60 kPa) to define when to irrigate. Each treatment had four repetitions, and each repetition was composed of four pots with three plants per pot, that is, one plant for each harvest stage. The experimental design was completely randomized, and the irrigation system was independent for each treatment.

2.3 Plants origin and crop management

The Basil IAC variety was supplied by IAC - Instituto Agronômico de Campinas and had Linalool as its primary component. The sweet basil seedlings were obtained by cutting and transplanted into 60-day-old pots. During the first 40 days after transplanting (DATP), the irrigation management was identical for all pots. It consisted of keeping the soil close to the field capacity, adopted as corresponding to the 10 kPa soil water tension, in order to guarantee the proper rooting of the crop.

The beginning of the application of treatments related to soil water tensions started at 40 DATP and

extended during the 3 harvests that occurred at 70, 100, and 130 DATP, which corresponded, respectively, to the beginning of flowering, full flowering, and end of the flowering. Before each harvest, all treatments were irrigated to raise the soil water tension to 10 kPa, and then a plant was removed per pot. The height and diameter of the stem at the base were measured, separating the inflorescences and all heavy material for subsequent drying in a forced air circulation oven at 40 °C, to obtain the dry and fresh masses of the plants and extract the essential oil.

The irrigation management with the differentiation of treatments in five stresses started at 40 DATP and extended during the three harvests that occurred at 70, 100, and 130 DATP, which corresponded, respectively, to the beginning of flowering, full flowering, and end of flowering. Before each harvest, all treatments were irrigated to raise the soil water tension to 10 kPa, and then one plant was removed per pot. The plant height and diameter of the stem at the base were measured, separating the inflorescences and weighing the plant material for subsequent drying in an oven with forced air circulation at 40°C, to obtain the dry and fresh masses of the plants and extract the essential oil.

2.4 Meteorological data

Climatological data, such as air temperature and relative humidity inside the greenhouse, were measured with Campbell Scientific's meteorological station (Figures 1 and 2).
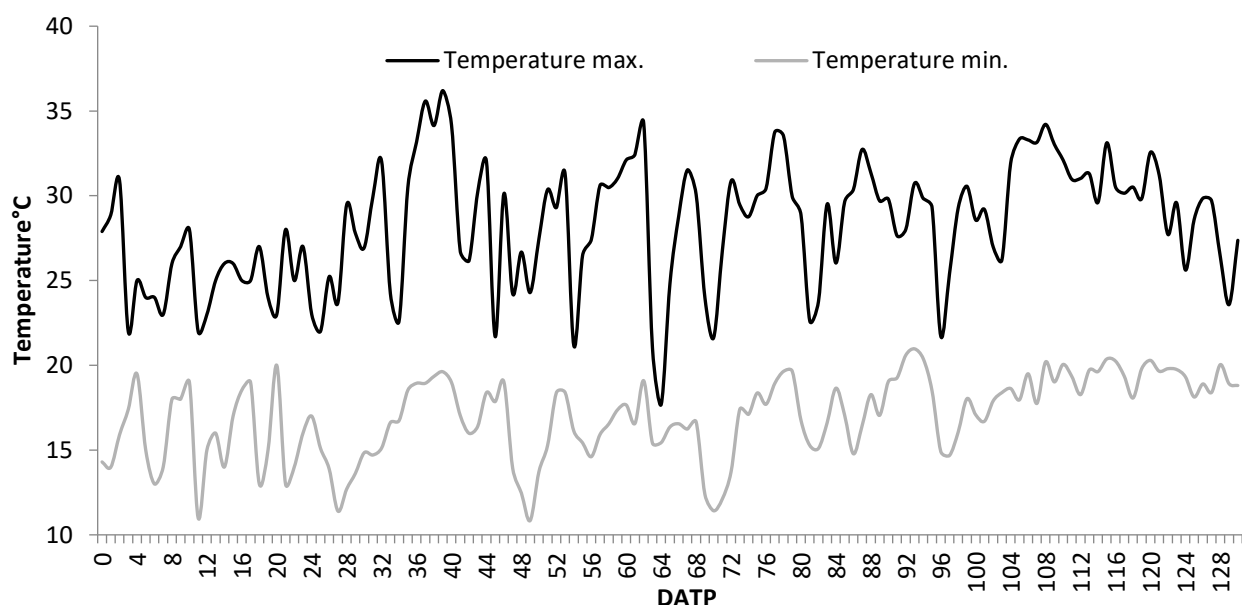
Figure 1 – Air temperature distribution during basil cycle in 2016 – 2017 (DATP: Days after transplantation).
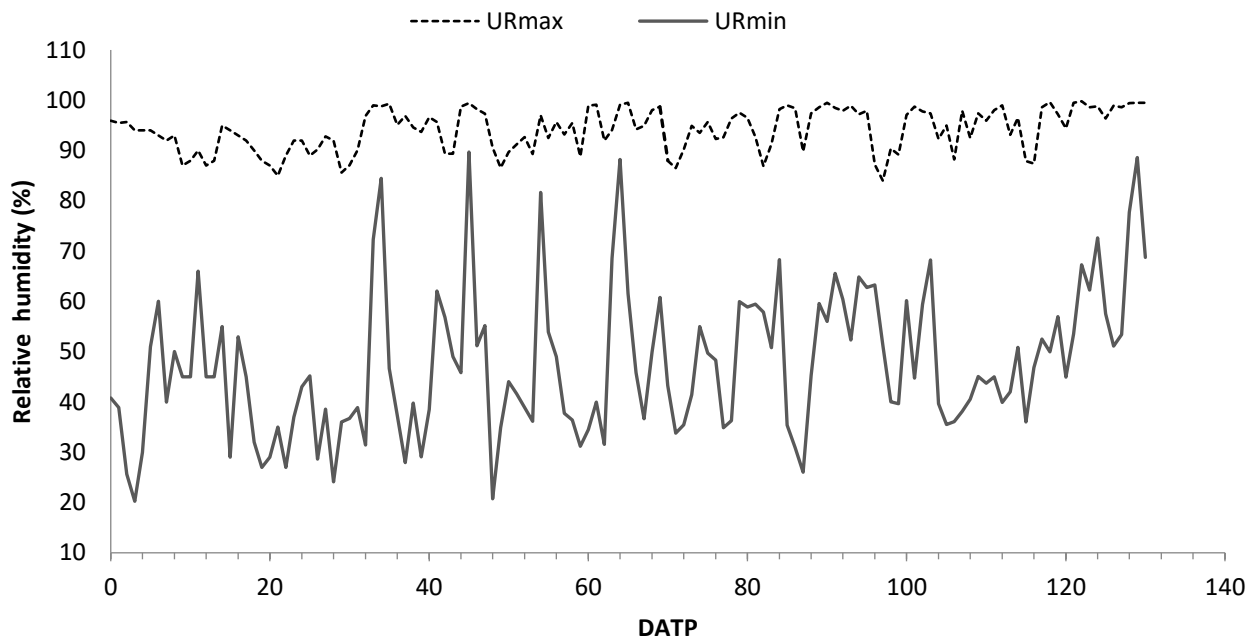
Figure 2 – Relative humidity distribution during basil cycle in 2016 – 2017 (DAPT: Days after transplantation).

2.5 Soil characteristics

The soil used was classified as distrophic red latosol (medium/loam) [24] and collected at the 0 – 20 cm deep layer, in a location with no agricultural presence or any soil handling in the last 10 years. The soil was sifted to remove vegetation and mineral residue, such as roots, stems, leaves, and rocks, and placed in 14-liter pots for subsequent pH correction and base fertilizing. Soil samples were collected, and the chemical characteristics were analyzed, according to [25], and the physical attributes with the methodology proposed by [26] (Tables 1 and 2).

Table 1 – Soil chemical analysis.

Soil Layer	pH	O.M.	P_{resin}	H+Al	K	Ca	Mg	SB	CEC	V%
	$CaCl_2$	g dm^{-3}	mg dm^{-3}	$mmol_c$ dm^{-3}						
0 – 20cm	4,1	16	4	77	0.7	3	1	5	81	5

O.M. - organic matter; Presin - phosphor in resin; SB - sum of bases; CEC - cationic exchange capacity, V% - Base saturation.

Table 2 – Soil physical analysis.

Layer	Sand (g kg^{-1})	Loam (g kg^{-1})	Silt (g kg^{-1})	Soil texture
0 – 20cm	652	291	57	Medium

From the chemical analysis results, the soil was corrected with dolomitic limestone to elevate the base saturation to 75%. The fertilization was performed with 30 mg of N per liter of soil (urea – 45%), 40 mg of K per liter of soil (white potassium chlorite) and 200 mg of P per liter of soil (super simple – 18%

of P_2O_5, 16% of calcium (Ca) and 8% of sulfur (S)).

The soil water retention curve was obtained with non-deformed samples and adjusted by the Soil Water Retention Curve (SWRC) software [27], presenting the following parameters for the equation [28]: α = 1.3011; m = 0.2656; n = 1.8482; θR = 0.1700 cm³ cm-³; θS = 0.599 cm³ cm-³; Ym = 0.181. The volumetric soil water content in the field capacity was associated with the soil water tension of 10 kPa, corresponding to 0.30 cm³cm-³ (Figure 3). [29] found soil moisture values in the field capacity varying between 0.29 to 0.35 cm³cm-³ for medium-textured soils.
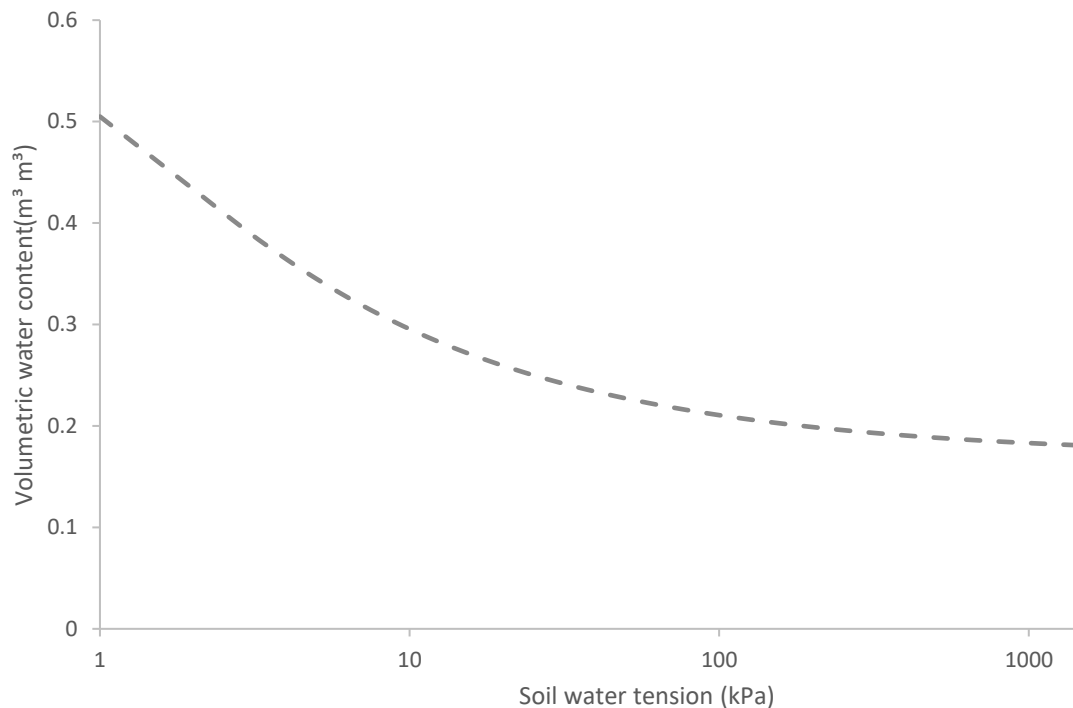
Figure 3 – Soil water retention curve.

2.6 Irrigation System

The basil plants were irrigated with a drip irrigation system, with one self-compensated dripper per pot, which applies a flow rate of 2 L h^{-1} in the pressure head range from 4 to 40 m.c.a. The service pressure for the system operation was 15 m.c.a., guaranteed by a pressure regulator in the pump output. A 4 mm microtube connected each dripper to a 16 mm lateral line, which in turn was supplied by a 25 mm manifold line. The system had a reservoir of 1000 L, and the motor pump used had a power of 0.5 HP regulated so that the operating pressure of the system operated at 0.147 MPa. For water filtration, 200-mesh disk filter was used to prevent the drippers from clogging.

The system uniformity test was performed on a test bench for drip line with the same dimensions of the system installed in the greenhouse and presented a Christiansen Uniformity Coefficient (CUC) of 98%.

2.7 Irrigation scheduling

The irrigation management was performed by tensiometry with four tensiometers per treatment,

installed at 16 cm deep. For soil water tension readings, a digital tensiometer was adopted, with 0.1 kPa resolution, pre-calibrated in mercury column at 20, 30, and 40 cm. Irrigation occurred when at least three of the four tensiometers reached the preset irrigation tensions of 20, 30, 40, 50, and 60 kPa. The irrigation depth for each soil water tension (Table 3) was calculated based on the soil water retention curve, aiming to increase the soil moisture until the field capacity (corresponding to 10 kPa).

Table 3 – Irrigation depth and time for the evaluated soil water tensions.

	Soil water tension (kPa)				
	20	30	40	50	60
Irrigation depth (mL)	419	615	736	820	883
Irrigation time (min)	12.57	18.46	22.08	24.60	26.50

2.8 Evaluation of crop development

The crop development analyses were performed during harvest, starting from measuring the height of the plants from the soil base to the highest point. Then, these plants were cut close to the soil for measuring the diameter of the stem, separating and counting the number of inflorescences per plant and weighting in a precision scale (±0.1g), aiming to obtain the fresh mass of the plant and the inflorescences. The plants were placed in paper bags, and the drying process occurred at 40ºC until constant weight, in a greenhouse with forced air circulation. After drying, the dry matter mass and the essential oil content in the plant were determined.

2.9 Essential oil extraction and composition analysis

The essential oil extraction occurred in the aerial part of the plant, composed of stem, leaves, and inflorescences. The materials were chopped and weighed on a precision scale (±0,1g), put individually in 2 L volumetric balloons, and half-filled with deionized water. The hydrodistillation was performed in Clevenger type apparatus, for 2 hours. After the extraction of the essential oils, they were collected using a Pasteur glass pipette, stored individually in 2.5 mL amber-colored glass flasks, adequately identified, and weighted on a ±0,0001 g resolution/accuracy scale. The material was kept in a freezer at -4 ºC until the moment of the chemical composition analysis.

The essential oil content in percentage, which is the ratio between the mass of essential oil extracted and the dry matter mass, was calculated.

The chemical composition analyses of the essential oil were performed with three independent repetitions for each treatment, at Rutgers University, Department of Plant Biology and Plant Pathology. For gas chromatography, the essential oil was diluted in the proportion of 6 µL of essential oil in 1.5 mL of T-butyl methyl ether solvent. The analysis was performed in an Agilent 6890 Series FID chromatographer, GC System with fused-silica capillary column DB5 (5% phenyl / 95% dimethylpolysiloxane; 30 m x 0.25 mm i.d.). Helium gas was used as transporter gas, in a pressure column of 16.2 psi (0.112 MPa), with 99.99% purity.

The identification of the essential oil components was confirmed using GC Agilent 6890, and the conditions were attached to an Agacent 5973 selective network mass detector and split 25:1 and 20.1

mL.min^{-1}, with electrons impact value (EI = 70eV). The constitutive identifications were performed using retention times and co-injection with authentic patterns, whenever possible, and combining the mass spectra with the patterns from the MS compound libraries (Wiley 275.L). The retention rates (RR) for n-alkane series (8 to 20) were calculated to provide the identification of the substances and to compare with values from the literature [30].

The essential oil yield per plant was estimated by multiplying the total dry mass per plant by the essential oil content, required to calculate the activity's profitability.

2.10 Statistical analysis

The statistical analysis of the data considered the variance analysis, and the measures were compared by Tukey test at 5% probability.

3 RESULTS AND DISCUSSION

3.1 Growth variables

The Ocimum basilicum L. plants had development according to the expected during cultivation in the greenhouse, and there was no incidence of diseases during the crop cycle, regardless of the treatment used. The mean interval between two successive irrigations was 1.4 days for tension of 20 kPa, gradually increasing up to 3.7 days for 60 kPa (Figure 4).

$$y = 1.8598 \ln(x) - 3.7721$$
$$R^2 = 0{,}8608$$
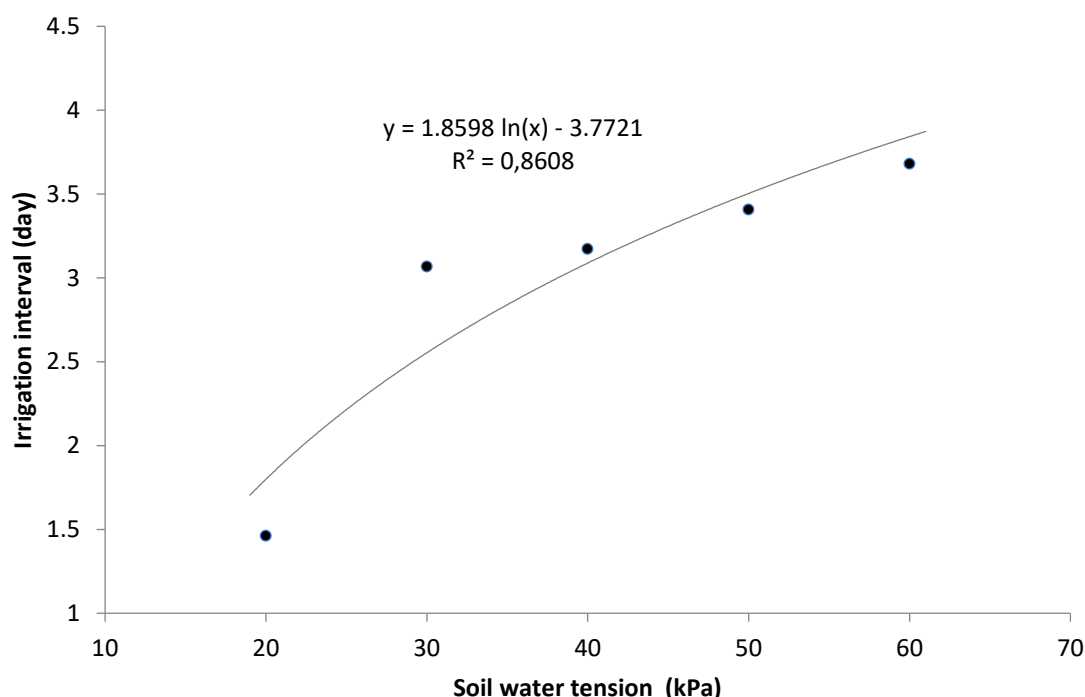
Figure 4 – Interval between irrigations in days for each soil water tension.

It was not observed statistical interaction between the analyzed variables, harvest stages, and soil water tensions. However, the growth variables (Table 4), total dry mass per plant (TDM), total inflorescence dry mass per plant (IDM), total fresh mass per plant (TFM), inflorescence fresh mass per

plant (IFM) and the number of inflorescence per plant (NI), had significant differences for harvest stage, with a gradual increase from the beginning of flowering to end of flowering. These results are following [8], who, studying Ocimum basilicum plants during the beginning, full and end of flowering, reported a higher increase in mass during the final phase, with the formation of seeds.

For the plant height, there was an initial increase between BF and FF, stabilizing between FF and EF, which indicates that the plant practically stopped its vertical development during the EF phase. However, it maintained its lateral growth, that is, increased the number of branches and leaves, as observed by the increase in TDM and TFM. The stem diameter (SD) stayed practically the same during the analyzed harvest stages.

Table 4 – Plant growth variables in relation to flowering stages.

Harvest stage	TDM(g)	IDM(g)	TFM(g)	IFM(g)	PH(cm)	SD (mm)	NI
IF	50.15 C	11.80 C	86.08 C	23.21 C	66.53 B	6.76 A	25.36 C
F	75.74 B	24.64 B	119.06 B	41.95 B	71.96 A	6.46 A	62.71 B
FF	117.40 A	44.48 A	162.52 A	67.02 A	72.36 A	7.68 A	123.40 A

TDM – total dry mass per plant (g); IDM – total inflorescence dry mass per plant (g); TFM – total fresh mass per plant (g); IFM – total inflorescence fresh mass per plant (g); PH – plant height (cm); SD – stem diameter (mm); NI – number of inflorescences per plant; BF – beginning of flowering; FF – full flowering; EF – end of flowering. Capital letters must be analyzed in column.

The soil water tensions mainly affected the TDM and the TFM. The TDM presented the highest average value when irrigation occurred in soil water tension of 20 kPa, with 88.38 g, and the lowest value in tension of 60 kPa, with 72.42 g, that is, a reduction of more than 20% when the plants were irrigated in higher soil water tensions, passing through stress cycles before water replacement. The intermediary irrigation tensions of 30, 40, and 50 kPa presented TDM values that did not differ among themselves (Table 5).

Table 5 – Plant growth variables in relation to different irrigation tensions.

Soil water Tension (kPa)	TDM(g)	IDM(g)	TFM(g)	IFM(g)	PH (cm)	SD(mm)	NI
20	88.38 A	28.31 A	138.51 A	47.00 A	71.49 A	6.96 A	72.48 A
30	81.28 AB	28.30 A	126.78 AB	42.14 A	71.52 A	6.28 A	66.15 A
40	83.01 AB	27.43 A	123.69 AB	45.44 A	67.68 A	6.85 A	70.85 A
50	80.30 AB	25.41 A	115.43 B	44.69 A	71.32 A	6.79 A	75.04 A
60	72.42 B	25.50 A	108.73 B	41.29 A	69.79 A	7.94 A	67.93 A

TDM – total dry mass per plant (g); IDM – total inflorescence dry mass per plant (g); TFM – total fresh mass per plant (g); IFM – total inflorescence fresh mass per plant (g); PH – plant height (cm); SD – stem diameter (mm); NI – number of inflorescences per plant. Capital letters must be analyzed in column.

The TFM presented the highest value when the irrigation occurred in soil water tension of 20 kPa,

with 138.51 g; it reached intermediary values in tensions of 30 and 40 kPa and the lowest values from the tension of 50 kPa on, which were maintained until the tension of 60 kPa.

Several studies reported a reduction in the dry and fresh mass of medicinal plants cultivated in hydric stress conditions [31]; [19]; [21].

The other growth variables, IDM, IFM, PH, SD and NI, did not show significant changes for the soil water tensions.

The results indicate that this basil variety generates higher TDM and IDM when irrigated when reaching soil water tension of 20 kPa. Otherwise, irrigation management with 60 kPa reduced the accumulation of fresh and dry mass of the plant as a result of the hydric deficit.

3.2 Essential oil content and yield

The content (in %) of essential oil present in the dry mass of the plants was affected by the harvest time as well as by the soil water tension. There was statistical interaction between these two variables, the essential oil content in the dry mass varying from 0.74% to a maximum value of 1.67%.

The irrigation tensions of 20, 30 and 40 kPa presented similar behavior for harvest times, with significant increase in the essential oil content between BF and FF, however, with no change between harvest at FF and EF (Table 6).

Table 6 – Essential oil content (%) present in the dry mass of plants in relation to harvest times and soil water tensions for irrigation.

Harvest stage	Soil water tension (kPa)				
	20	30	40	50	60
F	0.99 Ba	0.89 Ba	0.83 Ba	0.84 Ca	0.74 Ca
FF	1.57 Aa	1.50 Aab	1.30 Aab	1.22 Bab	1.12 Bb
EF	1.40 Aa	1.49 Aa	1.50 Aa	1.65 Aa	1.67 Aa

BF – beginning of flowering; FF – full flowering; EF – end of flowering. Capital letters must be analyzed in columns and miniscule letters, in lines.

For irrigation tensions of 50 and 60 kPa, the essential oil content in dry mass increased significantly among all analyzed harvest times, considering that, in the tension of 50 kPa, the essential oil content increased from 0.84% in BF to 1.65% in EF, while in the tension of 60 kPa, it went from 0.74% in BF to 1.67% in EF, that is, the essential oil content more than doubled between the BF and EF phases.

Considering the harvest stages in relation to the soil water tensions (Table 6), it was observed that, in BF, there was no differentiation. In the harvest at FF, the highest essential oil content in dry mass occurred in the tension of 20 kPa, with 1.57%, and decreased to 1.12%, in the tension of 60 kPa. For the harvest at EF, the different soil water tensions did not affect significantly the basil essential oil content.

The essential oil yield (g. plant^{-1}) was affected by harvest stages and soil water tensions (Table 7). The EF harvest was the one that presented the highest essential oil yield per plant, in all water regimes. However, for this harvest stage, no significant variation among the different soil water tensions was observed. The harvest should be carried out at EB, regardless of the soil water tension that determines the

moment to irrigate, to obtain the highest essential oil yield.

[32] and [8] reported differences in essential oil yield depending on the variety used and the season of cultivation, with the highest values between full flowering and end of flowering.

The essential oil yield varies in relation to the mass of the aerial part of the varieties used, environmental factors that can promote physiological changes in the plant, and the extraction method used [7].

Only during harvest at B, significant variation among the different soil water tension for irrigation was observed, with 1.31g in the tension of 20 kPa and 0.76 g in the tension of 60 kPa.

Table 7 – Essential oil yield (g. plant-1) extracted from dry mass in relation to flowering stages and water regimes.

Harvest stage	Soil water tension (kPa)				
	20	30	40	50	60
BF	0.61 Ca	0.47 Ca	0.42 Ca	0.41 Ca	0.27 Ca
FF	1.31 Ba	1.13 Bab	0.90 Bab	1.01 Bab	0.76 Bb
EF	1.67 Aa	1.69 Aa	1.95 Aa	1.79 Aa	1.85 Aa

BF – beginning of flowering; FF – full flowering; EF – end of flowering. Capital letters must be analyzed in columns and miniscule letters, in lines.

3.3 Essential oil chemical composition

The essential oil extracted from basil presented, in its composition, 49 identified substances.   The ones appearing in higher quantity (%) in all treatments, in decreasing order, are Linalool, 1,8-Cineol, Camphor, and Eugenol (Table 8). Linalool and 1.8-Cineol were already reported as being the components found in the highest quantities in the essential oil in several other studies [33]; [34]; [8]; [35]. This differentiation in the content is related to the variety used, geographical origin of the genetic material [32]; [36], and harvest stage [8], among other factors.

The harvest stage and soil water tension did not promote changes in the chemical components found in the basil essential oil; they only influenced the proportion of certain substances, some affected by harvest time, others by the water regime.

The harvest stages affected the major components found in the essential oil. Linalool, which was the substance found in the highest quantity in the essential oil, did not show significant differences in its amount between harvests at the beginning and end of flowering (Table 9). 1.8-Cineol and Camphor had a significant increase in their quantities between BF and EF, while Eugenol reduced between harvest at FF and EF. [8], working with Ocimum basilicum plants rich in Methylchavicol and Linalool, with the harvest at different flowering phases, observed difference in the proportion of these and other components in the essential oil between full flowering and end of flowering, when the plants were already presenting seeds.

Table 8 - Components found in essential oil.

P	Substance	(%)	P	Substance	(%)	P	Substance	(%)
1	α-Thujene	0.06	18	trans-Sabinenehydrate	0.16	35	α-Guaiene	0.11
2	α-Pinene	1.03	19	Fenchol	0.03	36	cis-Cadina -1(6),4-diene	0.04
3	Camphene	1.02	20	(E)-Epoxy-ocimene	0.05	37	α-Humulene	0.20
4	Sabinene	0.90	21	Camphor	15.15	38	Germacrene-D	0.09
5	β-Pinene	1.77	22	neo-Menthol	0.07	39	Valencene	1.41
6	Myrcene	0.77	23	δ-Terpineol	0.47	40	Germacrene B	0.15
7	α-Phellandrene	0.09	24	Terpinen-4-ol	0.69	41	α-Bulnesene	0.15
8	α-Terpinene	0.10	25	α-Terpineol	2.78	42	*Zonarene	0.39
9	o-Cymene	0.09	26	Octanolacetate	0.11	43	α-Cadinene	0.07
10	Limonene	2.01	27	Chavicol	0.04	44	cis-Muurol-5-em-4-β-ol	0.04
11	1,8-Cineole	20.74	28	Isobornylacetate	0.31	45	cis-Muurol-5-en-4-α-ol	0.05
12	(E)-β-Ocimene	0.28	29	Myrtenylacetate	0.08	46	Caryophyllene oxide	0.10
13	ɣ-Terpinene	0.20	30	Eugenol	5.27	47	1,-epi-Cubenol	0.30
14	n-Octanol	0.12	31	Copaene	0.06	48	Valerianol	1.87
15	cis-Sabinenehydrate	0.45	32	β-Bourbonene	0.20	49	Bergamotol	0.03
16	Fenchone	2.36	33	(E)-Caryophyllene	0.60	*	Total Substances (%)	96.46
17	Linalool	33.03	34	A-trans-Bergamotene	0.37			

P – Peaks in the order of analysis.

Table 9 – Substances (%) found in higher quantities in the basil essential oil, in the different flowering stages.

Substance	*BF	FF	EF
Linalool	31.58 a	34.37 a	33.13 a
1,8-Cineol	19.32 b	20.20 ab	22.70 a
Camphor	13.86 b	15.24 ab	16.35 a
α-Terpineol	0.41 b	0.50 a	0.50 a
Isobornyl acetate	0.21 c	0.31 b	0.42 a
Eugenol	5.48 a	6.09 a	4.23 b

BF – beginning of flowering; FF – full flowering; EF – end of flowering. Miniscule letters must be analyzed in line.

The water regimes only affected the Linalool and Isobornyl acetate. Linalool was found in higher quantity in tensions of 20 to 50 kPa, in quantities ranging from 35.03% to 34.27%, with significant reduction in the tension of 60 kPa, with 27.14%. Isobornyl acetate increased its proportion in the essential oil between the tensions of 20 and 60 kPa (Table 10).

Table 10 – Linalool and Isobornyl acetate (%) in different soil water tensions.

Substance	Soil water tension (kPa)				
	20	30	40	50	60
Linalool	35.03 a	34.84 a	33.85 a	34.27 a	27.14 b
Isobornyl acetate	0.261 b	0.32 ab	0.31 ab	0.33 ab	0.34 a

Miniscule letters must be analyzed in line.

The concentration of Linalool in the basil essential oil had different results in the literature. [37] and [38], working with hydric stress in Ocimum basilicum plants, observed a reduction in the proportion of Linalool with reduction water availability. On the other hand, [39] found variation in the Linalool quantity in different water regimes between 50 and 125% of field capacity. [21] reported an increase in the essential oil and Linalool content with the rise of hydric stress. [40] reported that, while other substances such as Methylchavicol and Methyleugenol were affected by the hydric stress, Linalool maintained the same proportion. This divergence of results shows that different varieties and origins can present distinct behaviors with essential oil content and composition.

4. Conclusions

Irrigation in the soil water tension of 60 kPa generated a reduction in the essential oils content and yield to the tension of 20 kPa, only in harvest stage FF. However, it did not change the essential oil composition.

Regardless of the soil water tension to determine irrigation, the highest essential oil content and yield were found in the harvest at the final stage of flowering.

Harvest stages did not alter the essential oil composition, nor the Linalool content. On the other hand, the contents of the Cineol, Camphor, ∞-Terpineol and Isobornyl acetate components increased with harvest time from BF to EF. Eugenol indicated an opposite tendency, with a content reduction from BF to EF.

The Linalool was the component found the highest proportion in the essential oil and had higher content in soil water tensions up to 50 kPa, decreasing only at 60 kPa.

In medium-textured soils, it is recommended, to basil producers that aim Linalool extraction to proceed with irrigation when the soil water tension reaches up to 50 kPa, with the harvest at any flowering stage.

6. Acknowledgement

7. References

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Futsal in Field with Variable Dimensions

Luiz Felipe Pinto Oliveira da Motta[1]; Lia Breda Vicentini[2]; Renan Rossi[3]; Angela Luciana De-Bortoli[4]; Robelius De-Bortoli[5]

[1]Physical Education Graduate, Federal University of Sergipe

[2]Psychology College of Paulista University – UNIP

[3]Sorocaba Physical Education College - YMCA

[4]Architecture Bachelor, Physical Education Graduate.

[5]PhD, Intellectual Property Sciences Postgaduate Program, Federal University of Sergipe.

Corresponding author: Robelius De-Bortoli, orcid.org/0000-0003-1231-6451 – ladec.ufs@gmail.com

Abstract

This study aims to verify how the variation of game area in futsal game alters the requirement for each athlete. It is an empirical study with transversal characteristics. The sample consisted of six young, male, aged between 16 and 26 years, with experience playing futsal. The independent variable was the square footage of the field per athlete. The dependent variables were the number of contacts with the ball, passing, dribbling/feints, shooting and ball stolen and the number of errors passing, dribbling/feints and shooting and total goals scored. Games were conducted with two teams in 3x3 format players with open goals. The goal was valid if they shots were after the half court. The procedures follow the criterion of game space simulation in accordance with the minimum and maximum of futsal rules in sizes from 80m2, 45m2 and 25m2 for each player dimensions. Whereas the 6 subjects, the games had spaces of 30mx16m, 24mx11m and 17.5mx8.5m respectively, totaling 480m2, 265m2 and 148.7m2. A team made more passes than other by possession. Game actions should always be relativised to have summed and actual results of what happened. The biggest field was no decrease in the shots errors. The percentage of time played was higher in the biggest field, which is more interesting for the fans and the press.

Keywords: Sports, Technique, Training

1. Introduction

Futsal is a sport that has had its rules changed several times in recent years. Since the unification between indoor football and 5-a-side football, its rules accompany the media needs. The playing time, time measurement and, mainly, the spaces on the court were changed.

Piñar et al. [1] (p. 446) tell us: "keeping in mind that competition is an educational setting, and with the aim of increasing and varying player's type of participation in mini-basketball, a modification of some of rules was proposed." Thus, we begin to analyze the changes that can be had in sport under a variation of spaces, which is done with small sports games.

Research of Costa [2] with basketball athletes shows us that altering the spaces available to each

player alters their gaming needs. The reduction of the court generates a greater need for actions, both technical and tactical. The pressure of the smaller space forces the athlete to move differently than previously.

In Fontana's study [3], 32 male soccer players were used, being 16 expert players and 16 inexperienced players. The development of decision-making in four exercise intensities was analyzed and then they were invited to answer seven decision-making questions as quickly as possible and as accurately as possible.

The results indicated that exercise does not affect decision-making precision for both expert and inexperienced players, but the decision-making speed of both groups of players improved with increasing intensity of exercise. This suggests that physiological stimulation affects only the speed of decision making, not affecting its precision.

Foresto [4] already used 3x3 games with 63m2 and 6x6 with 100m2 per player to analyze the differences in sports actions. Still, his conclusions on participation are not influenced by the number of players and if by the space of the court. More players are thought to produce less workspace, but in their study there was the opposite.

Other researchers such as Braz and Ré [5] found correlations between the interference of the ball and the number of touches per minute, as well as the shots, which is predictable since there is more pose of the ball, there should be more actions such as touches and shots.

These studies almost always bring us a search for relationships between the athlete's physical and biotipological capabilities with technical and tactical events. Of course, this is a very important line of research, but the path may be reversed. Analyzing the actions resulting from a game on court with different dimensions, you can predetermine what you want for physical, tactical and technical training. In the specific futsal sport, the court settings can make the training have to change everything, as well as the characteristics of the athletes.

This study seeks to know the differences produced by the change in court dimensions, including why there are still many sites that play on narrow and short courts. Thus, this study aims to verify how the variation of playing spaces in futsal alters the playing needs of athletes.

2. Materials and Methods

This is an empirical cross-sectional study, where an independent variable is controlled to verify how it affects other game variables. The sample used was intentional, consisting of six (6) young men, aged between 16 and 26 years, with experience of playing futsal.

The independent variable was the square footage of the field of play per athlete. The dependent variables analyzed were the numbers of ball contact, passing, dribbles / feints, shots and steals, as well as the number of pass, shooting and dribbles / feints errors and the total number of goals scored. .

The instruments used were a futsal court with a wooden floor and variable dimensions. For the analysis, the games were recorded with a Sony brand portable digital camera and later the actions were analyzed using Windows Movie Maker software. Once the actions referring to the dependent variables were identified and categorized, they were compared in the three forms of play.

The procedures followed the simulation criteria of the playing space, in accordance with the minimum and maximum regulatory dimensions of futsal, in the sizes of 80m2, 45m2 and 25m2 for each player. Considering the 6 subjects, the games had spaces of 30mx16m, 24mx11m and 17.5mx8.5m, totaling respectively 480m2, 265m2 and 148.7m2.

Games were held with two teams in 3x3 players, now called team "UF" and "CO", with open goals where it was a valid goal if the shots were after midfield. To start, a time of 3 minutes was observed for the subjects to be acclimated to the rules and spaces and then until the first ball was out after 5 minutes in each game in each court size, all recorded on video. The games followed the increasing order of spaces from least to greatest and in the end more than once the smallest space.

The data was recorded in a Microsoft Office Excel spreadsheet and presented descriptively, counting the number of actions, as well as relativizing the actions for the time played. Then the correct and wrong actions were considered, compared in the games in small court (pqn), large (grd) and once more small (pqn2). The game in the medium court was not considered because the objective of the study is to understand what happens at the extremes of the size of the court.

3. Results

Once the three games have been performed and the times have been arranged in each one, the total times played in seconds for the "small", "large" and "small 2" games are presented in Table 1. The total time was variable as it seemed better to use the criterion of taking the game to the first ball out of play after the minimum time of five minutes. Thus, the times recorded are not the same, the total time in which the ball was in play was still recorded and thus it is perceived that the game "grd" the percentage was 70.89%, higher than the two games "Pqn" that had 60.06% and 53.65% of the total time with the ball in play.

TABLE 1: Total playing time, ball play time and percentages in the three games.

	pqn	grd	pqn2
Total Time	313	316	356
Ball in game	188	224	191
%	60.06%	70.89%	53.65%

Table 2 shows the results of the frequency of playing actions that make up the dependent variables studied by court size and by team. The most frequent actions are the passes and here it is not making a differentiation of play style, but registration. There is a big difference between the number of passes of the two teams in the first game with the UF and CO making 11 and 50 passes respectively. The last game the difference fell for 24 and 30, even though the CO team maintained the highest number of passes.

The other actions presented almost the same frequency in the three games, but the number of missed passes increased for the two teams, going from 2 and 4 to 6 errors for each one.

TABLE 2: Number of team actions per game in the three games.

	pqn		grd		pqn2	
	UF	**CO**	**UF**	**CO**	**UF**	**CO**
Pass	11	50	27	39	24	30
Shooting	6	5	5	4	7	6
Dribble/feint	5	2	3	2	2	3
Stolen ball	2	0	3	4	2	1
Pass errors	2	4	2	3	6	6
Shoting errors	4	3	2	0	2	4
Dribble/feint errors	1	0	2	1	1	1
Goals	2	2	3	4	6	2

After presenting the shares in absolute numbers, Table 3 shows the shares in relative numbers. The stock values were divided by the time each of the teams held the ball in their pose in each of the games. Thus, it is possible to perceive that the CO team made more passes in the time in which they had the ball pose than the UF team in the three games, reaching 0.266 passes per second in the first game as the UF team made 0.035 passes per second.

Another individual result that seems important is that the CO team's shooting errors in the "pqn" and "pqn2" games were 0.016 and 0.021 per second, which in the "grd" game did not exceed 0.000 errors per second. In addition, the CO team achieved ball steal values of 0.018 in the "grd" game, while in the other games it was 0.000 and 0.005 steals per second of ball possession. These seem to be the most important information in this presentation table.

TABLE 3: Relationship between number of actions and total playing time per team in the three games.

	pqn		gad		pqn2	
	UF	**CO**	**UF**	**CO**	**UF**	**CO**
Pass	0,035	0,266	0,085	0,174	0,067	0,157
Shooting	0,019	0,027	0,016	0,018	0,020	0,031
Dribble/feint	0,016	0,011	0,009	0,009	0,006	0,016
Stolen ball	0,006	0,000	0,009	0,018	0,006	0,005
Pass errors	0,006	0,021	0,006	0,013	0,017	0,031
Shoting errors	0,013	0,016	0,006	0,000	0,006	0,021
Dribble/feint errors	0,003	0,000	0,006	0,004	0,003	0,005
Goals	0,006	0,011	0,009	0,018	0,017	0,010

With the data presented in a relativized way, the sum of the actions of the two teams was made and divided by the total time of the ball in play. Figure 1 shows the relationships of the actions that we judge to be positive in the game, such as shooting (chute), dribble / feint (drible) and stolen ball (roubada). A graphical comparison was made to verify the curves that the actions made. Differences in the three actions are visually perceived, considering the size of the court. On the "grd" court there were fewer shots and

dribbles / feints and a greater number of stolen balls than on the "pqn" court. That is, what happened on the "pqn" court changed for the "grd" court and happened again on the "pqn2" court.
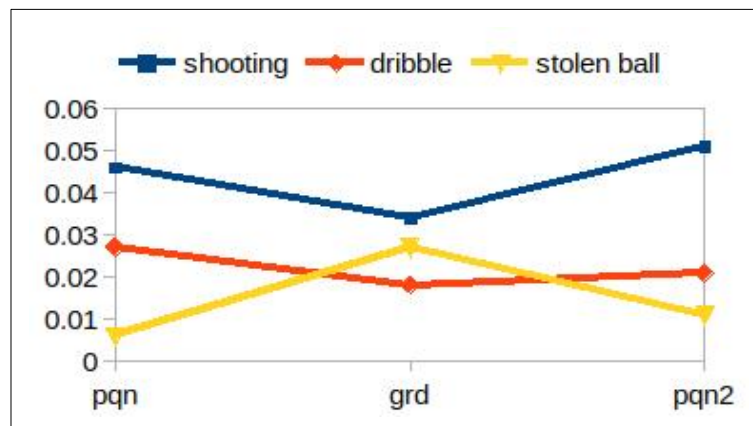
FIGURE 1: Sum of the relative values of the shooting, dribble / feint and ball stolen actions of the two teams by ball time in play.

Figure 2 shows the actions that are supposed to be bad for a team, as follows: dribble / feint errors (dribble errors), passing errors (erros de passe) and shooting errors (chipping errors). Here you can identify the same curves for all three types of games. What happened in the game "pqn" changed in the game "grd" and happened again in the game "pqn2".

What is more evident are the shooting errors that presented results greater than four times on the small courts, with 0.029 and 0.027 as for the large court it was 0.006 errors per second of the ball in play.
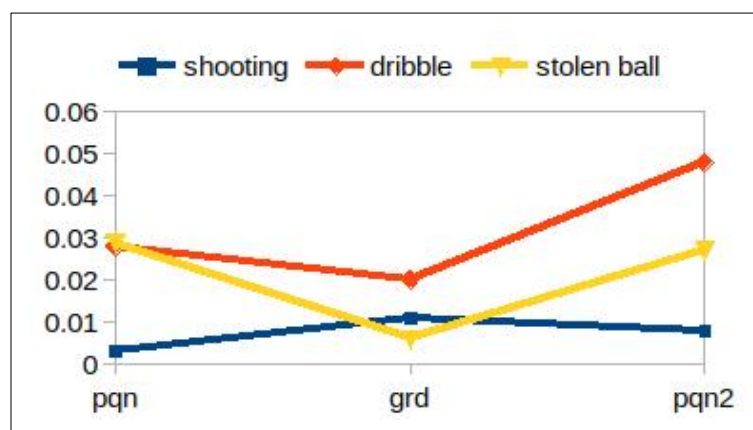
FIGURE 2: Sum of the relative values of shooting error actions, dribble / feint error and pass error of the two teams for ball time in play.

Another variable that was studied and that seems to be very important for the interpretation of the game was the time of the ball in play. Figure 3 shows the percentages of the time the ball was actually being played.

It is perceived that on the "grd" court the ball stayed longer relative to the game with a curve that follows the other variables, where what happens on the small court is different from what happens on the large court.
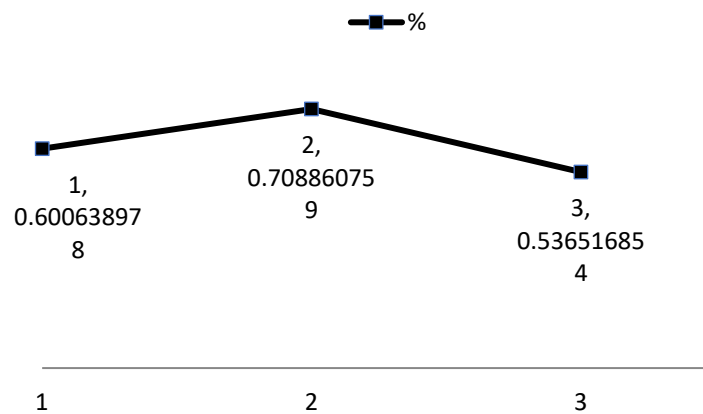
FIGURE 3: Ball percentages in play in the three games, small (1), large (2) and small2 (3).

4. Discussion

To interpret the results in light of recent studies, we will start with the variable of the playing space, or the size of the court. Authors such as Piñar et al. [1] say that the more space decreases, the more offensive actions increase, which cannot be said to have been repeated in our study, even because the expression "offensive actions" has many interpretations. The truth is that there were more shooting errors on the small court, which can be interpreted as an increase in actions, still the errors indicate lower quality of play.

Another contribution is that the pose of the ball did not guarantee the result of victories [5] nor the number of passes made by the team, as this is a difference that is related to the style of play that comes from their training school in different countries.

What seems certain is that there is a common census among coaches that changing training court dimensions can offer better capacity development. In a study by Serrano et al. [6] (p. 154) It is said that expert coaches prefer inexperienced trainers to teach in small spaces or small games and with numerical inferiority. The numerical inferiority increases the court spaces and, of course, there is a greater requisition of perceptual abilities, since it is always necessary to change the player to score or leave the score.

When we talk about dimensions and consequences that flow from them, we think about physical capacities. Drews et al. [7] studying the development of schoolchildren who practice volleyball and futsal did not find significant differences in their development for the agility test of the Shuttle Run. This would be very difficult to imagine in two sports as different as those mentioned. The training load could be the reason, because the court and the structure of the game are different.

It seems true to say that with training changes are achieved. Oliveira et al. [8] even say that pre-season training sessions of competitions help to improve heart rate results in physical tests, which is desirable when it comes to sports performance.

Still, Sampaio et al. [9] have studied the changes in effort and will use 12.2m2 and 16.8m2 per player in their 3x3 and 4x4 games in their studies, and they found no differences in heart rate or effort. What happens is that no comparison can be made with our study since the number of square meters per player was 80m2 and 25m2.

Some studies refer to the pose of the ball saying that there is some relationship with the final result.

De Bortoli et al. [10] talk about the game coefficients and found relationships between the number of errors and the total number of shots made by a team as well as the number of contacts with the ball and the number of total errors. This study remains very interesting because it relativises the actions and refers to the volume of the game.

Duarte [11] presents study results in the final of the futsal world championship at stake between Spain and Italy. Their notes indicate that the relationship between passes and time in pose of the ball remained like this, respectively between the teams of 0.348 and 0.198, which can be perceived that each player from Spain stayed a shorter time with the ball at his feet, not reproducing what happened with the change of court size in our study.

A criticism of Duarte [11] (p. 79) to the studies carried out is that "... the analyzes have been carried out, essentially, by registering the frequency of individual technical-tactical actions", a limitation that was attempted not to proceed.

From a technical point of view, the aging of the players must be taken into account, since our sample was of young people. Araújo et al. [12] say that the older the age, the greater the hardness in the hips. Considering that, the technique in futsal changes with age, since the actions are done with the feet and the motor and balance command follows a support route through the hips and the need to move on the court can add different physical requirements for execution of technique.

In a comparison between soccer and futsal, Barbieri & Gobbi [13] say that futsal has a more intense dynamic, which means that players act across the field. This could be said to be the consequence of the spaces per player being less than in soccer. With the lengthening of futsal courts, the spaces are greater, decreasing their intensity when compared to small courts.

Still, the same Barbieri and Gobbi [13] (p. 43) say that "...to reach proficiency not soccer and not futsal and indispensable similar performance between the two sides." You can look for examples in contemporary football that do not confirm this statement. There are good players who are proficient with both feet or ambidextrous techniques.

5. Conclusions

This study sought to know the differences produced by the change in the dimensions of the court and the objective was to verify how the variation of playing spaces in futsal alters the playing needs of each athlete. The results, even if they are not definitive, guarantee us some well-placed conclusions and some lines for future studies.

One team made more passes than the other due to ball possession time, which is believed to be due to the style of play adopted. The game actions must always be added and relativized to have real results of what happened. On the large court there was a decrease in shooting errors. The percentage of time played was higher on the big court, which is more interesting for the fans and the press.

It was also worth saying that there were no significant differences, there was a visual difference in the variables when we changed the size of the court. Perhaps this factor is due to the small sample and time played, which invites us to propose longer studies for possible verification of these data.

6. Acknowledgments

Special thanks to our team. It is the first work with representatives from five different institutions.

7. Conflicts of Interest

The authors declare no conflict of interest.

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An analysis of overlapping terms to define articles key words: The use of VOSviewer tool applied to technology transfer in fuel cells

Carlos Eduardo Celestino Andrade[1]; Epaminondas Gonzaga Lima Neto[2], Francisco Sandro Rodrigues[3], Luiz Diego Vidal Santos[4], Lucas Celestino de Andrade Júnior[5], Arilmara Abade Bandeira[6]

[1,2,3,4,6]Programa de Pós-Graduação em Ciência da Propriedade Intelectual-PPGPI
Universidade Federal de Sergipe –UFS – São Cristóvão/SE –Brasil.

[5]Programa de Pós-Graduação em Desenvolvimento e Meio Ambiente - PRODEMA
Universidade Federal de Sergipe –UFS – São Cristóvão/SE –Brasil

Abstract

Several ways of structuring sources of innovation have been provided in order to achieve competitiveness and reduce the impacts during a crisis time. The use of renewable technologies that also reduce global carbon dioxide emissions and dependence on fossil fuels has been encouraged. The objective of this study was to identify the main groupings of terms through the VOSviewer tool, related to technology transfer in fuel cells found from searching in the Scopus database repository. The structuring of relationship networks of the terms of greater co-occurrence of technology transfer in fuel cells enabled a verification based on clear definitions, providing a synthesis of the most researched devices, or potentially found in the Scopus database. The search provided a number of 170 articles in an unbiased way presenting an overview of the main understanding of selected articles from 2015 up to the present, indicating central operators to be considered, as well as innovation perception to support future economic growth, focusing on most significant terms on the searched parameters.

Keywords: Knowledge transfer, Decarbonized Energy, Bibliographic Mapping.

1. Introduction

In the globalized world, economies are becoming increasingly competitive, investments in technological innovation are deeply related to development. Kloosterman et al. (2015) mentioned that the added value of science is materialized through technology, allowing society to benefit from new discoveries. Such benefits are diverse (such as health, economy, commerce, transport, communication, sustainability, conservation of cultural and historical heritage, security and justice), but they have in common the demand for increased quality of life and the possibility of progress and prosperity in societies. The science cycle, innovation and development are the reasons behind the massive and structural investment in scientific programs in developed countries (Fukuda, 2020).

Technologies development from intensive knowledge innovations can be described as strategic for companies and has been encouraged to provide alternative techniques capable to achieve decarbonization

goals (ASONGU et al., 2017 and SILVA et al., 2017).   According to Malta and Pereira (2018) sustainable technology production is an articulated process based in ecological potential, environmental conditions and socio-cultural values. Garrone et al, (2018) stated that the concept of sustainable innovation is broad, focusing on the reduction on the effects that cause negative impact to the ecosystem.

In this scenario of sustainable innovations, the development and improvement of fuel cells is an excellent alternative to energy generation. Being a knowledge-intensive technology, fuel cells is reported when investigating the location where research was carried out, are primarily at the heart of researches conducted by the research centers (Su et al., 2020; Staffell et al., 2019; Dwivedid, 2020; Ouyango et al., 2020; Messing; Kjeang, 2020; Wang et al., 2020).

Technology transfer is directly linked to know-how, i.e. technological development of production. This perspective is supported by the ongoing global trends of technological, economic and social changes, those the companies struggle to keep following (Fukuda, 2020). Thus, in order to provide technology transfer, contracts and/or agreements must be signed, after negotiations, with the elaboration of well-defined and transparent clauses to meet legal agreements and effective knowledge transfer in an environment of legal security, leading to a positive influence on the quality of the outcome, i.e., success in commercialization (Santos et al., 2015) and (Sun; Zhang; Kok, 2020).

It is noticeable that the performance of an analysis to obtain indicators related to technological innovation processes that involve the transfer of technologies related to fuel cells is very important to the guidance of a more sustainable energy matrix, not only from the theoretical point of view but also from the pragmatic point of view of the tool use which allows the visualization of research of overlapping terms what express the market interest. The objective of this study was to identify the main groupings of terms through the VOSviewer tool, related to technology transfer in fuel cells found from searching in the Scopus database repository.

2. Methodology

The literature search was performed using a procedure of term network formation and data visualization about what is more relevant in order to simplify the study (Treinta et al., 2014). Then, an article folder was generated containing 170 peer-reviewed articles. The search task was conducted considering a cautious, pluralist and flexible approach, according to the following criteria (Gallart, 2018): first, only articles focused on fuel cell technology transfer were chosen. Secondly, a restriction was applied to the search for academic literature to define economically viable fuel cells with a potential to be produced in a commercial way.   Finally, an exploratory assessment was carried out to define the most recurrent keywords with promising aspects.

The procedure of analyzing overlapping terms in order to define keywords began after the following activities were completed:

> Step 1: Choose the data repository, define search terms and time horizon;
> Step 2: Choose the overlapping term viewing tool;

2.1 Regarding the data repository, definition of search terms and time horizon

The preparation of the manuscript folder was possible after the database choice, onsidering the digital environment in which ideas were shared and examined by pairs. This decision was based on the data repositories of World Wide Web-based platforms that synthesize researchers' ability to securely access and manage research information remotely (Gallart, 2018).   The quality of scientific information is guaranteed, since the content has usually been examined by qualified professional members of scientific committees.

This work used the Scopus databases, focusing on aspects related to the storage of abstracts and citations from books, scientific journals, thus providing an approach at an international level of researches production, eliminating repeated works among the platforms. It is important to consider literary contribution which state that to analyze the state-of-the-art reviews of scientific productions of researcher's interest, limitations of the specialized research system should be observed and should be used citation information from major platforms, thus providing a minor margin of error and avoiding crossing citations (Gusenbauer, 2020) and (Guimarães; Araújo; Sousa, 2020).

Due to the determination of the data repositories, the establishment of the terms to be used was initiated, in such a way that they were intrinsically related to the research goals.   Considering that the objective of the research is to discuss two central themes, technology transfer and fuel cells, the descriptors ("technology transfer" and "fuel cell") and ("fuel cell" and "viable cost") were defined in order to verify the research profile in fuel cells that have the potential to be economically viable. Furthermore, when using Boolean research logic, it is important to note that the connective logic operators "and" and "or" were used, because this expedient of usage of the connectors explains the existence of many or few manuscripts located (Tavares; Rodrigues; Filho, 2012).

In this sense, it should be pointed out that the most common search operators are the "AND", "OR", "NOT" and they are used respectively: to locate documents containing all the distinct subjects by the operator; to locate documents containing one of the distinct subjects by the operator and to exclude documents containing certain words from its search. (Scopus Reference Guide, [n. d.]).

Thus, a search based on   titles, abstracts and keywords in the Scopus database was performed, selecting recent scientific publications from the last 5 years to build visual maps of keywords using the software applied to co-occurrence data. It was found respectively a number of 27 articles for the search based on the logical structure ("technology transfer" and "fuel cell") and 143 articles for the search based on the operator ("fuel cell" and "viable cost") and the files were exported according to the CSV Excel extension.

2.2 Regarding to the viewing tool

The used tool to build networks of terms for the overlap visualization was the VOSviewer software (Jan and Ludo, 2010), adjusted to visualize bibliometric data, selecting the compatible option with the searched databases, choosing the saved CSV Excel file, based on the determined operators and later defining the co-occurrence analysis, complete counting and keyword index.

Two types of maps were used. A map that links terms over time in a network, and the other map to check the general distribution of co-occurrence regarding to the activity intensity verified by color and size variation. The colors vary from blue to red. Where blue represents low intensity activity and red represents

high intensity activity. The size of the grouping sphere indicates the number of publications per subject (Zahedi; Eck, 2014). In fact, these maps helped to analyze the information formed by the main terms of the research field over time and the most and least active terms.

3. Results

The overlapping terms views applied to the logical structure of search ("technology transfer" and "fuel cell") is shown in Figure 01 (a and b) which provides an overview of the interconnection among the term grouping spheres of the network composed by the central terms respectively ("technology transfer") and ("fuel cell"). As far as the grouping spheres are located in positions further apart, there will be a lesser correlation among the grouped terms.

Also in Figure 1 is possible to notice that the terms technology transfer and fuel cells are strongly related to each other, not only as a priority, but also as a main network of terms with: (*microbial fuel cells, electrodes, proton exchange membrane fuel cells, efficiency, costs, electrode, electrolytic reduction, climate change and oxygen*).   It is also noticeable that since 2018 the groupings of publications with the terms (*investiments and hydrogen*) have been highlighted.
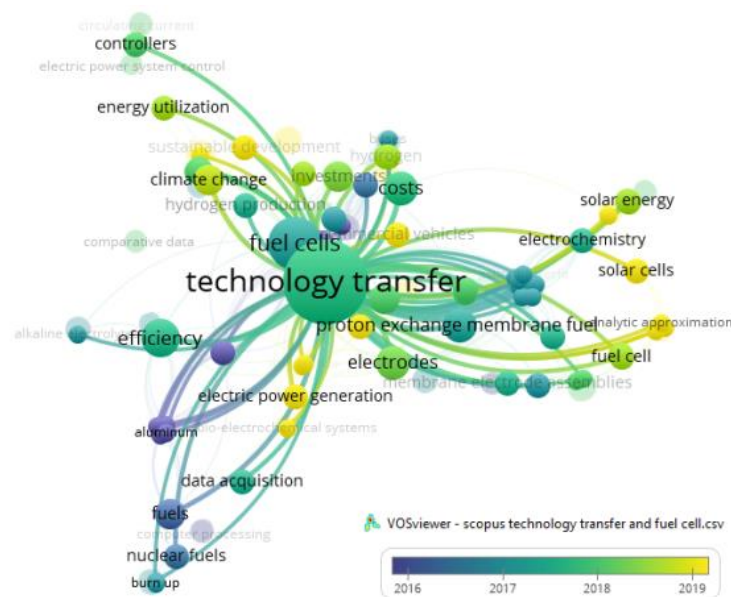
(a)
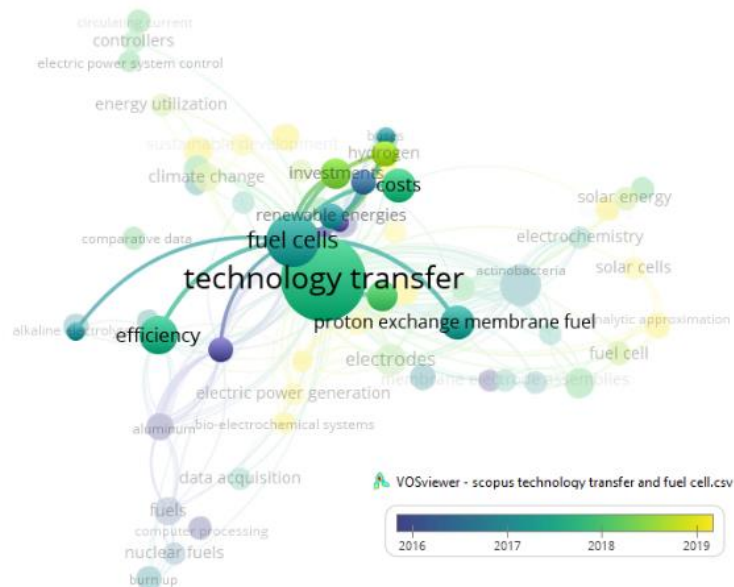
(b)

Figure 1- map terms display related to time: (a) technology transfer and (b) fuel cells, through the VOSviewer tool to logical operators (*"technology transfer"* and *"fuel cell"*).

Considering the analysis regarding the groupings geometrical feature, as well as the activity intensity through the search (*"technology transfer"* and *"fuel cell"*) (Figure 2), it seems that the term "technology transfer" is object of intense publication activity represented by the orange color. Regarding to the used parameters, the term "fuel cells" is represented by a lower intensity color and smaller volume of the grouping sphere compared to the term technology transfer. On the other hand, Figure 2 lists the subjects (*investments, efficiency and cost*) with more intense color representation and similar size which indicates that the publications for the researched terms may respresent something to the keywords choice consideration.
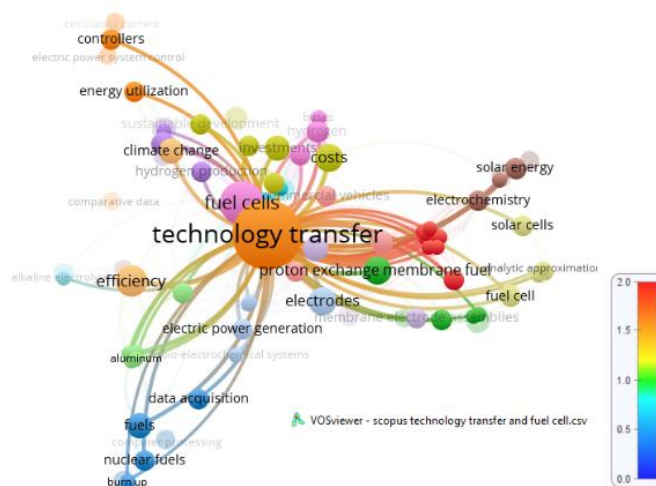
(a)
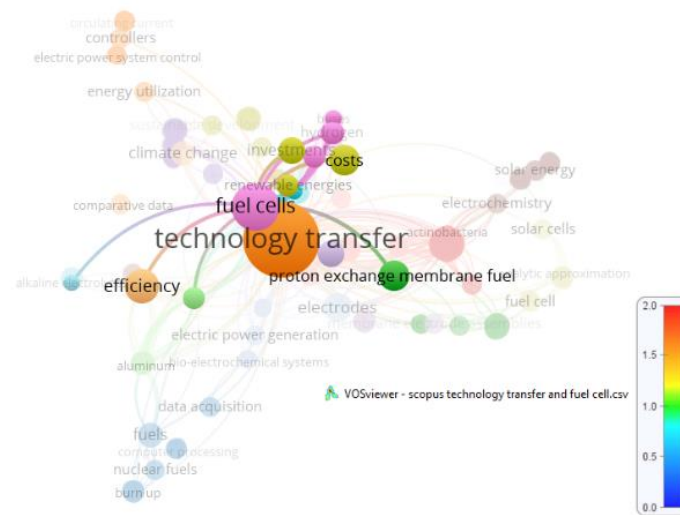
(b)

Figure 2- Map terms display related to activity intensity: (a) technology transfer and (b) fuel cells, through the VOSviewer tool to logical operators ("*technology transfer*" and "*fuel cell*").

Figure 3 shows the matching groups of terms forming co-occurrence networks applied to the logical utilized operator ("*fuel cell*" and "*viable cost*").
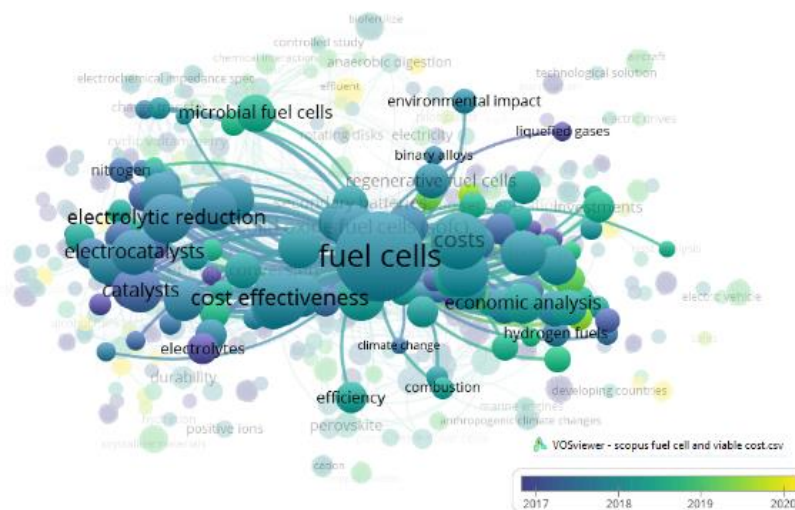
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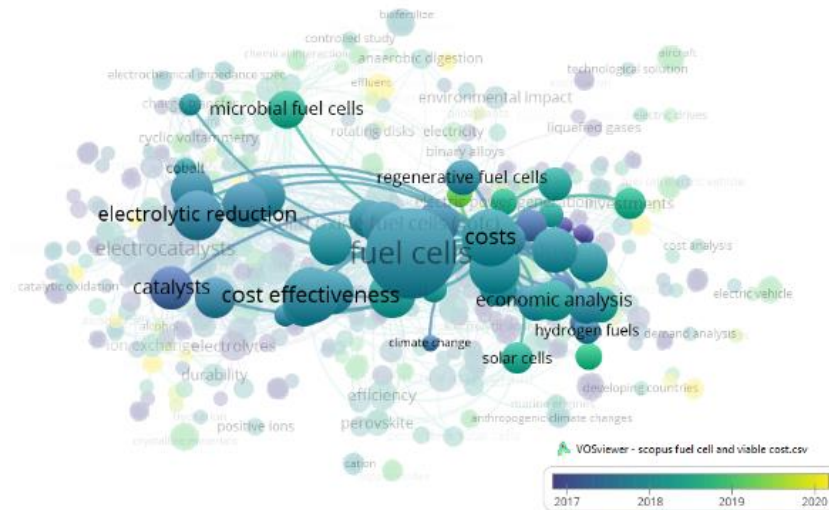
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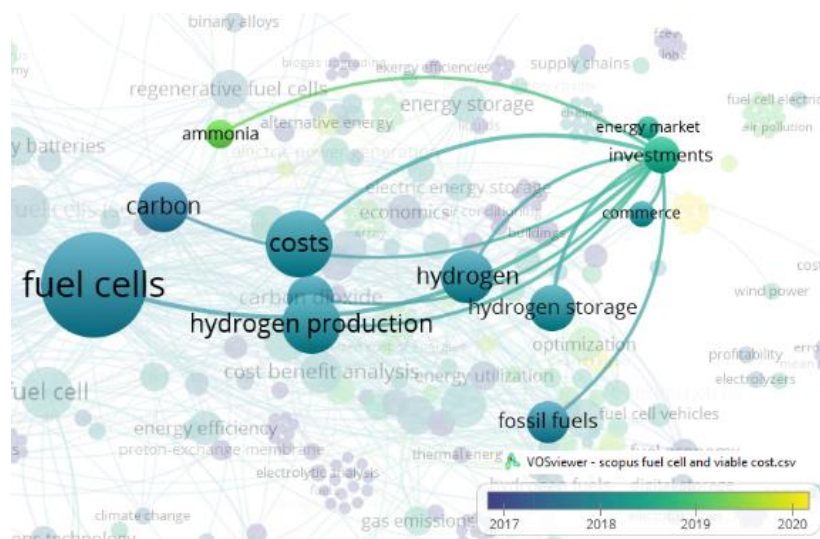
(c)

Figure 3- Map terms display related to time: (a) fuel cells, (b) cost and (c) investment through the VOSviewer tool to logical operators ("*fuel cell*" and "*viable cost*").

The observation of the networks allows provides an understanding that the integrated terms of the logical operator used in the searches (a) and (b) are quite similar positions, which indicates a strong relationship between them. Also in (c) a network built based on the term *"investments"* can be considered by the representation of the location of the spheres of terms (*hydrogen, carbon, and ammonia*). The network has been established in a dominant way from published terms from 2018, as follows: (*fuel cells, costs, cost effectiveness, hydrogen production, hydrogen, electrolytic reduction oxygen, catalysts, carbon, próton exchange membrane fuel cells, platinum, solid oxide fuel cell, microbial fuel cells, methanol e cathodes*). The Figure 4 presents networks formed by the terms "*fuel cells*" (a), "*costs*" (b), "catalysts" (c) and "methanol" (d). The groupings terms associated with the fuel cell operating mechanism are positioned far from the cost related grouping, indicating a weak relationship.
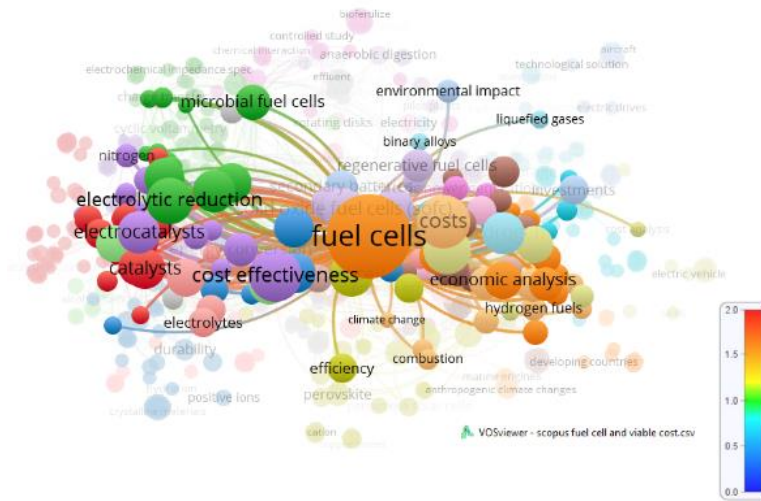
(a)
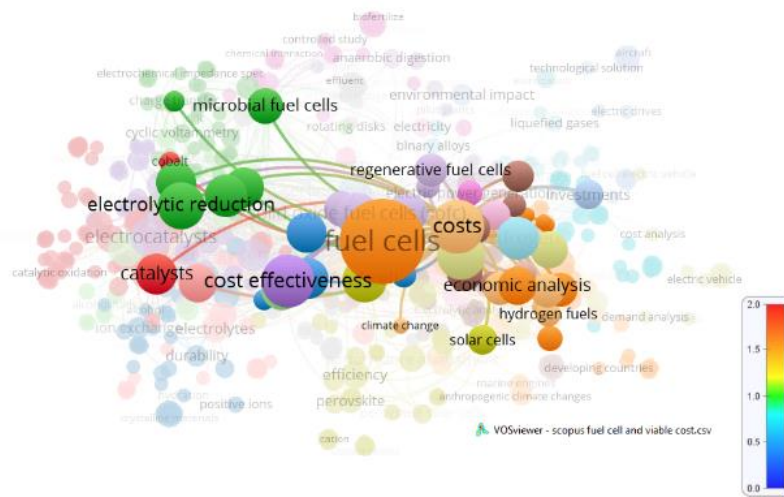
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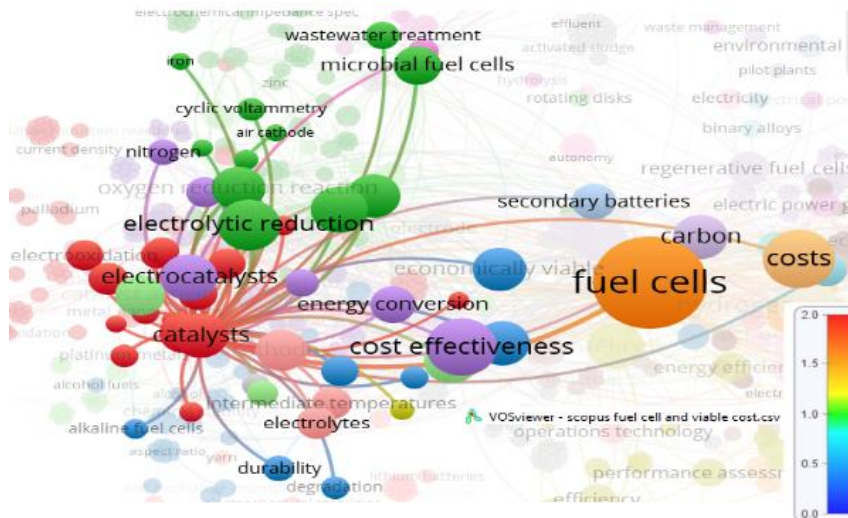
(c)
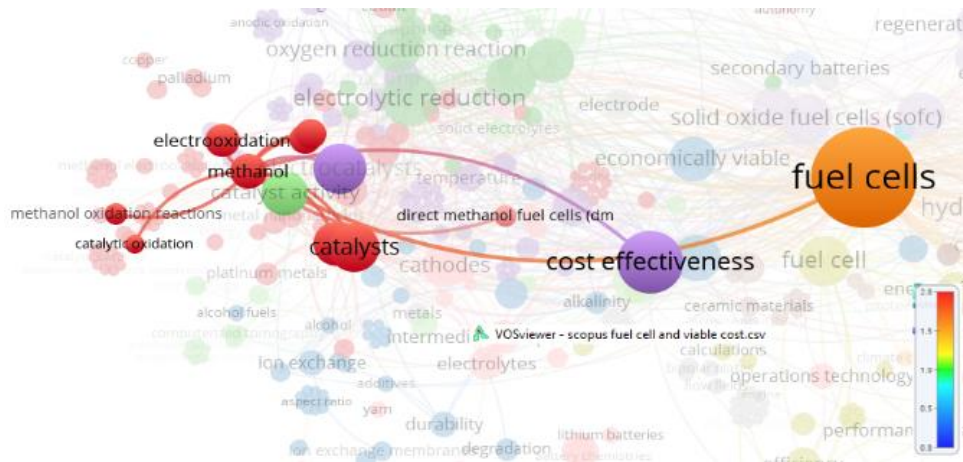
(d)

Figure 4- Map terms display related to activity intensity: (a) fuel cells, (b) cost and, (c) catalysis and (d) methanol through the VOSviewer tool to logical operators ("*fuel cell*" and "*viable cost*").

The groupings of terms linked to the conversion principle that were represented by the color red, i.e. the ones that showed high research interest by the scientific community was analyzed. Thus, the groupings networks of terms, Figure (c) and (d) were selected, where was verified that the terms groupings spheres present similar dimensions and equivalent distance to the used terms. Therefore the visualized groupings as (electrocatalysts, electrolytic reduction, microbial fuel cells, methanol and eletctro oxidacion) have a weak relation regarding to the cost.

On the other hand, in the analysis of the grouping network related to the term "hydrogen" (Figure 5), it is possible to observe a predominant composition of terms for publications established from 2018, a close position to the search structure, meaning a strong relationship between the terms. It was noticed that the representation by the blue color, provides an assumption that this term has low scientific research activity. Also it seems that the 'carbon' grouping is always in a high reference position considering the applied terms.

(a)

(b)
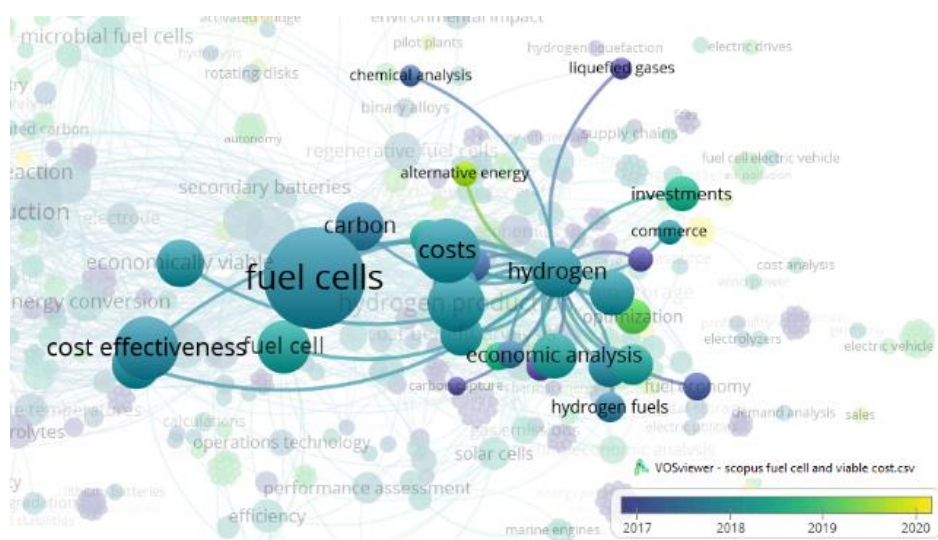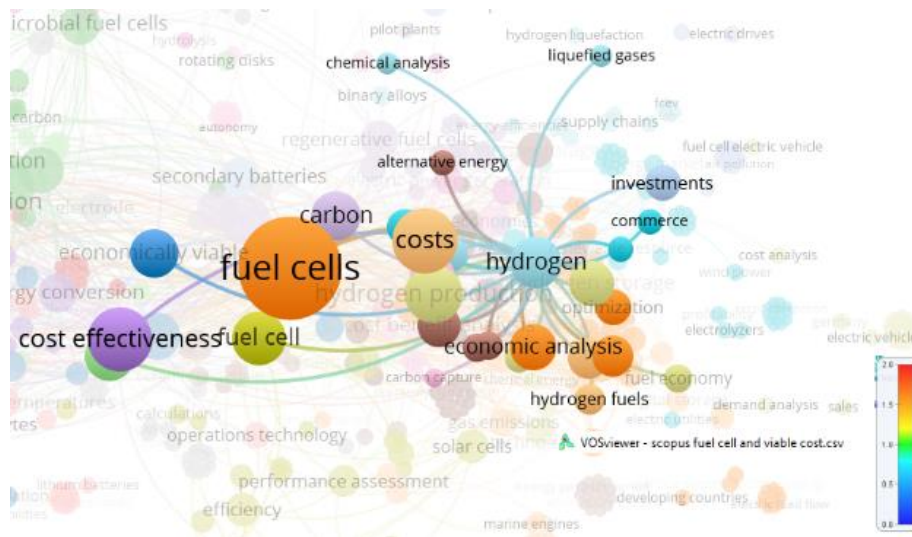
Figura 5- Map terms display through time of (a) the activity intensity and (b) for the network generated for the term hydrogen through the VOSviewer tool to logical operators ("*fuel cell*" and "*viable cost*").

In order to synthesize the choice plan, the terms for the composition of the logical structure were established, as presented in Figure 6 - Synthesis of the terms groupings. The term ("*hydrogen*") was chosen for the keywords composition of the Boolean structure, to integrate close spatial relationship with the searched terms and searched intensity, showing what seems to be a low explored search field.
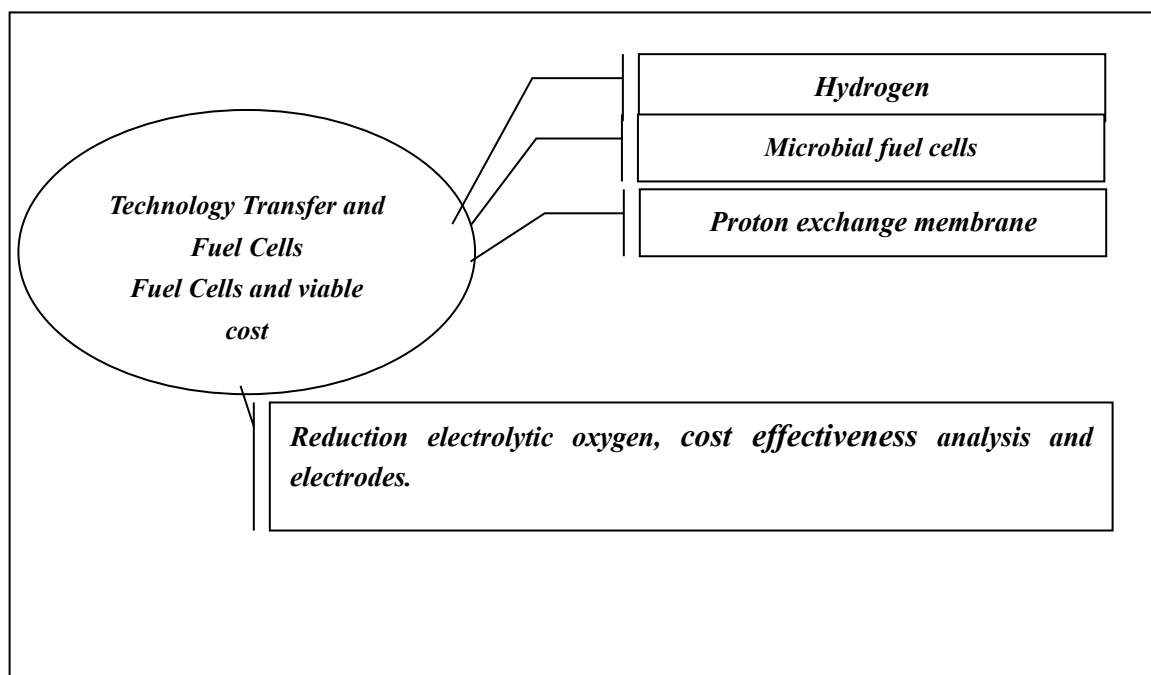
Figure 6- Synthesis of the terms groupings.

The formed groupings by *("cost effectiveness", " Microbial fuel cells", " electrodes ", "proton exchange membrane fuel cells", "electrolytic reduction oxygen")* were presented as relevant operator terms, either because they had been researched intensively or because they hold a promising relationship for further research. Finally, the visualization and analysis of the overlapping of groupings of terms proved to be

important in view, indicators related to the improvement of devices associated with the functioning mechanism in order to seek more economical means that can be applied to fuel cells, that is, to an efficiency ratio between the costs incurred and the benefits arising, adapting as support for the choice of articles.

4. Final Considerations

The analysis of the overlapping of grouping terms using VOSviewer tool, allowed anetwork visualization, and therefore the choice of indicators related to technological innovation processes applied to the fuel cell technologies transfer which present promising scientific evidence to the market.

The need for investigation and interpretation through a structured procedure seems appropriate, once there has been no search of literature on the subject, and also because the categorization of the research using the applied methodology proved to be relevant, as it offered direction and structure for the most recurrent terms found in the specialized and peer-reviewed literature described when used the Scopus database in the last 5 years.

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Minimizing Students' Spelling Mistakes Through the Use of Facebook: A Case Study of Second Baccalaureate EFL Learners at Abdurrahman Ennacer High School

Samir BASSAOUI

Dept. of English Language & Literature

School of Arts and Humanities

Ibn Tofail University

Kenitra, Morocco.

Abstract

The present research studies the effects of using Facebook as a medium to minimize students' spelling mistakes of high school EFL (English as a Foreign Language) students. The study used four types of data collection which are: students' questionnaire, classroom observation, Spelling Mistakes Group on Facebook, and Diagnostic test which was administered to students in order to check their spelling mistakes. The finding of the questionnaire found that students had positive attitude toward using Facebook as a means of developing their writing skills in general. As an educational tool assisting, Facebook will provide students with an attractive medium to help them engage in discussions with their teachers and classmates to share their knowledge.

Keywords: English as a foreign language (EFL), Writing skills, Spelling mistakes, Facebook, Baccalaureate students.

1. Introduction:

Various English Foreign Language (henceforth EFL) official guidelines (1994, 2005, and 2006) devoted a lot of space to learner training urging teachers to help learners develop the necessary skills to become more successful and independent learners. These guidelines include all four skills, receptive skills (listening, reading) and productive skills (speaking, and writing). This later, writing, is considered as one of the most complex and challenging skills that learners of English as a second or foreign language encounter when it comes to productive skills.

Moroccan learners of English language are expected to face various difficulties while learning English. One of these difficulties that stands as a nightmare for the majority of them is writing, especially during exams. Donn Byrne (1986) states "why writing is commonly a difficult activity for most people, both in the mother tongue and in a foreign language" (pp. 3-4). Writing is an important indicator that shows the progress of students while learning English because it requires knowledge of vocabulary, grammar, punctuation, and orthography. On the other hand, any writing product with spelling errors shows less progress of the learner. This spelling problem stands as an obstacle for students in their carrier. Hence,

mastering the skill of writing is very crucial for English as foreign language learners to be able to communicate effectively when writing English.

Indeed, most of EFL high school students have serious spelling problems. Some of them do not care about their handwriting while writing, and others do not even know that they have really serious problem in their writing. For this reason, I have chosen to investigate and report what I have learnt about this problem through conducting a fieldwork in Abdurrahman Ennacer High School in Kenitra in order to know the real problems of Moroccan's EFL high school students. For this reason, I have chosen a technological strategy that may help students to minimize their spelling mistakes which is through the use of social media (Facebook). Through this medium, student will practice and develop their writing skills outside the classroom.

1.1. Statement of the Problem

According to my experience as a student at Ibn Tofail University, and to the result of survey that I have conducted at Abdurrahman Ennacer High School for second year baccalaureate students which focused on writing problems that students face in their writing. I have worked with 76 students from two second year baccalaureate (science economy) classes in order to investigate how can spelling be a big problem among learners of English in Moroccan public schools. This study has revealed different types of spelling errors of the words according to their parts of speech. Because of the various benefits that accrue out of writing practices, and the attempt to strength students' writing skills, I have opted for social media (e.g. Facebook) as an independent variable of the present study to enhance students' writing skills by minimizing their spelling errors which is considered as a dependent variable.

1.2. The Study Objectives

The aim of this study is to develop students' writing skills related to English department program of second baccalaureate classes through the use of online homework via Facebook, as well as to develop new strategy of teaching writing skills in the sense of giving feedback. Next, to encourage students to use English language while chatting because it is one of best element that helps students to minimize the spelling errors and to develop their writing skills.

To achieve the research objectives, the study uses diagnostic test to tackle different spelling mistakes of words that are made by students according to their parts of speech, and uses also a questionnaire to measure the same students' perceptions of the use of social media (e.g. Facebook) as a medium to promote their writing skills in minimizing their spelling errors.

1.3. The Rationale

In 2007, the educational and guidelines programs adopted standards-based approach that sets relatively high expectations with regard to teaching skills of listening, reading, speaking, and writing. This later is considered as a key factor in the field of language learning, for it is a documented proof that tells us about the learner's mastery of the basic grammar and lexical items, and his ability to combine them in order to produce a coherent and cohesive text. In addition to that, in the emergency plan of 2009, Moroccan

educational system has heavily invested in technology to support teaching, first to encourage teachers to use technologies, and second to enhance students learning experience.

From what have been said above, and because EFL Moroccan students do less writing at high school level, I assume that the use of social media (e.g. Facebook) between teachers and students is an important medium of learning, first to promote and refine students' writing skills in high school, and second to give teachers a new strategy of helping students and to develop their professions.

In this research, I will explore whether students are ready to be engaged in social media with their classmates and teacher or not.   If they are ready, how can their engagement on social media promote their writing skills? In particular, I will focus on how social media (e.g. Facebook) is a medium that may help students to minimize their spelling errors. Then, I will shed light on some difficulties that hinder the teaching-learning process using Facebook. Finally, I'll provide some suggestions and solutions trying to overcome the mentioned challenges, and which can be applied in the Moroccan context.

1.4. Research Questions

In order to make the objectives of the study, the research questions are stated as follows,

1- How can Facebook enhance Moroccan high school EFL learners in minimizing their spelling mistakes?
2- What are the students' attitudes of the engagement of their teacher on Facebook?
3- To what extent does Facebook contribute to the enhancement of Moroccans' students' writing skills?

1.5. Research Hypothesis

This study attempts to test the validity of the following hypothesis:

- **The null form:**

There is no relationship between the independent variable (Facebook) and the dependent variable (minimizing spelling mistakes of Moroccan EFL).

The aim of this research is to refute or reject the null hypothesis

- **The alternative form:**

There is a relationship between the independent variable (Facebook) and the dependent variable (minimizing spelling mistakes of Moroccan EFL).

The goal of this research is to support or accept the hypothesis.

2. Literature Review

2.1. Spelling Mistakes and Spelling Errors

2.1.1. Concept of Spelling

Kress (2000) defines the word spelling as *"knowing how to write words correctly"* (p. 1). Spelling is concerned with the rules for writing words of the language correctly. In English language, words are spelt according to the English orthography using the Roman writing system. English language is completely different from other languages, it involves a number of orthographic traditions from many languages, which offers a variety of representations for the same sounds where the spelling of a word is not entirely predictable from its sound. Oliviao's allivan and Anne Thomas, (2007) drew attention to the idea that spelling is mainly about "encoding or generating written language" (p. 14). They argue that spelling focuses mostly on the way in which sounds are produced. They also add that "spelling is an encoding process in which the learner is required to construct words from their own resources" (p. 14).

2.1.2. Concept of Error

Llach (2011) claims that "error refers to the wrong utterances that differ from those of a native speaker of the L2" (p. 73). Most studies did not provide a precise definition of (spelling errors), they are just concerned with description, and categorization of the term. However, Simon Botley and Doreen Dillah (2007) defines the term spelling errors as: "violation of certain conventions for representing phonemes by means of graphemes", and is "an encoding error while writing" (pp. 74-93).

Llach (2011) says that Spelling errors are also called Misspellings or orthographic errors. These are considered as a misuse of the English orthography that is affected by the trouble encountered by students in the English encoding system. Such examples include, *"biutiful"* for *"beautiful"*, *"smool"* for *small*, and…. Etc" (p. 123). Misspelling is also deemed as one of the most frequent categories of lexical errors. It is claimed that this category is very often noticed in the early stages of language acquisition.

Wang (as cited in Khalid M. Al-zuoud and Mohammad K. Kabilan, 2013) found five types of spelling errors: substitution e.g. *rabbit-ribbit*, omission: e.g. *bigger-biger*, transposition: e.g. *minute-miunte*, addition: e.g. *October-octorber*, and combination of the above. Wing, Baddeley and Cook (as cited in Naruemon, 2010) "the errors observed were classified into eight major categories:

1. **Insertion (addition):** one letter inserted/added, as in <betaween> for <between>

2. **Omission:** one letter omitted, as in <telephon> for <telephone>

3. **Substitution:** one letter substituted, as in <herry> for <hurry>

4. **Transposition (inversion):** two adjacent letters transposed, as in <gola> for <goal>

5. **Grapheme substitution:** "involving more than two letters but only a single cause, for example when an equivalent according to sound correspondence rules is substituted for the usual form, as in 'thort' for 'thought'" (Cook, 2004, p. 124)

6. **Word space:** an extra word space or a lack of word space, as in <class room> for <classroom> and <anythingelse> for <anything else>

7. **Capital**, as in 'english' for 'English'

8. **Other** (p. 29).

If there is more than one error in the same word such as in <sprot man> <for sportsman>, all errors are counted. The first error is transposition of <ro> for <or>, the second is omission of <s> and the last is word space.

Beyond the previous spelling errors, Carney (1997) suggested three types of errors: "Competence Error vs Performance Error, Variant Error, and Slip" (p. 57). Competence error is consistent while Performance error is temporary. Variant error is an error of choice among competing spelling of the phoneme. For example: <*father*> for <*fother*> and <*wemen*> for <*women*>. The correspondence is wrong, but the phoneme can be spelt like that elsewhere. Slips result from carelessness and inattention. For instance, the writer may double the wrong letter such as in <*developping*> for <*developing*> and <*abssent*> in <*absent*>. Carney (1997) claims that "doubling for the wrong letter is a very common slip, particularly where there are treacherous analogies such as innocent, committed" (p. 57).

In addition to what have been said before, Carney (1997) has cited other types of errors that refer to the confusion between elements of word structure. These types are "analogy errors, jumbling, splits and mergers are other types of errors" (p. 58).

Analogy errors involve confusion between elements of word structure often appear to be analogy errors. For instance, <*analize*> for <*analyze*> may be a false analogy with <*realize*>. Uncertainty about word structure can result in JUMBLING, for example: <*inpossible*> for <*impossible*>. This may be just a letter metathesis, but it might possibly represent a pronunciation.

> Carney (1997) explained that "Mistakenly putting a space boundary in what should be written as a single word can be called a SPLIT such as <*to gether*>, <*out side*>, <*be fore*>, <*in tact*>. Occasionally the opposite mistake is made as MERGER: The writing system has sometimes been inconsistent. Until quite recently the one-word spelling <alright> rather than all right" (p. 58).

2.1.3. Causes of Spelling Errors:

There are various factors that are behind the problem of spelling that many learners of English have. These factors are development factors, irregularity of the English spelling system, mother tongue interference and linguistics differences between Arabic and English.

- **Development factors:** Bahloul (as cited in Jayousi, 2011) "exhibited that many of the spelling mistakes made by the learners who took part in the study were very similar to those made by native speakers as part of their developmental stages" (p. 7). Those errors can be in baby talk, such as reversing the order of two adjacent phonemes in some words, as in spelling *bird* as *brid.*
- **Irregularity of the English spelling system:**
  > Hildreth (as cited in Jayousi, 2011) discusses four features of English writing system that give its notorious reputation of being irregular. The first one is that different sounds are given to the same letter or combination of letters, as in *break* versus *cream* and *gem* versus *get*. The second cause is that a single sound can be expressed by different letters or combinations of letters as in *maid*, *made*, *say*, and *weigh*. A third cause is that many English words contain silent letters as in

debt, *enough*, *light*, *tongue*, and *foreign*. He also adds that the alternate spellings that many English words have, such *theatre-theater* and *color-colour*, also cause some confusion to language learners. All these irregularities cause learners of English to find English spelling a big burden.

- **Mother tongue interference:** Corder (as cited in Jayousi, 2011) argues that "those speakers whose mother tongue has more similarities to the target language are likely to find it easier to acquire than other speakers whose mother tongue is more "distant linguistically" (pp. 8-9).
- **Linguistics differences between Arabic and English:** Swan and Smith (as cited in Jayousi, 2011) state that "Arabic is a cursive system; it includes only words written in combined forms of letters. To illustrate, the Arabic equivalent word of the English word *study* is يدرس which is formed of the separate Arabic letters (ي\د\ر\س)" (p. 10).

2.2. Social Network

2.2.1. The Emergence of Social Networks:

Social Network Service emerged before the ending of the second millennium, as a main component of the second generation of the WEB 2.0 that has targeted more communication and exchange information. When talking about social networks on the Internet, we cannot overlook the two largest social networking sites that are more known and expanding which are Facebook and Twitter. These last two are considered as one of the most important media, which escalated their star in cyberspace, despite its modernity, the demand for them has doubled, and become playing an influential role politically, economy, and socially.

Maarten de Laat (2007) claims that "Social Network Analysis (SNA) may help in identifying patterns of relationship between people who are part of a social network. It may assist us in the analysis of these patterns by illuminating the 'flow' of information and/or other resources that are exchanged among participants" (p. 3).

Concerning Facebook and twitter users, Number of monthly active (2015) shows that "Facebook had 1.55 billion monthly active users in the third quarter of 2015. In the third quarter of 2012, the number of active Facebook users had surpassed 1 billion. On the other hand, the monthly, whereas, at the beginning of 2014, twitter had surpassed 255 MAU per quarter" (para. 1).

2.2.2. Facebook

Facebook was created by, named Zuckerberg, a student at Harvard University, who aimed to create this website to find a way to communicate between university students and existing graduates. He entered all the names of the students to the site, and then invite them to join and take advantage of the features provided through the site and to identify the current and former colleagues. The idea was soon spread among college students, after the expansion of its activity, and then it really competed with the other social networks that was already existed in that period in the United States. The Global social network (2015) shows that "In 2012, more than 1.4 billion internet users accessed social networks and these figures are still expected to grow as mobile device usage and mobile social networks increasingly gain traction" (para. 2).

The Facebook platform is designed by users to share and communicate with each other, so it is private and personal. In order to use the website, people have to register and create their own profile, and then they will be able to add other users as friends, exchange messages, join groups or pages according to their particular interest. The popularity of Facebook has increased more and more rather than any other social media, or special site on the Internet.

2.2.3. Pages on Facebook

Facebook enables public figures, businesses, organizations and other entities to create their own pages. Unlike personal profiles, Facebook pages are visible to everyone on the Internet. Everyone in Facebook can connect with these pages to become one of its fans, and then they will receive their updates from Facebook news feed.

2.2.4. Groups on Facebook

Facebook groups are used by a small group to communicate and share their common concerns among themselves. Groups allow people to discuss the issues, common activities, organizations, or the dissemination of images, as well as the exchange of relevant content. Villiers (2010) points that "A group, like an individual member, has a wall but, most importantly, groups are forums for discussions" (p. 1). When a group is created, the user can decide whether to make it available to all, or the approval of the administrator should be required to join other members or keep them private only by invitation. As is the case with the pages, new messages are included in the News Feeds and members can interact and share.

The advancement in the sector of information and communication technology in the last two decades, especially with the spread of the internet have really made people to think about the virtual world which has a great impact on the humanity, policy and socially. One of the productions of this virtual world is the existence or the presence of the Social Networking, which are sites that support educational programs in order to consolidate human relations, building knowledge on the Web. Hichang Cho, Geri Gay, Barry Davidson, and Anthony Ingraffea (2005) "claim that learners' performance is an actual outcome of emergent collaborative learning social networks" (pp. 309-329).

Considering social network as a faster e-learning sectors of growth in recent educational, the educational policy over the world, in general, and the Moroccan educational plans in a particular, have sought to find the best ways which enable students to learn. So that students could build new relationships with others and share the intellectual and cognitive offspring. All these would be published through multimedia text, sound, image and video which are the most important technologies of the Internet.

2.2.5. The Role of Social Networks in the Educational Field:

The electronic social networks play an important element in providing students with diverse information that serve most of the areas and disciplines, and social network has provided a number of positive points in the field of education. Collin, P., Rahilly, K., Richardson, I. & Third, A. (2011) noted that studies conducted in the workplace on the role of ICT in learning and development find:

"- As a setting for sharing content & creating/maintaining relationships, Web 2.0 functionality facilitates peer-based & self-directed learning;

- Young people in particular value social & interactive opportunities for learning;

- Handheld technology is a particularly useful tool for workplace learning due to regular accessibility

- Access to virtual or online communities is more important than the physical education environment

- Online forums and SNS can support the continuation and extension of learning and discussion outside formal classroom setting.

- Peer based learning is a key characteristic of the way in which young people direct their own learning outside school & formal organizations. This is characterized by a context of reciprocity, where participants feel they can both produce and evaluate knowledge & culture.

- Young people expect interactivity "the Net Generation has been described as experiential, engaged, and constantly connected, with a strong need for immediacy" (pp. 13-14).

Sivert, Egbert, and Taylor (as cited in Galavis, 1998) show that "computers, multimedia systems, and even multimedia labs for the teaching and learning of English are already being used throughout the world" (p. 1). In fact, according to a survey of online learning conducted by Babson Survey Research Group, "over 6.7 million students, or nearly one-third of all higher education students, enrolled in at least one online class in the fall of 2011" (Dalby 2013).

The reason behind the growing number of students' users of the computer and the Internet in the learning process is to positive effects that offers in learning, especially in learning foreign languages. In a study conducted by Edwards and Fritz (as cited in Bailey 2002) "on university students to know their views in Three methods of teaching depends on the technology, the students reported that e-learning is fun and Interesting, as well as, it achieved the intended results. So that students were able to learn and apply the concepts better. In addition, students reported that their learning outcomes of e-learning materials were better than the traditional educational materials" (pp. 16-17).

Teeter (1997) "Students who completed American Education via the Internet did equally well to students in traditional classrooms on four standard course examinations. Electronic alternative to traditional classrooms, however, are not for all students and not for all teachers. For those comfortable with the medium, electronic learning provides greater flexibility in completing course requirements" (p. 5).

3. Research Methodology

This chapter will describe the framework of the research in order to answer the research questions we have asked in the chapter 1. The aim of this research is to find if the social media (e.g. Facebook) can promote students' writing in reducing their spelling mistakes.

3.1. Setting of the Research

This research is about promoting students' writing skills by minimizing their spelling mistakes through the use of Facebook. This research was conducted in Abdurrahman Ennacer High School. Abdurrahman Ennacer is one of famous senior high schools which is located in the heart of Kenitra. It was created on 1969 as a middle school first. The first promotion of bachelor was on 1981. Abdurrahman Ennacer is a comfortable high school. It is equipped with complete learning facilities. In general, it has 60 classrooms included natural science laboratory and physics laboratory, multimedia room, library, a large office for teachers, a mosque, a large parking, office administration, and some other facilities. The staff consists of 24 members, and 95 teachers. The total number of students is 2056, half of them are girls.

3.2. Participants

The participants of this study were from two classes of second year baccalaureate of economy in Abdurrahman Ennacer High School. The total number of two classes is 90, where 43 students were girls and 47 were boys. A sample was only 76 out of 90 students who participated in the research because 14 students were absent at the day of collecting data.

Unfortunately, I could not have a large sample because the host teacher has only two baccalaureate classes of the same level, so the limited sample is not representative. However, it would be easier to work with two classes that are taught English by one teacher.

3.3. Research Instruments

Concerning the instruments used in this research are the following: diagnostic test, questionnaire, and classroom observation.

1- Diagnostic Test

Diagnostic test is used to discover the week spellers among students. The test consisted of dictation of a short paragraph that contains 83 words which are more frequently used in writing (see appendix A). Dictation plays a significant role toward the ability of students where they can recognize words according to their context. Garcia (1996) claims that "In the cases of dictations, the fact that students put so much emphasis on unfamiliar words indicates that they are still too concerned about guessing word rather than understanding the text as a whole" (p. 78). Davis and Rinvolucri (as cited in Melawanti, 2007) found out that "dictation can be very useful as a test by which to ascertain pupil's progress in spelling, punctuation and pronunciation" (p. 12).

The text was read three times. First, students listened to the text at normal speed. Next, the researcher read the text in lower speed to students the chance to hear all the words. Last, the whole text was read at normal

speed for them to check their versions. After 15 min of dictation, the students' papers were collected and corrected out of class using red colour to cross all spelling mistakes.

2- Questionnaire

The questionnaire was distributed to the same number of students who assisted the diagnostic test. The questionnaire composed of 10 close-ended questions (see appendix B). The questions 1 and 2 concern students' information, they were required to tick only one option. The questions 3, 4, 5, and 6 are about social media and its uses by students, all of them were required from the respondents to tick one or more options, except the question 4 that was required from the informants to tick only one answer. The remaining questions, 7, 8, 9, and 10 were required information about social media and its use in learning in general, the respondents had to tick only one answer.

The questionnaire was translated into Arabic language in order to make them easier to the respondents, and then it was distributed to 76 students after explaining the content in Arabic and English (when necessary). The rationale behind having a questionnaire to students is to have a clear idea of why some of experimental group did not accept the invitation to Bac Spelling Mistakes Group on Facebook who were supposed to set in a post-test that was predetermined.

3- Classroom Observation

Classroom observation is a live instrument that enables the researcher to use one's mind and eyes at the same time to collect data related to one's research. Cohen, L., Manion, L., & Morrison (2005) state that "observational data are attractive as they afford the researcher the opportunity to gather 'live' data from 'live' situation" (p. 305). During the whole period of training with the first and second year baccalaureate classes at Abdurrahman Ennacer High School, the researcher used the checklist to jot down all his observation related to students' writing skills (see appendix C). Angela Estacion, Teresa McMahon, Janet Quint, Bernice Melamud, and La Fleur Stephens (2004) claim that "checklist records whether the teacher is interacting with one or two students, a small group, a large group, or the whole. It also notes the presence of certain 'learning opportunities'" (p. 12).

4- Group on Facebook

Facebook is used as an instrument for collecting data. Specifically, a group named **Bac Spelling Mistakes** was created to select students who were supposed to join the group in order to have some discussions with the researcher and their peers. They were allowed to post questions and leave messages, or chat with researcher and other users on Facebook during the whole period of stage.

4. Data Presentation, Analysis and Discussion

4.1. Procedure

After collecting the data, the researcher counted and classified all the words of the paragraph tested according to their part of speech (see table 1). Then, all the papers were corrected with emphasis on students' spelling mistakes only (see table 2). As far as Diagnostic test is concerned, the researcher has scored the participants' papers, and scored them according to the number of spelling mistakes (see table 3). Concerning the questionnaire, the researcher entered all the data in the computer by using Microsoft Excel to calculate the percentages of the concerned variables. As for classroom observation, the checklist was used as in instrument during the period of training, it was analysed according to four sections which are the following: class organization, methods and materials, teacher-students' interaction, and content. Lastly, the Facebook group was open for the selected students who were supposed to join the group. They were allowed to leave message, post pieces of writing, and chat on Facebook to discuss their writing difficulties.

Parts of speech	Parts of speech	Number
Nouns	Summer, Holiday, Spain, Weather, Time, Meals, Class, Restaurant, Waiters, Day (2), Bus, Trip, Mountains, Nature, Photos, Picnic, Air	18
Verbs	Have (2), Be (6), Swim, Go, Take, Enjoy	12
Adjectives	Last, Fantastic, Sunny, Pleasant, Able, Delicious, First, Friendly, High, Interesting, Marvelous, Lovely, Wonderful, Open	14
Adverbs	Very (3)	3
Pronouns	We, It, Us, Where	8
Prepositions	In (3), To (3), Up (2), On	9
Conjunctions	And (3)	3
Determiners	A (3), The (6), All (2), One, An, Some ((2), Every	16
	Total	83

Table 1: List of words according to their parts of speech

Parts of speech	Number
Nouns	387
Verbs	189
Adjectives	380
Adverbs	36
Pronouns	72
Prepositions	24
Conjunctions	3
Determiners	104
Total	1195

Table 2: Number of spelling mistakes of the words according to their parts of speech

Scoring	Number of mistakes	Number of students	Percentage
Excellent	1	2	3%
Very Good	(2-3)	3	4%
Good	(4 -5)	4	5%
Satisfactory	(6-7-8)	5	7%
Poor	more than 8	62	82%
TOTAL		76	100%

Table 3: Students' scoring according to the number of spelling mistakes

4.2. Presenting and Analyzing the Findings

As it has been stated in the research questions of the study, this paper studies the effectiveness of social media in general and Facebook in particular in minimizing students' spelling mistakes in order to promote their writing skills. The third research question encompasses one major point: the role of social media (e.g. Facebook) in students' writing skills. Concerning the analysis of the data of the present work, the researcher presents the data in the form of percentages, and diagrams are used to illustrate the results of the study.

The findings of the study are going to be presented and discussed in relation to the research hypothesis and questions in a descriptive way. The researcher will also take into consideration the findings of the previous research (the review literature).

4.2.1. The Result of the Test

Most of students have spelling difficulties while writing, especially in writing nouns, verbs, and adjectives. 387 nouns were misspelt among 74 students. While 64 students encountered difficulty in writing verbs such as the past form of verbs (to take and to be). On the other hand, the majority of the students still struggling with adjectives, 380 adjectives were misspelt by all participants except one. For example, the word *"marvelous"* was misspelt by 70 students. Furthermore, several words were missed by a large number of students. Words such as *"mountain", "holiday", "interesting"* and *"wonderful"* are frequently used by students in their English studies, but 68 students haven't spelt them correctly.

4.2.2. The Result of the Questionnaire
1) Gender

Gender	Number of gender	Percentage of gender
Female	47	62%
Male	29	38%
Total	76	100%

Table 4: The distribution of gender of the sample studies
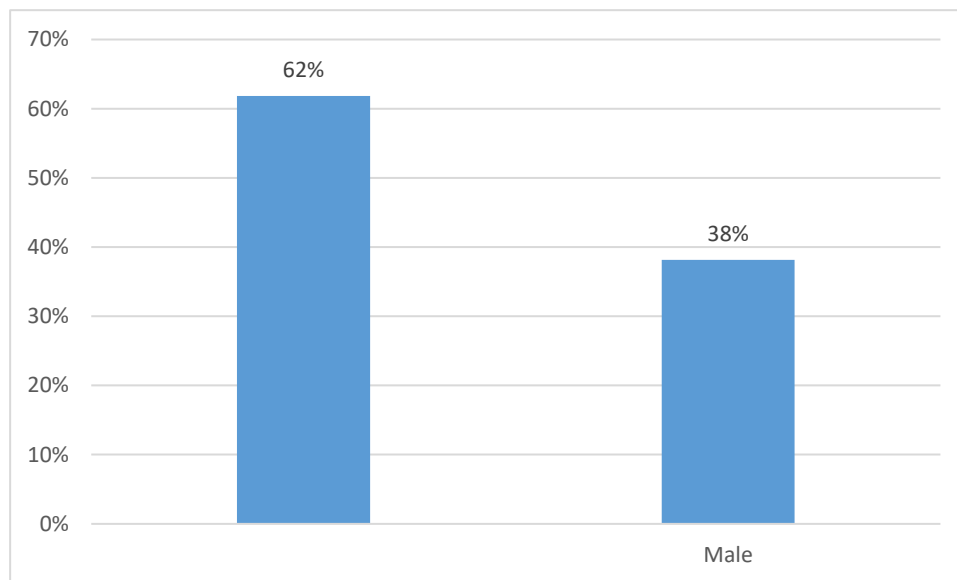
Graph 1: The distribution of gender of the sample studies

The majority of students' population are females (47 females = 62%), whereas male are only 29 students which equal 38% of the total participants. The following table (4) illustrates the distribution of gender of the sample studies.

2) Age

Age	Number of age	Percentage of age
(15 - 16)	7	9%
(17 -18)	62	82%
(19 -20)	7	9%
Total	76	100%

Table 5: Students' age
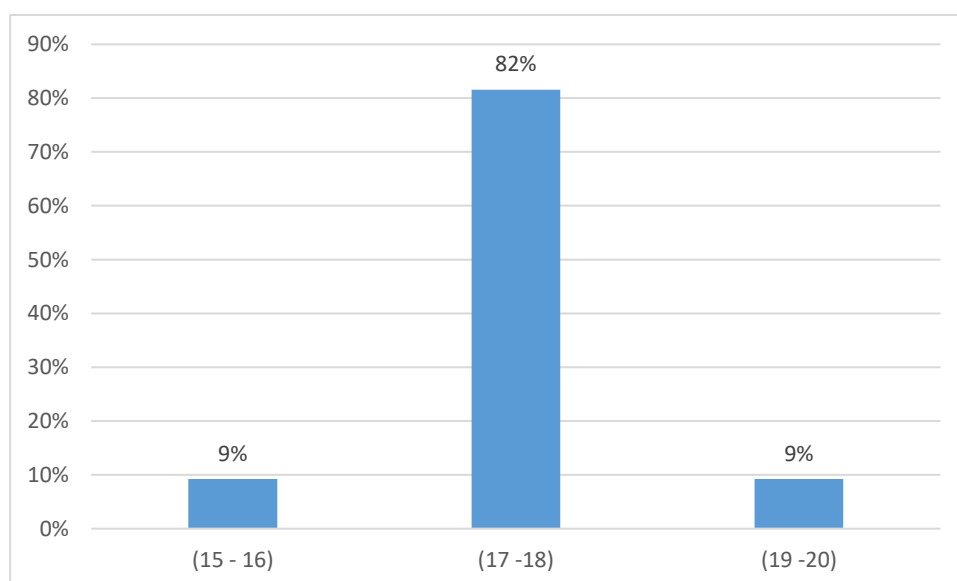
Graph 2: Students' age

Concerning the age of the participants, 62 students that equal 82% are between (17 -18) years old. The half of the remaining students' number are only 9% which are between (15 -16), and the second half of the participants are between (19 -20) (see the table 5).

3) What types of social media do you currently use?

75% of the participants prefer Facebook as a tool for social networking, while 11% are Google users. However, Twitter is only used by 3% of the total participants, and the 12% of students use other social network.

Best social network	Number of Responses	Percentage
Facebook	57	75%
Google	8	11%
Others	9	12%
Twitter	2	3%
TOTAL	**76**	100%

Table 6: The best social media for the participants
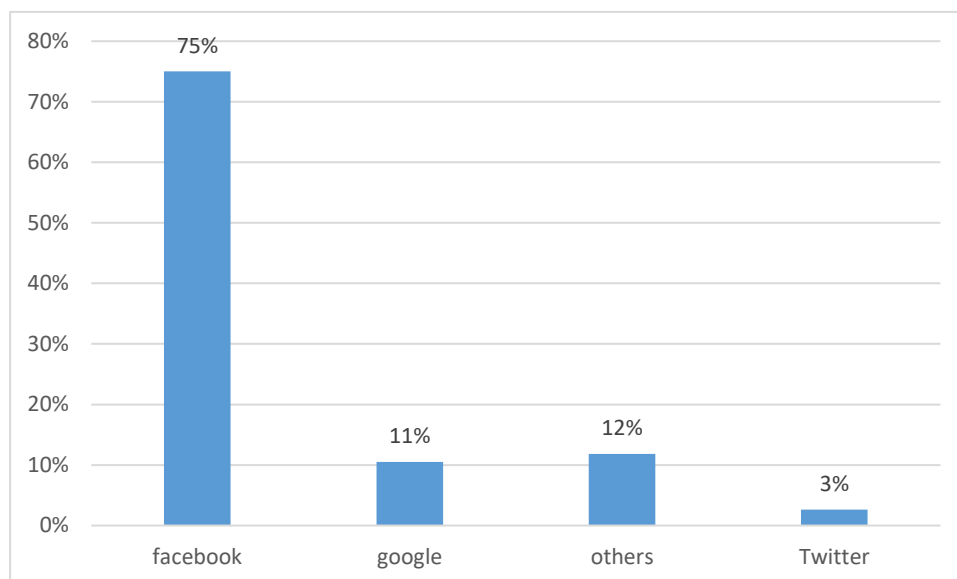
Graph 3:The best social media for the participants

4) How many hours do you spend using social media?

The table below shows the average hours of the users among the participants.

Average hours	Number of Responses	Percentage
Less than one hour	11	14%
between (1 -3) hours	28	37%
between (4 -5) hours	15	20%
more than 6 hours	22	29%
TOTAL	**76**	100%

Table 7: The average hours used by the participants
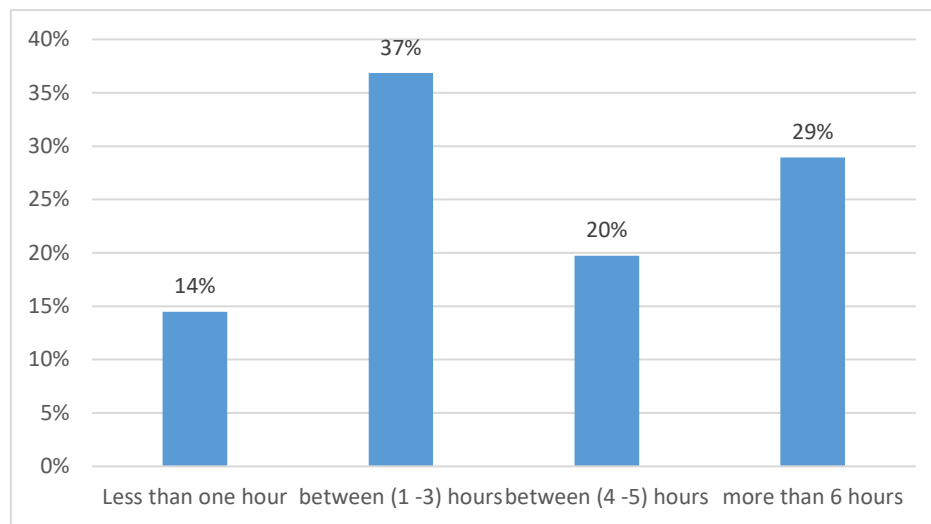
Graph 4: The average hours used by the participants

37% of the students' participants use social media between (1 -3) hours, and 29% among 74 students use social media for more than 6 hours per a day. Concerning the networking who use the social media between (4 -5) are 20% among students' participants, whereas 14% of the students are the less users of social media. This statistic shows that 76% of the participants use social media between (1 -3) hours per day, and 49% amonge76 students use social media between (4 -5) hours.

5) For what purpose(s) do you use social media?
   a- To have Access to information
   b- To play online games
   c- To communicate with family and/or friends
   d- To discuss / Share ideas with others

Raisons for using F.B	Number of Responses	Detailed percentage
a	2	3%
a - b	11	14%
a – b - c	3	4%
a – b - d	2	3%
a - c	11	14%
a – c - d	3	4%
b	13	17%
b - c	14	18%
b - d	1	1%
c	9	12%
c - d	5	7%
d	2	3%
Total	76	100%

Table 8: The purpose for using social media
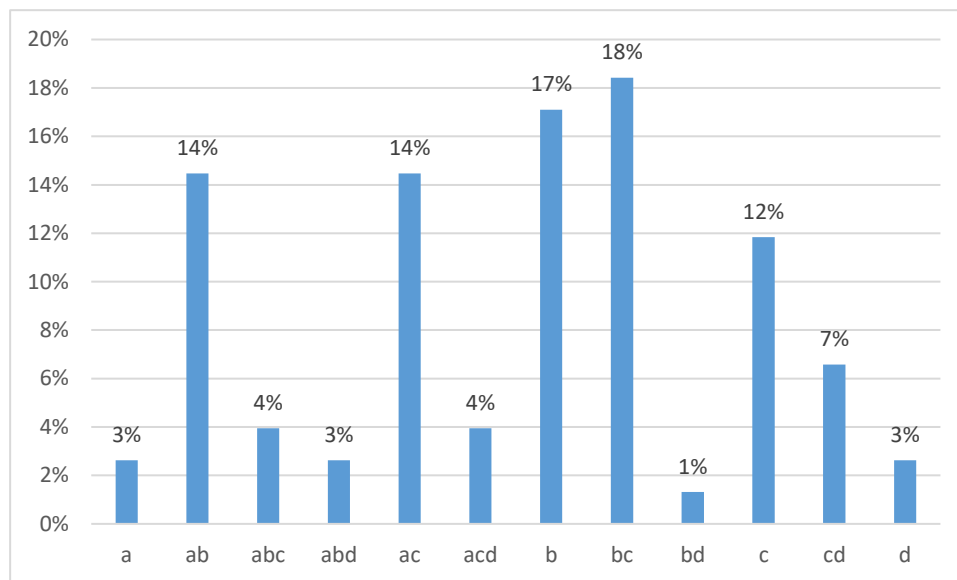
Graph 5: The purpose for using social media

17% of students claimed that they use social media only for playing online games, and 12% said that they use it only to communicate with family and others, while 18% said that they use it for both playing online games and to communicate with family and others. Few students who use social media for other purposes, such as 3% of students use it to have access to information, and others 3% use it to share ideas with others. 14% of students use social to have access to information and communicate with family and others, and the same proportion use it to have access to information and play games, and few students chose more than one option.

6) **What is the language you prefer in using social media? (more than one option is allowed)**
   a- Moroccan Arabic (M.A.)
   b- Modern Standard Arabic (M.S.A)
   c- French (F)
   d- English (E)

Language used	Number of Responses	Detailed percentage
M.S.A - F	2	3%
M.A	7	9%
M.A - M.S.A	4	5%
M.A - E	1	1%
M.A - F	28	37%
M.A - F - E	3	4%
M.A -F	4	5%
F	15	20%
F - E	12	16%
Total	76	100%

Table 9: Language preferred in using in social media
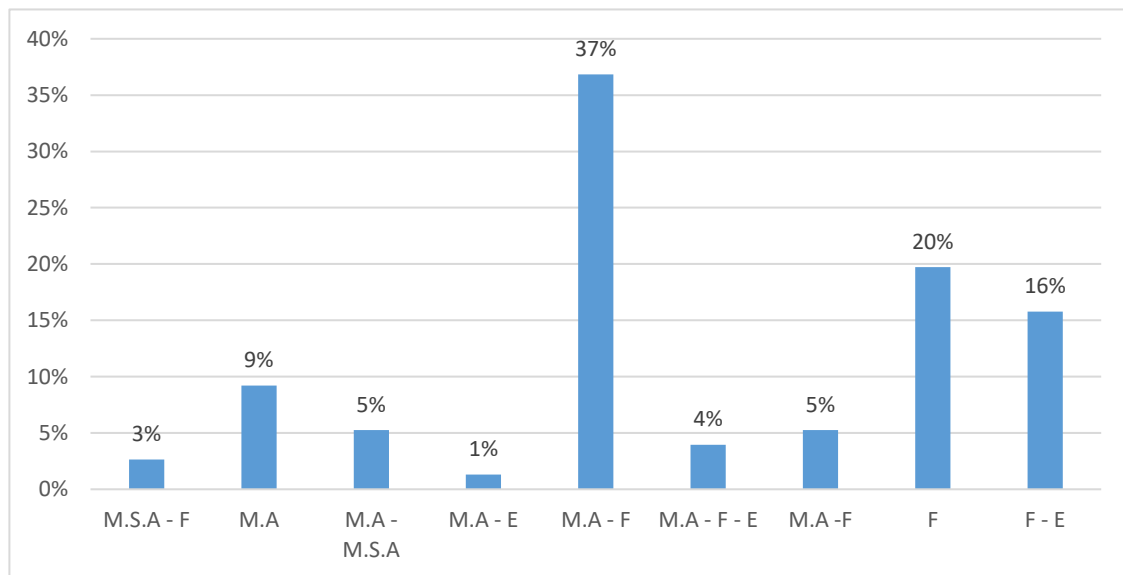
Graph 6: Language preferred in using in social media

37% of students prefer using French and Moroccan Arabic in social media, while 20% prefer only French. 16% of the participants use both English and French, and 9% of students use only Moroccan Arabic.

7) Do you think social media is useful in developing learner writing skills?
   a) Yes
   b) No

The use of social media in English learning	Number of Responses	Percentage
Yes	70	92%
No	6	8%
TOTAL	76	100%

Table 10: Students' attitude toward the use of social media in developing Writing skills
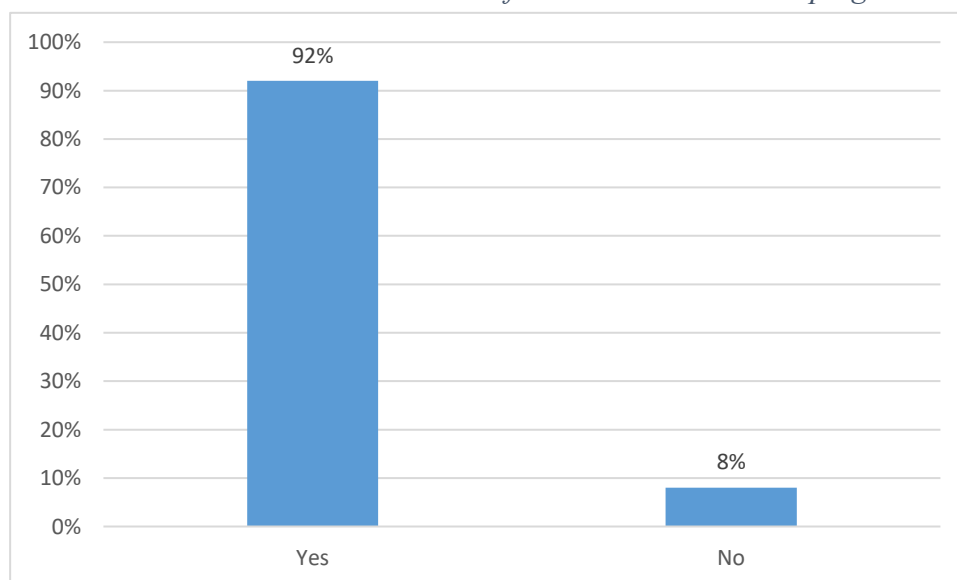
Graph 7: Students' attitude toward the use of social media in developing Writing skills

The vast majority 92% of the respondents said that social media is a very good medium for students to enhance their writing skills.

8) Have you ever thought to join any English group to develop your writing skills?

   a) Yes

   b) No

Thinking of joining English group	Number of Responses	Percentage
Yes	69	91%
No	7	9%
TOTAL	76	100%

Table 11: Students thought about joining English group
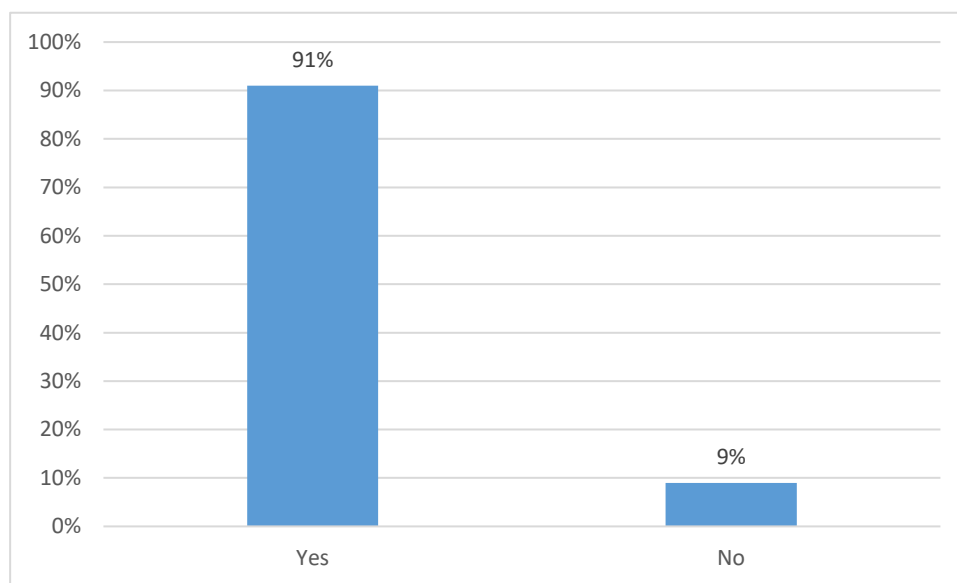
Graph 8: Students thought about joining English group

91% of the respondents said that they have already thought to join an English group to enhance their writing skills.

9) Do you like to be a member in an English group through social media?

Accepting the invitation of English group	Number of Responses	Percentage
Yes	72	95%
No	4	5%
TOTAL	76	100%

Table 12: Students' attitude toward English group's invitation
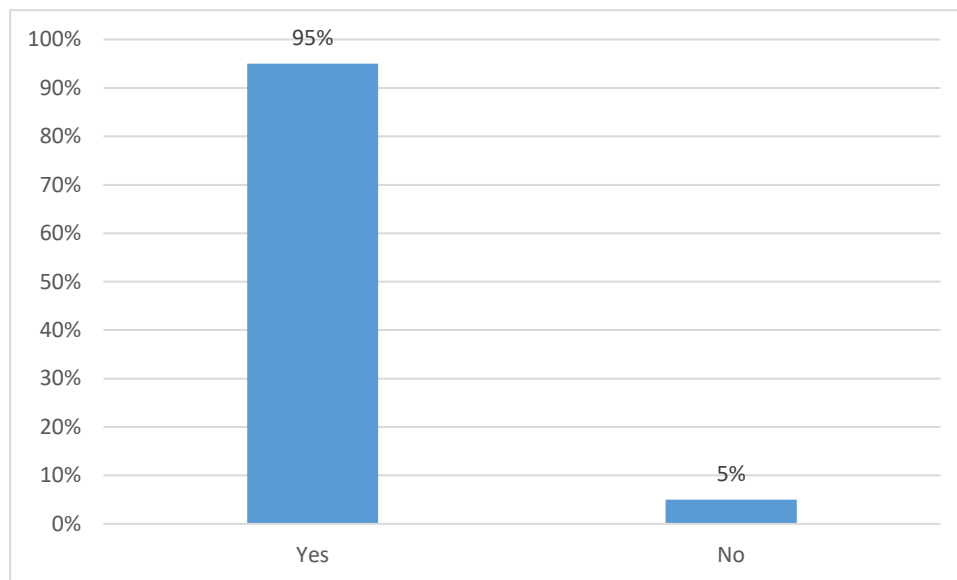
Graph 9: Students' attitude toward English group's invitation

The overwhelming majority 95% of students responded that they would accept the invitation for English group in one of the social media.

10) Do you like your English teacher to be part of this group?

Accepting teacher in English group	Number of Responses	Percentage
Yes	74	97%
No	2	3%
TOTAL	76	100%

Table 13: Students' attitude towards the participation English teacher in the group
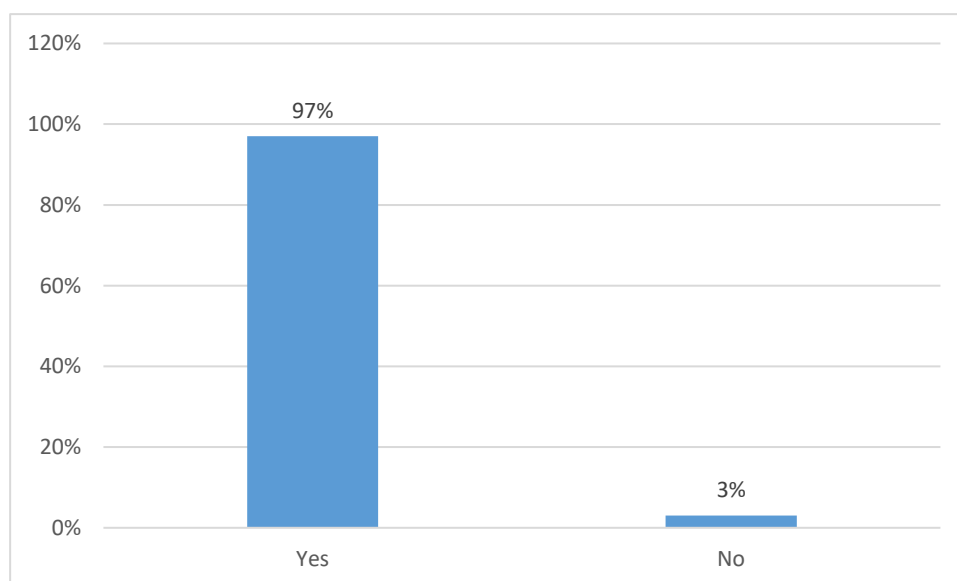
Graph 10: Students' attitude towards the participation English teacher in the group

Almost 93% of students responded that they accept teacher to be part of the English group.

4.2.3. Classroom Observation

During the period of training, the researcher discovered that most of students' performance was done orally rather than written; they did not have a chance to display their writing skills. The host teacher wrote everything by himself on the blackboard during the explanation of the lessons, and then students had to write down everything from the blackboard.

In spite of the fact that each unit contains a writing stage where students have an opportunity to perform and develop their writing skills, the host teacher had never even a chance to end the exercises orally due to time constraint. For example: the writing stage in the unit 1 urged teacher to help students to write an informal email. After clarifying the structure and introducing the methodology that should be followed in writing this email, the host teacher wrote an example on the blackboard by showing his students different examples that might be used in the introduction, the body and the conclusion. This phase of explanation and writing the example on the blackboard took about 40 min, which means that it remains only 5 min for students to write down the example given by their teacher. When the bell rang, the teacher asked his students to write an email to their friends on a sheet of paper and bring them in the coming session. After collecting the task given at home, the researcher finds that the majority of students still have serious problems in spelling mistakes, but only few students who really care about their writing.

4.2.4. The Result of the Group on Facebook

After sending the invitation to 22 students who were selected to be part of **Spelling Mistakes Group** on Facebook, only 13 students accepted the invitation. The researcher asked a question related to spelling mistakes that were made by students in the diagnostic test. 10 members have seen the question, but only one who replied to the question. The day after, another question related to the diagnostic test was asked by the researcher, but nobody replied even the question was seen by 8 members. However, in the next day, one member asked the researcher about the first question.

4.3. Discussing the Findings

The present study gives us, to some extent, and idea about Moroccan EFL learners' perception of social media and its relationship with writing skills. The result of this study is going to be discussed in a descriptive statistical procedure to describe the data.

Before starting the discussion of the results of the field work, it is worth to remind the reader of this paper of the research questions and hypothesis. The research questions are:

- How can Facebook enhance Moroccan high school EFL learners in reducing their spelling mistakes?
- What are the students' attitudes of the engagement of their teacher on Facebook?
- To what extent does Facebook contribute to the enhancement of Moroccans' students' writing skills?

The results of the questionnaire show that 75% of the students prefer using Facebook than other social media in social which are less used by the participants. 47% of them use social media for playing games and communicating with family and others and they use it for playing online games and to communicate with family and/or friends while 28% are able to have access to information and play online games or

communicate with family and others. Furthermore, 86% of students spend more than one hour per day on social media, and 34% from 86% of students spend more than six hours per day on networking. This result shows that social media in general and Facebook in particular respond the students' needs.

Concerning the language preferred in using social media among participants, 20% of students prefer only French language while 37% use both French and Moroccan Dialect, which means that an important rate, 57% of students use French language as a medium in social media. As far as English language is concerned, 16% of the participants use both English and French languages. This shows that English language is less used by students in social media.

This result drives the researcher to give an interpretation about the absence of students who were selected to be part of **Spelling Mistakes Group**. In spite of 92% of students claim that social media is useful in developing learner's writing skills, and 91% of the participants say that they have already thought to join an English group to develop their writing skills; they really improved less communication between them and the researcher. Maybe English language which is less used by the participants on Facebook could be an obstacle that made students to not participate in the group. The results of the diagnostic test may give an interpretation to this query.

Many of misspelled words that are committed by students are categorized in the four following types of spelling mistakes: Insertion, omission, substitution, and disordering. For example, in the sheet of the student (X):

- He inserted the letter *e* to the word Class.
- He omitted the letter *d* in the word enjoyed.
- He substituted the letter *i* for *e* in the word interesting.
- He disordered the two adjacent letters *i* and *e* in the word friendly (see appendix D).

French language interference is the second most important cause of spelling mistakes for the majority of students. Words such as "*delicious", "mountain", "restaurant", "class", and "picnic"* were committed by students who got poor scoring.

For example, the student (Y) wrote in his sheet the word "*pleasant* "as in French language "*plaisant"* (see appendix E). Whereas the students (Z) wrote the word *"picnic"* as in French language "*pique-nique"* (see appendix F).

These types of spelling errors which are categorized in the four types of spelling mistakes and caused by French interference say that students who received poor scoring do not have more exposure to English; unlike students who got good scoring show that they have more exposure to English. In addition to that, the percentage of students who are above the average is approximately equal to the percentage of students who use English language in social networking while 82% of students who have serious problem in spelling mistakes got poor scoring (see the tables above 3 and 9). This convergence of the results drives the researcher to assume that spelling mistakes could be a barrier that leads students to not participate on

4.3.1. Spelling Mistakes Group on Facebook.

Krashen (as cited in Du 2009) "people acquire second languages only if they obtain comprehensible input and if their affective filters are low enough to allow the input (in)" (p. 162). He also (as cited in Thanawan Suthiwartnarueput & Punchalee Wasanasomsithi 2012) "motivation, attitude, self-confidence, and anxiety

are principle factors in second language acquisition" (p. 198). Motivation is an important factor in language learning in general and in developing writing skills in particular. 95% of the participants are motivated to be part of the group in order to enhance their writing skills. But the creation of the group is not enough to prove students' writing skills. Because as has been mentioned earlier, almost 22 students who were selected to be part of **Spelling Mistakes Group** on Facebook did not show their willingness to participate except one. This non-participation in the group indicates that students need another factor that may motivate them and make them participate as much as they can in the group to promote their writing skills.

When students were asked about the participation of their English teacher on the group, almost 97% of students say yes, this means that they appreciate the idea. This participation may be a good factor that may motivate students to change their attitudes toward their teacher in building a good relationship between each other, and promote their self-confidence to participate in the group. Lam (2012) says that "teacher's roles changes when participating in online learning environments such as Facebook and communicating with students in order to establish the relationship and motivate students in learning" (p. 379). Furthermore, teacher's participation on Facebook may recover the absence of writing session inside the classroom and gives additional time to his students outside the classroom to promote their motivation towards learning in general and toward writing in English in a particular in order to reduce their spelling mistakes.

According to the findings of the research, The Moroccan high school EFL learners who participated in the present study show a great interest toward the use of social media in learning to promote their writing skills through the engagement of their teacher on group in Facebook. Also the review of related studies (see chapter 2, part 3) has shown that there is a strong relationship between social media and students development in writing skills. In addition, the emergency plan of 2009, Moroccan educational system has heavily invested in technology to support teaching, first to encourage teachers to use technologies, and second to enhance students learning experience. Therefore, the majority of the surveyed students, if not all, are in favour of the alternative hypothesis which says there is a relationship between the use of Facebook and reducing spelling mistakes of Moroccan EFL learners. This means that the null hypothesis is rejected.

5. Conclusion

This study has shown that Facebook is currently being massively used by the surveyed students who are spending much of their time on playing online games and communicating with family and friends, rather than having access to information and sharing ideas with others. Moreover, the majority of students are suffering from spelling mistakes in their writing. This is due to the luck of writing practice inside classroom. The saying says "practice makes perfects", which means while you are encouraging someone to continue to do something many times, he/she will learn to do it very well.

Facebook can be regarded as a platform for collaboration and knowledge sharing. As it has been observed in the study, a few minorities of students are using Facebook to share ideas with others while the majority are using it for playing games and communicating with family. Otherwise, teacher can promote the use of Facebook in sharing ideas with others by encouraging students to create a group in Facebook and add their teacher and classmates as friends because the majority of students are supporting the idea of teacher

participation and the use of Facebook as a medium where they can practice writing to promote their writing skills.

5.1. Recommendation

- The ministry should continue encouraging teachers about the use of ICT with their students by providing teachers with technological facilities.
- Teachers should be provided with appropriate knowledge and skills about the use of Facebook or other social media before creating the group with their students.
- The results of the survey show that Facebook is the most popular online social network site among students. Thus, Facebook has other features that should take them into account for their use in Moroccan educational sector, as tools to promote students learning.

5.2. Limitations

Although this present study studies the use of Facebook in reducing students' spelling mistakes by Moroccan high school EFL students, it is limited to two classes in Abdurrahman Ennacer High School. This limitation will prevent the generalization of the finding over Moroccan high school EFL students. Another reason for the limitation of the study is that the instrument used in the research such as diagnostic test and questionnaire cannot provide reliable findings. Therefore, doing an experimental research where the instruments include pre-test, treatment, and post-test may help to obtain reliable findings.

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Appendices

Appendix A: The paragraph of the diagnostic test

Last summer, we had a very fantastic holiday in Spain. The weather was sunny all the time and it was pleasant to be able to swim every day. We had some delicious meals in a first class restaurant where all the waiters were very friendly to us. One day, we went on an interesting bus trip up the mountains. We were very high up and the nature was marvelous. We took some lovely photos and enjoyed a wonderful picnic in the open air.

Appendix B: The questionnaire
Questionnaire about the use of social media in developing English writing skills among Moroccans' high school students.

Please respond to all of the following items. Do NOT write your names any whereon this paper or make any mark(s) on the paper which might reveal your identity. This questionnaire is only to investigate to which extent high school students make use of social media in learning English. Thank you for your cooperation.

1- Select your age

Between 15-16   ____

Between 17-18   ____

Between 19-20   ____

2- Indicate your gender

Male   ___

Female   ___

3- What types of social media do you currently use? (Select all that apply.)

Facebook   ___

Twitter   ___

Google   ___

Others   ___

4- How many hours do you spend using social media?

Less than 1 hour per day   ___

1-3 hours per day   ___

4-6 hours per day   ___

more than 6 hours per day ___

5- For what purpose(s) do you use social media?

To have Access to information   ___

To play online games   ___

To communicate with family and/or friends   ___

To discuss / Share ideas with others   ___

    6- What is the language you prefer in using social media? (more than one option is allowed)

Moroccan Arabic   ____

Modern Standard Arabic   ____

French   ____

English   ____

    7- Do you think social media is useful in developing learner writing skills?

Yes   ___

No   ___

    8- Have you ever thought to join any English group to develop your writing skills?

Yes   ___

No   ___

    9- Do you like to be a member in an English group through social media?

Yes   ___

No   ___

    10- Do you like your English teacher to be part of this group?

Yes   ___

No   ___

Appendix C: Checklist

<div align="center">

Observation Checklist

</div>

Class: ………………………….   Date: ……………………………………

1= Not observed   2= More emphasis recommended   3= Accomplished very well

Items for Observation	1	2	3
I-The Pre-writing Stage			
1-Teacher (T, henceforth) activates students' prior knowledge about the writing topic.	1	2	3
2- T helps students (ss, henceforth) to develop a sense of audience.	1	2	3
3-T encourages Ss to work in pairs and / or groups	1	2	3
4- T provide ss. with strategies for generating ideas through, organizing them and planning.	1	2	3
5-T teaches Ss how to apply these strategies	1	2	3
6- T encourages Ss to use visual and sensory images such as graphic organizers and webs to organize main ideas and supporting or related ideas	1	2	3
7- T enables Ss to collect information from reading, taking notes ..etc	1	2	3
8-T helps Ss analyse a model text related to the writing topic.	1	2	3
II-The Writing Stage			
1-T lead ss. into building awareness of discourse organization	1	2	3
2-T models how the parts of a text are linked through cohesive devices	1	2	3
3-T illustrates how sentence structure can vary to develop meaning.	1	2	3
4-T helps Ss use correct punctuation, word form, structures ….etc.	1	2	3
5-T helps ss correct facts and meaning of the topic	1	2	3
6-T encourages collaborative tasks	1	2	3
III-The Post Writing Skills			
1-When assessing Ss' work, T marks areas for improvement	1	2	3
2-T uses encourages self and peer correction.	1	2	3
3-T locates errors and gives them symbols to denote types of errors (using a coding system)	1	2	3
4-T indicates in the margin that there is an error of a	1	2	3

particular kind somewhere on that line and asks Ss. to locate it and correct it			
5-T shares with Ss. the grading criterion that is to be used to assess their written work.	1	2	3
6-T provides form-focused feedback	1	2	3
7-T provides content-focused or integrated feedback.	1	2	3

Appendix D: Sheet of the student (X)

Full Name: ....
Class : 2 Bac Eco2
Date : 27.10.2015
E-mail (Facebook) : ....

Last summer, we had a very fantastic holiday in Spain. the weither was sunny old the time and it was plaisent to be able to swoem everyday. we had some délécious mils in the first class restaurant where all the waiter's were very freindly to asse. one day, we want on interisting bushex up the montain's. we were very high up and the nature was mervelus. We took some lovely photos and enjoy a wonderful pecnic in the open air.

15 mistakes

Appendix E: Sheet of the student (Y)

Full Name: ....
Class : 1Eco2 ....
Date : ....
E-mail (Facebook) : ....

Last summer we had a very fantastic Holiday in
spain full stop, the wather was sunny all the time and
it was plaisant to be able to swim every day we had
some delicious meals in first class restaurant wher all
the water were very friendly to us. one day we went
on an interesting up and the nature was mervelous,
we tauk came lovely photos and enjoy a wonderfull
Picnic in the open air

19 faultes

Appendix F: Sheet of the student (Z)

Full Name: ....
Class : .....2 Bac economie 1.........................
Date : ....27/10/2015...........................
E-mail (Facebook) : ....

Last summer, we had a very funtastic hoffiday in Span. the wethen was sunny old the time and it was plisent to be able to sixem every day. we had sum dilishes mils in a first classe restaurant where old the weteres wore very frinckly to as oneday, we went on in inteesty bus treep up the monthen's, we wore very hay up a the nuture wase marvelis, we tuke some loyly photo's and enjoy a wenderfful pique-nique in the open air.

30 mistakes

Neurotoxicity evaluation of meloxicam in the alternative *in vivo* model, *Caenorhabditis elegans*

Juliana Cyrillo Guimarães da Silva[1,2], Cassiana Bigolin[1,2], Laura Cé da Silva[2], Thalia Emmanoella Sebulsqui Saraiva[1,2], Julia Machado Menezes[2], Andriele Veiverberg[2], Mariele Feiffer Charão[1,2], Andresa Heemann Betti[1,2*]

[1]*Graduate Program in Toxicology and Experimental Toxicology, Institute of Health Sciences, Feevale University, Novo Hamburgo, Rio Grande do Sul, Brazil.*
[2]*Department of Bioanalysis, Institute of Health Sciences, Feevale University, Novo Hamburgo, Brazil.*

*Corresponding author
Andresa Heemann Betti, PhD.
Feevale University, Campus II - 2755, RS 239
Postal code 93525-075 Novo Hamburgo, Rio Grande do Sul, Brazil
E-mail: andresa@feevale.br

Abstract

Inflammatory processes cause changes in the permeability of the blood brain barrier. Non-steroidal anti-inflammatory drugs (NSAID) are most commonly used to treat these inflammatory processes, including meloxicam, and they can reach the central nervous system (CNS) and cause neurotoxicity. Since there are no studies evaluating the neurotoxicity of NSAID in alternative models of toxicity, the aim of this study was to evaluate the acute neurotoxicity (through nematodes changes in behavior) of meloxicam in an alternative in vivo model, Caenorhabditis elegans, as well as, to determine meloxicam toxicity through LD_{50} and development assessments. Meloxicam LD_{50} was high (50.03 mg/mL) and only the highest dose (100 mg/mL) caused a decrease in the nematode body size, indicating low toxicity in this alternative model. Besides, a neurological effect was observed only in the highest dose. Meloxicam showed neurotoxicity only at a very high dose, suggesting low potential to cause toxicity in the CNS. However, further studies are necessary to evaluate meloxicam neurotoxicity.

Keywords: *C. elegans;* neurotoxicity; meloxicam; NSAID.

1. INTRODUCTION

Inflammation is a defense response of the organism to an infection or tissue damage and it might cause changes in the permeability of the blood brain barrier [1]. Non-steroids anti-inflammatory drugs are most commonly used to treat these inflammatory processes, including meloxicam [2,3]. Thus, anti-inflammatory drugs can reach the central nervous system (CNS) and cause neurotoxicity. However, the literature lacks

studies evaluating the neurotoxicity of these drugs in an alternative model of toxicity.

According to the Interagency Committee on Neurotoxicology (ICON), neurotoxicity comprehends a broad concept, which includes adverse effects on the structure or function of the central or peripheral nervous system, caused by biological, chemical or physical agents. Neurotoxic effects can be permanent or reversible, resulting in direct or indirect action in the nervous system. Then, the nervous system represents a challenge to the development of risk assessment strategies of the neurotoxic effects in view of the complexity of the mechanisms involved in their triggering [4].

Caenorhabditis elegans is an alternative model for assessing neurotoxicity, since these nematodes do not have blood brain barrier, becoming a good choice to assess the toxicity of drugs that arrives in the CNS [5,6]. Furthermore, they have 302 neurons representing 118 characterized neuronal subtypes, providing an *in vivo* model for studying mechanisms of neuronal injury with resolution of single neurons [7]. In addition, it presents strong genetic homology with mammals, being possible to evaluate drugs effects and mechanism of action with the use of this model [8].

*C. elega*ns is an advantageous model organism to be used as a biosensor, since it has a sensorial and response system against xenobiotic compounds, which facilitates the detection and evaluation of toxic compounds, discovery of new molecules that can reduce or neutralize toxic compounds, besides of evaluating compounds that improve health or increase longevity [9,10].

Regarding the above, the aim of this study was to evaluate the acute neurotoxicity of the meloxicam in an alternative *in vivo* model, *Caenorhabditis elegans*. Also, to determine the toxicity of the NSAID through of LD_{50} and development assessments.

2. MATERIALS AND METHODS

2.1 Caenorhabditis elegans strain

The N2 wild type *C. elegans* strain was obtained from the Caenorhabditis Genetics Center (CGC) and was maintained on nematode growth medium (NGM) plates seeded with *Escherichia coli* OP50 at 20 °C.

2.2 Synchronization and treatment

The nematodes were synchronized according to Ávila et al. [8], the pregnant nematodes were treated with a solution of 0.25 M NaOH and 1% NaClO to break the cuticles thereof, and the eggs were separated by flotation with 30% sucrose solution. The eggs were stored in an incubator at 20 °C and after 14 hours the animals were obtained in the L1 stage, in which experiments were performed.

Meloxicam solution (100 mg/mL) was prepared in DMSO. 2,500 nematodes were treated with 5 different concentrations of meloxicam (10 to 100 mg/mL) in liquid medium by constant agitation in a rotator for 1 hour at 20 °C, after which the nematodes were placed in NGM medium seeded with *E. coli* OP50. 24 hours later, the scoring of survival nematodes per treatment was evaluated and it was compared with the control group treated with DMSO. All concentrations were tested in five independent experiments in replicates within each experiment.

2.3 Determination of lethal dose 50% (LD₅₀)

After exposure to meloxicam, the worms were placed on a new NGM/OP50 plate. For the survival assays, they were counted in stereomicroscope and compared to the control group (DMSO) in order to plot a survival curve and calculate the LD_{50} [11].

2.4 Development

Development was assessed by sampling. After reaching the adult stage, 20 nematodes per group were evaluated by measuring the body surface area. This procedure was performed through photos acquired in the stereomicroscope coupled with a camera. Subsequently, the measurement of the surface area was performed in ImageJ software [12,13].

2.5 Behavioral test

The behavioral evaluation assessed the motor activity of the worms and the sensorial activity. The nematodes were transferred to NGM plates without OP50 and stood for 1 minute to get used to the environment. Subsequently, the number of times with which the animal moves its head up was evaluated for 1 minute. Data were always compared to the control group and the experiment was repeated at least five times [14].

2.6 Statistical analysis

One-way ANOVA followed by Tukey was performed for the evaluation of *C. elegans* body area and head-thrashes frequency. The lethal dose 50% was determined by the log dose–response curve. $P < 0.05$ was considered as significant. Statistical analysis was performed at Graph Pad Prism 5.0.

3. RESULTS AND DISCUSSION

Meloxicam demonstrated a high LD_{50}, since the dose increase resulted in an increase in mortality rate of the nematodes. Figure 1 shows the percentage of survival versus logarithmic dose of meloxicam. The LD_{50} for meloxicam was 52.51 mg/mL. All the tested doses were compared to the control group, which did not receive the treatment.
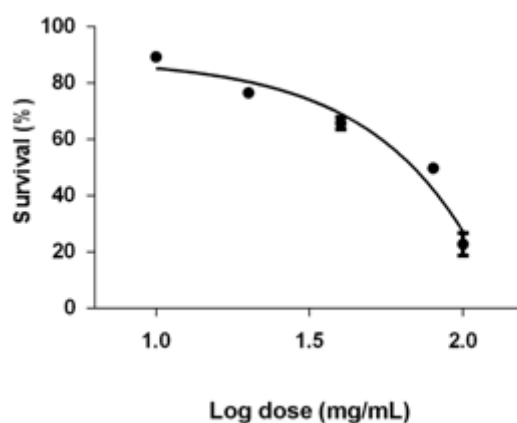
Figure 1. Log dose-response curve for lethal dose 50% determination of meloxicam after acute treatment.

Data are expressed as mean $\pm$ S.D (n=5).

It was verified that the LD_{50} was half the highest tested dose, suggesting the low toxicity of meloxicam. According to Ura *et al*. [15], the LD_{50} is only one of the parameters to be considered in toxicological tests, since the mortality rate shows only the acute effect [16]. Then, development may be more sensitive than the mortality rate and it is necessary to consider other aspects such as growth and movement [15].

The size of the nematodes after treatment with meloxicam, assessed by the measurement of surface area of the worms, showed that only the higher dose caused a decrease in body size compared to the control group (Figure 2).
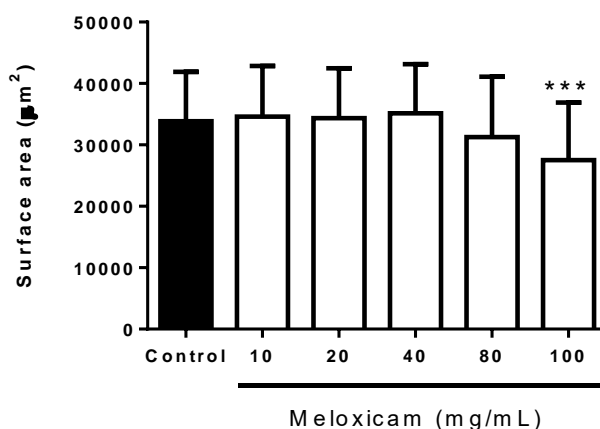
Figure 2. Body area of *Caenorhabditis elegans* after acute treatment with meloxicam in different concentrations. ANOVA post hoc Tukey. Data are expressed as mean + S.D. $F(5, 354) = 6.860$, $P < 0.0001$. Different from Control ***$P < 0.001$ (n=5).

Since *C. elegans* growth is determined by a conservative genetic regulatory pathway, this endpoint test is a good parameter to evaluate toxic effects [17,11]. Jiang et al. [18] conducted an experimental study with *C. elegans* to verify toxicity endpoints of heavy metals, and evaluated the growth, as a physiological endpoint. They demonstrated that this evaluation has high sensitivity and it could be a good parameter in toxicological studies in *C. elegans*. In the present study, we observed that only the highest dose caused a decrease in the nematode development. Regarding that the effect of a toxicant in the development of the nematode can be evaluated by measuring the body length or surface area of synchronous worms [12,19,20], the results suggest that meloxicam presented low toxicity. Jacques and Avila [21] also used this endpoint to assess toxicity of the commercial compound glyphosate. They observed that the worms' exposure to this compound caused significant changes in brood size and worm body length. Moreover, Charão et al. [13] evaluated the development of nematodes as a toxicity endpoint in *C. elegans* through surface area measurement and demonstrated the low toxicity of lipid core nanocapsules.

Moreover, the acute exposure to 100 mg/mL of meloxicam decreased *C. elegans* basic movements (Figure 3), suggesting neuronal damage.
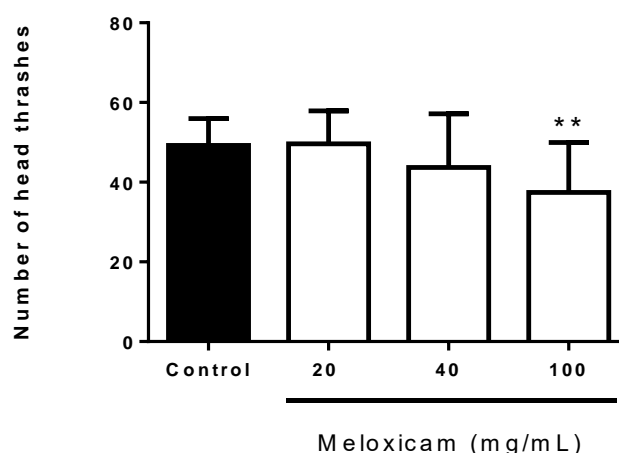
Figure 3. *C. elegans* head-thrashes frequency. ANOVA post hoc Tukey. Data are expressed as mean + S.D. $F_{(3, 83)} = 6.198$, $P < 0.0007$ (n=5). Different from Control **$P < 0.01$.

Jiang et al. [18] evaluated the behavior through body bends and head thrash frequencies. They demonstrated that there is a great concentration response between the parameters evaluated and the four metals tested in *C. elegans* and the determination of behavioral and physiological tests (as growth evaluation) presented similar results in terms of toxicity endpoint. The same was observed in our study, where only in high doses of meloxicam it was observed a decrease in *C. elegans* head thrashes, the same doses that presented reduction in growth. According to Yu et al. [21] effects on the locomotion of nematodes have been linked to a deterioration of the neural network, which can be evaluated based on several criteria, such as head thrash, body bend frequency and basic movements, suggesting neuronal damage caused by meloxicam at 100 mg/mL. Furthermore, a defect in locomotion reflects an impairment of the neuronal network formed by the interneurons AVA, AVB, AVD, and PVC providing input to the A and B-type motor neurons (responsible for forward and backward movement) and the inhibitory D-type motor neurons involved in the coordination of movement [22].

Considering that the inflammatory process can cause alterations in the permeability of the blood brain barrier [1], the present study evaluated for the first time the neurotoxicity of the anti-inflammatory meloxicam in an alternative *in vivo* model of toxicity, using the nematode *C. elegans*. The use of alternative methods is an important aspect in the toxicity study [19] and *C. elegans* presents many advantages, such as oral absorption of drug administration in worms, as demonstrated by Charão et al. [13], who evaluated oral absorption and potential toxicity of biodegradable nanocapsules in the same alternative model. In addition, *C. elegans* is well suited for neurophysiology of neurotoxicity evaluation [5,6]. According to the results obtained it is possible to infer that meloxicam presents low toxicity in the *C. elegans* model. In addition, meloxicam demonstrated low potential to cause toxicity in the Central Nervous System in the nematode.

4. ACKNOWLEDGEMENTS

5. CONFLICTS OF INTEREST

The authors declare that there is not any conflict of interest.

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Consumer behavior towards pharmaceutical services: a scoping review

Helena Hiemisch Lobo Borba (Corresponding author)

Dept. of Pharmacy, Universidade Federal do Paraná,

Curitiba, Av. Pref. Lothário Meissner, 632, Jardim Botânico, Curitiba, PR. Zip code 80210-170, Brazil.

Denise Maria Woranovicz Carvalho

Dept. of General and Applied Administration, Universidade Federal do Paraná,

Curitiba, Av. Pref. Lothário Meissner, 632, Jardim Botânico, Curitiba, PR. Zip code 80210-170, Brazil.

Abstract

The present study aimed to map the evidence on consumer's behavior towards pharmaceutical services. A scoping review based on the PCC (Population, Concept, and Context) mnemonic was conducted in Pubmed, Scopus and Web of Science. Population included consumers of pharmaceutical services, the concept referred to marketing/consumer behavior and the context to pharmaceutical services. Electronic searches were held on December 2019. Studies published in non-roman characters were excluded. A qualitative synthesis of the data extracted from included studies (i.e. author, country, study design, aims, patient/consumer profile, pharmaceutical services, marketing strategy, data analysis, conclusion) was performed. Electronic searches retrieved 1,215 articles that were screened by titles and abstracts. Of these, 31 studies were fully appraised, of which five fulfilled the inclusion criteria. One record was identified through manual search, totaling six included articles. All studies occurred within the scope of community pharmacy. The studies show that most consumers seek pharmacist's orientation regarding over-the-counter drugs. Also, despite the expectations concerning pharmaceutical services, consumers exhibit distrust in pharmacists' competence, which may hamper the seeking for pharmaceutical services. Hence, a marketing plan involving the knowledge of consumer's value along with the recognition of the consumer needs should be considered. Through this scoping review the available evidence on consumer's behavior towards pharmaceutical services was mapped, elucidating consumer's perceptions that motivate or prevent the seek for such services in the context of community pharmacies.

Keywords: Clinical Pharmacy; Community Pharmacy; Consumer Attitudes, Patient Attitudes; Health Seeking Behaviour; Pharmaceutical Care

1. Introduction

Being healthy is a persistent aspect during the course of human life, and this makes the way people seek healthcare services a pivotal activity to be researched.[1] Moreover, several articles and stories related in mass media reveals that health is one of the opportune subjects examined.[2]

Among healthcare providers, the pharmacist stands out in its role of improving the effectiveness and safety of drug therapy. Historically, the concept of Pharmaceutical Care was introduced in 1980, referring to the

provision of the necessary services, besides determination of drug needs and dispensation of the required drug, aiming optimally safe and effective therapy.[3] Therefore, quantifying the economic value of pharmacy services is an important objective for the profession of pharmacy.[4]

De facto, despite the profession of pharmaceutic has made enormous advances, not only from the medical profession and consumers, but also in establishing clinical pharmacy as a value-added element of the health care system, the need to provide evidence of the economic benefit of clinical pharmacy services has not declined with such advances. [5]

According to Pillai et al. (2019), healthcare is considered a vital service from both personal and social points of views.[1] In this sense, pharmaceutical care lays on the philosophy of delivering patient care and comprises interactions with patients and other healthcare professionals, through which interventions aiming to improve the quality of medications use and disease management are provided.[3, 6]

In the current context of the outbreak of coronavirus disease 2019 (COVID-19), community pharmacists' role in the management of the disease is standing out. Pharmacists represent the most accessible healthcare provider, acting as an information axis and being frequently the most common first contact point of the population, hence contributing to the prevention of infection spreading and the correct use of medicines. The role of pharmacists in the context of public health emergencies, specifically in Covid-19 scenario, is in focus and was endorsed by a publication of the International Pharmaceutical Federation (FIP) entitled "Coronavirus 2019-nCoV Outbreak: Information and Interim Guidelines for Pharmacists and the Pharmacy Workforce", which highlights the key role of this professional in the public health, providing services such as informing, counseling and educating the community.[7, 8]

Indeed, the range of services offered in pharmacies is very wide, and can benefit consumers greatly, but it is observed that they do not always know that the pharmacy offers such services, which seems to point to a lack of adequate information for these consumers. In addition, it is highlighted the need for pharmacists understanding consumer's concerns in order to provide satisfactory care.[9]

Pharmaceutical care represents a significant transition in the profession of pharmacy, because the focus of pharmacy services has expanded beyond the dispensing of medication to the provision of pharmaceutical care (assessment of drug regimens, development of care plans, and execution of follow-up evaluations), rather than the distribution of drug products.[10, 11]

To Lovelock and Wirtz (2011) services correspond to activities offered by one party to another and cover a vast array of diverse and complex activities, which hampers its definition. Service is a performance that brings the desired results or experience to the customer. It is not a property; it is a form of rental. Service customers hire labor and staff experience, obtain the right to use a physical space or object, or pay for access to facilities and physical environments.[12] Indeed, the service sector indicates growth at a global level and improves competition; thus, the quality, progress, and future of an economy are measured by the liveliness and triumph of the service sector.[13] Moreover, evaluating health services and product plays crucial roles: serving as a way of controlling costs and monitoring care; promote accountability for scheduled expenditures; assure the delivering of superior quality services.[14]

The Medical Subject Heading "Health Services" is defined as "Services for the diagnosis and treatment of disease and the maintenance of health", while "Pharmaceutical Services" are defined as "Total pharmaceutical services provided by qualified pharmacists. In addition to the preparation and distribution

of medical products, they may include consultative services provided to agencies and institutions which do not have a qualified pharmacist". In the context of the pharmaceutical care, pharmacists may provide services such as prescribing, vaccines and drugs administration, medication therapy management, minor disorders schemes.[15] For the purposes of our study, pharmaceutical services were defined as a comprehensive range of health interventions executed by the pharmacist, within the scope of pharmaceutical care, besides the routine activities performed by this professional, such as administrative duties (e.g., stock conference) and medicine dispensing/sale without proper patient orientation.

As a matter of fact, the business practices of healthcare professionals always have many changes. One of these changes is that consumers are increasingly involved in their own health care, and take more responsibility for treatments than they used to do in the past.[16]

Due to these changes, not only is increasing the participation of the pharmacist in the health system a challenge, but also harmonizing terms, concepts and work processes related to the clinical performance of this professional, in order to elucidating the consumer about the services offered in the pharmaceutical field.[17]

How does the consumer of pharmaceutical services behave? "We strongly encourage further research into the specific characteristics of health consumers and into health marketing as an integrated field."[18] These issues refers to health consumers' behavior , which is paramount due to consumers' involvement, compliance and purchasing attitude.[18] Notwithstanding, once not all consumers attribute a high value on health, "it is important to understand how consumers make trade-offs between health goals and other life goals."[19]

What helps us to understand the consumer? "The field of consumer behavior is the study of the processes involved when individuals or groups select, purchase, use or dispose of products, services, ideas or experiences to satisfy needs or desires."[20]

For a marketing manager is very important to investigate consumer behavior, in order to understand the factors that affect relationships of a company, e.g., by laying emphasis on people who buy, a company is able to select the right features for the product or for the service, as well as the right price and distribution outlets, and the right words and strategies to promote the product.[21]

"On the consumer's side there exists a great need for products, services, and experiences that facilitate health and prolong the duration of human existence."[2] If the consumers seek to become more engaged in managing their own health, they need to have the ability, reliance and knowledge to understand health information and how their behavior impacts their health and well-being.[19]

Despite the immense importance of pharmaceutical services in the health scenario, there is limited attention paid to the development of studies on the consumer behavior of services offered in pharmacies. Therefore, the objective of this scoping review was to explore consumer behavior towards pharmaceutical services.

2. Methods

To accomplish the mentioned objective, a scoping review following Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), the Joanna Briggs Institute and the Cochrane Collaboration recommendations was conducted. A comprehensive search strategy was elaborated based on

the PCC (Population, Concept, and Context) mnemonic, in which population included consumers of pharmaceutical services, the concept referred to marketing/consumer behavior and the context accounted to clinical pharmaceutical services.[22]

Electronic searches were performed on December 2019 in Pubmed, Scopus and Web of Science. No filters for limiting the searches were used (e.g. language, publication dates). Descriptors related to Marketing of Health Services, consumer and pharmaceutical services were combined with the Booleans AND and OR (see the complete search strategies for each electronic database in the Appendix 1). In addition, a manual search was performed by checking the reference lists of the articles included in the scoping review. Articles addressing the consumer behavior towards pharmaceutical services in the context of pharmaceutical care were included. Exclusion criteria comprised publications in non-roman characters (e.g. Chinese, Japanese, Arabic) and studies evaluating the consumer behavior on services out of the scope of pharmaceutical care. After performing the electronic searches and retrieving the articles from the databases, two independent reviewers (D. M. W. C. and H. H. B.) screened the studies by reading its titles and abstracts in order to identify irrelevant records (i.e. studies that did not fulfill the inclusion criteria). After consensus on the studies included in this stage, both reviewers, independently and in a blind fashion, appraised the full-text articles (eligibility phase), applying the aforementioned inclusion and exclusion criteria. After consensus on the studies included in the eligibility phase, both reviewers proceeded to the data extraction, again in an independent and blind fashion, followed by consensus. Data collection was conducted by using a standardize form elaborated by the reviewers, comprising the following information: author/year of publication; journal in which the paper was published; country in which the study was conducted (in the absence of this information, the country listed in the first author's affiliation was considered); study design; study aims; patient/consumer profile; age and gender of consumers; pharmaceutical services (as defined by the authors of the included studies); marketing strategy; key elements; study setting; study conclusion. The form for data extraction was developed by using the software Microsoft Excel 365.

The characteristics and results of the included studies were qualitatively synthesized. In view of the heterogeneity and nature of the retrieved data, no quantitative comparison was observed, and no statistical analysis was possible to be conducted. Regardless of that, Witell et al. (2020) suggest that qualitative research rises new insights that can lead to new directions, and researchers draw on observations from the data to introduce abstract knowledge.[23] Hence, the main findings of the included studies will be presented, highlighting the points concerning the behavior of consumers of pharmaceutical services in the setting of community pharmacies. Further discussion on how these services are structured and how they can improve, based on consumers' needs, will also be presented, along with a reflection on the direction that new studies should take to clarify issues raised by the present scoping review related to clinical pharmaceutical services.

3. Results and discussion

Through a scoping review, the available evidence on the consumer behavior towards pharmaceutical services was mapped, in order to elucidate potential facilitators and barriers that affect the implementation and success of such services.

Electronic searches retrieved 1,215 articles which were screened by titles and abstracts. Of these, 31 were fully appraised in the eligibility phase. Five studies met inclusion criteria and were encompassed in the qualitative synthesis. One record was identified through manual search (Figure 1).
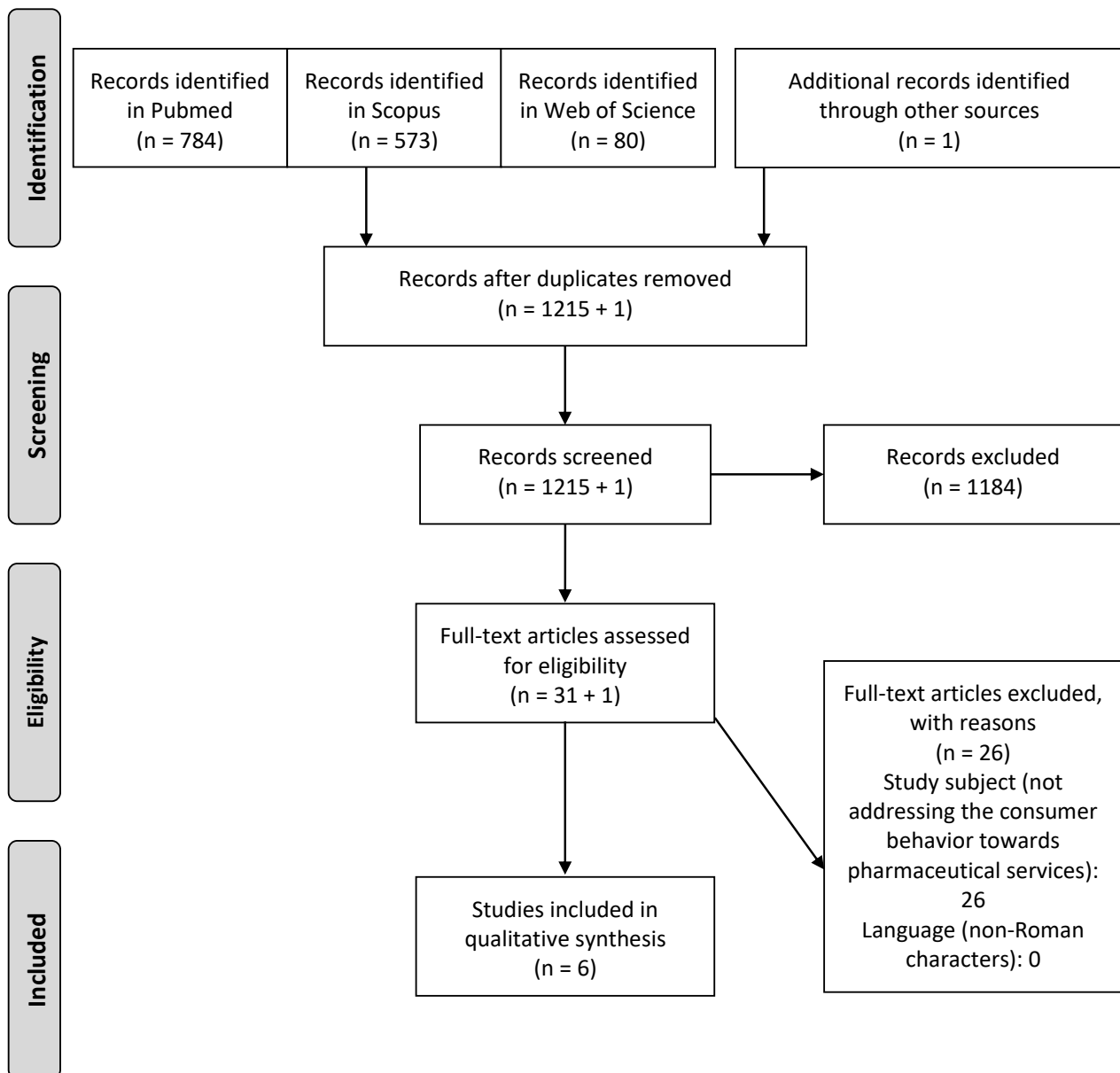
Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2009 Flow Diagram.

Among the six included studies, five were conducted in the USA[24-28] and one in China[9]. Concerning the type of study, two were commentaries[24, 26] and four were exploratory/surveys[9, 25, 27, 28], totaling 1,480 consumers. All studies were conducted in the community pharmacy setting. The complete data extracted from the six included studies is presented in Appendix 2.

Study 1. Alston and Blizzard (2012) wrote a commentary on the value prescription: Relative Value Theorem (RVT) as a call to action. It mentions pharmaceutical services that usually do not appear in research of marketing services - which is a relevant contribution - and points to the creation of value and the need to know the consumer. The importance of the pharmacist is also highlighted, as this professional can provide a service that adds value. The reflection raised by this study is very pertinent for pharmacists who desire to perform services in the context of the pharmaceutical care, since the authors point to key elements such vision of the future, perceived value, services, price, culture of dispensing medicine *versus* culture of service provision. Therefore, the essence of a good marketing plan is to create value for a target customer. A pharmacist who understands RVT can become a powerful agent of change to help the healthcare industry make the right decisions to provide high quality patient care that is sustainable in the future.[24]

To Arditto et al. (2020), value can have its origin in the relationship.[29] "Knowing the consumer's value for pharmacy services may aid the profession in marketing pharmacy services to consumers and may assist practitioners who wish to implement various pharmacy services in their practice settings. Unfortunately, the published literature to date provides little guidance on true valuation of pharmacy services. A limited number of studies have been conducted."[4] Furthermore, "it has become increasingly difficult for the pharmacist to quantify the value of his or her services."[11]

Study 2. Gore et al. (1994) conducted an exploratory study aiming to assess the extent of consumer involvement in decisions to purchase drugs without a prescription. Concerning the type of service, the focus is on consumer guidance on nonprescription medicine (over-the-counter [OTC] drugs), dispensation and health education. The key element is that consumers' information search during the purchase of OTC medicine is a function of their involvement in the purchase decision. Hence, health organizations can benefit from the development of programs to promote greater consumer involvement in the decision of purchasing OTC drugs. These programs should provide consumers with information regarding the value of proper use of over-the-counter medications and the role that affordable healthcare professionals, such as pharmacists, can play in assisting consumers with OTC drugs purchase.[25]

In this sense, effective communication is vital to a pharmacy succeed when providing services within the community pharmacy setting. To Lovelock and Wirtz (2011), communication plays a crucial role in terms of needed information and council; convincing customers of the virtues of a service; and encouraging customers to take action at particular times. "In services marketing, much communication is educational in nature."[12] In the opinion of Moser et al. (2018), consumers desire more information about the services of pharmacies.[16]

Study 3. Grauer (1981) wrote a commentary on the marketing mix (service, price, distribution, promotion) for pharmaceutical services. The study contributes to the marketing services literature, as it addresses dispensing and drug-knowledge-distribution services. The study raises a reflection concerning the identity problem that pharmacies have with the consumer of their services. The marketing concepts discussed can serve as a model for the development, communication and sale of future pharmaceutical services. Pharmaceutical services designed in this way will help the pharmacy achieve strong value with consumers of its services.[26]

Lovelock and Wirtz (2011) states that numerous services need direct interaction between service employees and customers.[12] An employee, when embrace individual consumers' feelings, is emotionally capable, and it is critical to a positive relationship experience.[30]

To Hindi et al. (2006), patients are more disposed to admit extended services if they had a good relationship with the pharmacist, and think that permanence of care with the pharmacist add a "personal touch" to services provided.[31]

Study 4. The article by Lee (2010) uses a 2002 FDA - Food and Drug Administration survey which conducted telephone interviews. As the core of the article is to evaluate the relative power of interpersonal communication and mass media, it sought to examine the struggle for power between doctor-patient relationships influenced by other health professionals and mass media, and investigates whether communication channels in mass media, hybrid and interpersonal healthcare can empower patients with the knowledge to persuade their doctors to prescribe a specific medication. The service involved is consumer orientation. The key elements are patient empowerment (through mass and hybrid media and through interpersonal communication), doctors' reaction to patient requests and patients' reaction to doctors' responses. This study presents a pertinent concern rarely mentioned in direct-to-consumer prescription drug advertising (DTCPDA) concerning the influence of other healthcare providers (e.g., pharmacists). It is true that DTCPDA and mass mediated drug information are means of education through which patients try to influence their physicians to prescribe drugs. Nevertheless, only patients who received information from other healthcare providers obtained what they wished from their physicians, pointing to the relevance of pharmaceutical care in the decision-making process towards medicine purchase and the role of the pharmacist as a communication brigde between the patient and the physician. The lack of influence of one's own physician may indicate that physicians are prescribing a medication that its patients want in addition to what they prefer. This scenario demonstrates that physicians ceded to requests of patients who were advised by pharmacists and other physicians. Therefore, the influence of drug prescription behaviors definitely emerged from interpersonal influence of healthcare providers other than from mass or hybrid media alone. This influence has proven to be so strong that patients would be willing to change their physicians who go against the advice given by pharmacists.[27]

To Wright et al. (2006), the final decisions are made by consumers, mainly because of their abilities of choice: whether to buy or not to buy. Consumer empowerment is specific to the individual consumer psyche.[32]

Successful pharmacies require cutting edge marketing approaches. A competitive strategy is necessary to anticipate customer wants and expectations, and to increase consumers' empowerment.

Study 5. The article by Lindstrom et al. (2007) is an anonymous and self-administered survey (5-point Likert scale), applied in 8 community pharmacies within grocery stores. Study aims were assessing consumer preferences concerning pharmaceutical services and identifying the characteristics of study participants that can foresee the success of pharmacy services. The types of services include: traditional and expanded; 24-hour pharmacy (20 miles distance of home); 24-hour drug information; education in heart disease; vaccinations (influenza and pneumococcal); cholesterol screening; education concerning

diabetes; automatic refills; diabetes screening; comprehensive medication reviews; urgent care clinics in the interior of the pharmacy; osteoporosis screening; A1C testing; education on fitness; education on pain management; travel vaccines; liver function screening; thyroid function screening; memory screening; weight / fat analysis of   the body; trainings on diabetes glucose meter; drive-through pharmacy; screening of blood pressure; asthma education; classes on smoking cessation; liquid medicine flavoring; diabetic shoe fittings; delivery service; compounding medicine. Marketing, pharmacy services and patient preferences are key elements of the research. The study shows that a broad range of nontraditional pharmacy services could be integrated into community pharmacies. However, pharmacies need to supply both traditional and expanded pharmacy services to encounter desires and expectations of patients. Additionally, pharmacy practitioners should enlarge their marketing options based on patient preferences and market services. Profession must secure that the pharmacy services provide complement patient interest. Acknowledging the prominence of this concept before initiating new or updated pharmaceutical services will lead to increasing value, improving customer satisfaction, and enhancing rates of use.[28]

Study 6. Chen et al. (2018) conducted an exploratory study aiming to investigate consumer's perceptions vis-à-vis pharmaceutical care provided by community pharmacists on OTC drugs. The type of service is consumer orientation. The key elements are: expectancy on pharmaceutical care; posture onto pharmacist's competence; experience of self-medication. The study indicates that consumers expected pharmacists to supply professional service about OTC drugs at community pharmacies; however, they were not acuminate on pursuing pharmaceutical care from community pharmacists owing to distrust in pharmacists' competency. That is, on one hand, participants exhibited high expectations on pharmaceutical care provided by community pharmacists, nevertheless they were not inclined to seek community pharmacy services. Distrust in the competence of the pharmacist was the main reason, including mistrust in pharmacist's certification, in knowledge, in ccommunication skills, and in attitude. The lack of demand for pharmaceutical orientation in this regard is worrying, since confidence on self-medication with OTC drugs caused higher drug risks to consumers.[9]

To Ou and Sia (2010), both trust and mistrust can be present in individuals simultaneously, as positive and negative feelings.[33] Athavale et al. (2015) argue that numerous studies have evaluated the relationship between trust in the pharmacist and loyalty behavior.[34] According to Bergel et al. (2019), customer loyalty has been judged a success indicator across varying industries, and it is true also to pharmacies.[35] Božič et al. (2020) postulate that trust helps customers reduce the perceived complexity correlated with buying activities.[36] One of the key barriers pharmacies face when offering health promotion is, according to Joyce et al. (2007), the level of confidence of pharmacists.[37]

The article written by Chen et al. (2018) also make some reflections concerning self-medication.[9] To Eticha and Mesfin (2014), self-medication is a component of day-to-day self-care behavior and an important issue in healthcare systems. "Self-medication is common in a wide range of illnesses, and makes consumers more health conscious, reduces treatment burden on healthcare facilities and curtails the cost and time of obtaining access to treatment. However, it increases risks: excessive use of medication, extended duration of consumption, incorrect diagnosis, drug interactions, and polypharmacy."[38] Self-medication process requires that all parties involved are aware of risks and benefits of any self-medication

product.

According to Chui and Li (2005), managing self-medication is a frequent practice worldwide. In this sense, consumers must know about potential risks caused by the indiscriminate use of medicines, especially OTC products. Advising consumers on the correct use of medicines is an important role to pharmacists to play.[39]

Thus, pharmacists must embrace its role in guiding consumers towards the proper use of medicines, especially within community practice.[39]

Clinical pharmacy services have shown to improve patient's health, especially when targeting specific conditions (e.g. hypertension). Successfully implementing these services may be challenging, and the patient is a key stakeholder in this scenario, since its behavior influences significantly the achievement of this branch of pharmaceutical market.[6, 17]

The present scoping review reveals consumer's lack of knowledge about pharmaceutical services in the community pharmacy setting. This is a major barrier to the successful implementation of these services, highlighting the need for disclosure and clarification of the interventions that the pharmacist, as a healthcare professional, can perform. In addition, this study also indicates that pharmacists and pharmacy owners/managers must recognize consumer's needs before starting the design and implementation of services, otherwise consumers will not seek for services that are not of their interest. Therefore, the present scoping review highlights two major elements that should be considered when implementing pharmaceutical services within the community pharmacy setting: proper communication and recognition of consumer's needs.

Thereby, this paper adds to the existing literature in view of the fact that, whereas previous research has yielded important insights into consumer behavior of health services, to the best of our knowledge, the plethora of services provided by pharmacists have not yet been examined as core competency of pharmacists, and this feature can add value to healthcare consumers and maximize the safe use of medications. Likewise, this study can stimulate a deeper knowledge of differentiation strategies, because of the hypercompetitive market of the current pharmacy landscape. Additionally, once services are relevant in terms of employment and output within countries economies[40], it is important to consider that services involves not only what is consumed, but how it is delivered, and even health care is been impacted by the rise in the service economy.[41] So, due to the fact that to quantify the economic value of pharmacy services be an important objective to pharmacists[42], through the exploration of the role of the pharmacist as health services provider, innovations in the pharmaceutical sector may be achieved, along with improvements in healthcare field and a positve economic impact, i.e., innovation in health products and services, especially in the economic and social aspects, points to the strategic importance of offering adequate training to the pharmacist [43]

The present scoping review has some limitations. Despite the comprehensive search strategy only six studies were included. Due to the heterogeneity among them, no quantitative synthesis was possible to be conducted. Nevertheless, the evidence mapped and untangled through this review helps to understand the perceptions of the consumer that motivate or prevent the seek for pharmaceutical services in the context of community pharmacies.

4. Conclusion

Through a scoping review it was possible to gather the available evidence regarding the consumer behavior towards pharmaceutical services. Most consumers seek pharmacist's orientation for the correct use of OTC drugs. Nevertheless, despite consumer expectations regarding pharmaceutical services, a certain level of distrust in pharmacists' competence was identified. The implementation of new health services into established healthcare practices is defiant;[17] the service that most affects quality of life refers to health care, because it is the service that demands more resources and that deals with more challenges when facing the future.[44] Actually, marketing scholars often seek to contribute by bringing new knowledge applicable to all sectors, but some sectors have unique characteristics that require the development of sector-specific knowledge, such as pharmaceutical companies, in which marketers face some challenges (e.g. in the promotion of treatment, there is the issue of managing communication and encouraging patient compliance).[45] Lack of knowledge and lack of use of pharmacy services suggests the need to disseminate the knowledge and skills of health promotion of community pharmacies, in addition to the need to disseminate the knowledge and skills of health promotion of community pharmacies. Understanding consumer behavior and needs more deeply, and developing appropriate communication with these consumers, can lead them to know and purchase pharmaceutical services, which will transform the pharmacy into a valuable health promotion scenario. In this sense, a good marketing plan involving the knowledge of consumer's value for pharmacy services in addition to the proper recognition of the consumer needs by the pharmacists may contribute to the successful implementation of pharmaceutical services in the context of community pharmacies. Further studies are needed to develop field research that seeks to better understand the behavior of consumers of pharmaceutical services. Such surveys can identify not only what consumers expect from services and pharmacists, but also the reason for the lack of knowledge about the existence of such services in community pharmacies. Other questions that further research could address include the following: What are the determinants of the consumer's choice of pharmacy and pharmaceutical service? Why does the consumer seek little or is completely unaware of pharmaceutical services? How to generate value to the consumer of pharmaceutical services? How to customize the offer of services to the consumer? Could effective marketing communication increase demand for services?

6. Acknowledgement

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Appendix

Appendix 1. Complete search strategy by database.

Pubmed	#1 (((((((((("Marketing of Health Services"[MeSH Terms]) OR "Health Services Marketing"[Title/Abstract]) OR "Health Marketing Service"[Title/Abstract]) OR "Marketing of Health Services"[Title/Abstract]) OR "Health Marketing Services"[Title/Abstract]) OR "healthcare marketing"[Title/Abstract]) OR "health marketing"[Title/Abstract]) OR "health care marketing"[Title/Abstract]) OR "pharmaceutical marketing"[Title/Abstract]) OR "marketing mix"[Title/Abstract]) OR "market mix"[Title/Abstract]) OR "marketing mixes"[Title/Abstract] OR "market mixes"[Title/Abstract]) OR Marketing[MeSH Terms] #2 ((((((((((((consumer*[Title/Abstract]) OR "consumer behavior"[Title/Abstract]) OR "Consumer Behavior"[MeSH Terms]) OR "Consumer Behaviors"[Title/Abstract]) OR "Consumer Preference"[Title/Abstract]) OR "Consumer Preferences"[Title/Abstract]) OR "Consumer Satisfaction"[Title/Abstract]) OR "healthful behaviors"[Title/Abstract]) OR "healthful behavior"[Title/Abstract]) OR "health behavior"[Title/Abstract]) OR "health behaviors"[Title/Abstract]) OR "health-related behavior"[Title/Abstract]) OR "health-related behaviors"[Title/Abstract]) OR "consumer decision making"[Title/Abstract]) OR "consumer decision-making"[Title/Abstract] #3 (((((((((("Pharmaceutical Services"[MeSH Terms]) OR "Pharmaceutical Services"[Title/Abstract]) OR "Pharmaceutic Services"[Title/Abstract]) OR "Pharmaceutic Service"[Title/Abstract]) OR "Pharmaceutical Service"[Title/Abstract]) OR "Pharmacy Services"[Title/Abstract]) OR "Pharmacy Service"[Title/Abstract]) OR "Pharmaceutical Care"[Title/Abstract]) OR medicines[Title/Abstract]) OR drug*[Title/Abstract] OR pharmacy[Title/Abstract] OR pharmacist*[Title/Abstract] #1 AND #2 AND #3
Scopus	#1 (TITLE-ABS-KEY ("Health Services Marketing") OR TITLE-ABS-KEY ("Health Marketing Service") OR TITLE-ABS-KEY ("Marketing of Health Services") OR TITLE-ABS-KEY ("Health Marketing Services") OR TITLE-ABS-KEY ("healthcare marketing") OR TITLE-ABS-KEY ("health marketing") OR TITLE-ABS-KEY ("health care

	marketing") OR TITLE-ABS-KEY ("pharmaceutical marketing") OR TITLE-ABS-KEY ("marketing mix") OR TITLE-ABS-KEY ("market mix") OR TITLE-ABS-KEY ("marketing mixes") OR TITLE-ABS-KEY ("market mixes"))
	#2 (TITLE-ABS-KEY (consumer*) OR TITLE-ABS-KEY ("consumer behavior") OR TITLE-ABS-KEY ("Consumer Behaviors") OR TITLE-ABS-KEY ("Consumer Preference") OR TITLE-ABS-KEY ("Consumer Preferences") OR TITLE-ABS-KEY ("Consumer Satisfaction") OR TITLE-ABS-KEY ("healthful behaviors") OR TITLE-ABS-KEY ("healthful behavior") OR TITLE-ABS-KEY ("health behavior") OR TITLE-ABS-KEY ("health behaviors") OR TITLE-ABS-KEY ("health-related behavior") OR TITLE-ABS-KEY ("health-related behaviors") OR TITLE-ABS-KEY ("consumer decision making") OR TITLE-ABS-KEY ("consumer decision-making"))
	#3 (TITLE-ABS-KEY ("Pharmaceutical Services") OR TITLE-ABS-KEY ("Pharmaceutic Services") OR TITLE-ABS-KEY ("Pharmaceutic Service") OR TITLE-ABS-KEY ("Pharmaceutical Service") OR TITLE-ABS-KEY ("Pharmacy Services") OR TITLE-ABS-KEY ("Pharmacy Service") OR TITLE-ABS-KEY ("Pharmaceutical Care") OR TITLE-ABS-KEY (medicines) OR TITLE-ABS-KEY (drug*) OR TITLE-ABS-KEY (pharmacy) OR TITLE-ABS-KEY (pharmacist*)) #1 AND #2 AND #3
Web of Science	#1 TÓPICO: ("Health Services Marketing") OR TÓPICO: ("Health Marketing Service") OR TÓPICO: ("Marketing of Health Services") OR TÓPICO: ("Health Marketing Services") OR TÓPICO: ("healthcare marketing") OR TÓPICO: ("health marketing") OR TÓPICO: ("health care marketing") OR TÓPICO: ("pharmaceutical marketing") OR TÓPICO: ("marketing mix") OR TÓPICO: ("market mix") OR TÓPICO: ("marketing mixes") OR TÓPICO: ("market mixes") #2 TÓPICO: (consumer*) OR TÓPICO: ("consumer behavior") OR TÓPICO: ("Consumer Behaviors") OR TÓPICO: ("Consumer Preference") OR TÓPICO: ("Consumer Preferences") OR TÓPICO: ("Consumer Satisfaction") OR TÓPICO: ("healthful behaviors") OR TÓPICO: ("healthful behavior") OR TÓPICO: ("health behavior") OR TÓPICO: ("health behaviors") OR TÓPICO: ("health-related behavior") OR TÓPICO: ("health-related behaviors") OR TÓPICO: ("consumer decision making") OR TÓPICO: ("consumer decision-making") #3 TÓPICO: ("Pharmaceutical Services") OR TÓPICO: ("Pharmaceutic Services") OR TÓPICO: ("Pharmaceutic Service") OR TÓPICO: ("Pharmaceutical Service") OR TÓPICO: ("Pharmacy Services") OR TÓPICO: ("Pharmacy Service") OR TÓPICO: ("Pharmaceutical Care") OR TÓPICO: (medicines) OR TÓPICO: (drug*) OR TÓPICO: (pharmacy) OR TÓPICO: (pharmacist*) #1 AND #2 AND #3

Appendix 2. Data extracted from the included articles.

Author, Year	Country	Study type	Study goals	Number of consumers/ gender	Age	Consumer profile	Pharmaceutical service	Marketing strategy	Key elements	Conclusion
Alston; Blizzard, 2012	USA	Commentary	Commentary on "The value prescription: Relative value theorem as a call to action"	NA	NA	NA	General (e.g., immunizations, smoking cessation services, disease state management, drug regimen reviews, or prescription dispensing services)	Relative value theorem	Future Vision of Pharmacy Practice, perceived value, services, price, culture of dispensing drugs, culture of the provision of services	A pharmacist who understands the RVT can become a powerful agent of change to help the health care industry make the right decisions to provide sustainable high-quality patient care in the future.
Gore; Madhavan; McClung; Riley, 1994	USA	Exploratory	To determine the extent of consumer involvement in nonprescription medicine purchase decisions	458 Males: 185 Females: 247	NR	NR	Orientation regarding over-the-counter drugs	Five of Zaichkowsky's items were modified to measure involvement in the context of buying drugs without a prescription and the other two items were developed to further reflect the information search characteristic of the involvement construct	Consumers' Involvement Score by Information Source Utilization	No significant differences were noted when involvement was compared on the basis of frequency consultations with family members, friends, or colleagues for nonprescription medicine information. This result, when taken with the differences in involvement that were noted for expert source consultations, suggests that the greater the involvement, the greater the likelihood of expert source consultation for nonprescription medicines. Lay source consultations probably take place because of their immediate accessibility; therefore, irrespective of the degree of their involvement, most consumers use these sources. In contrast, expert sources, because they are not as easily accessible as lay sources, are consulted only when information is actively sought as in the case of high involvement behavior. The nonsignificant correlation between age and

										involvement must be noted with concern. A positive correlation indicating greater involvement among the elderly would have been a more desirable finding, implying the safe and effective use of nonprescription medicines by members of this vulnerable population group.
Grauer, 1981	USA	Commentary	Commentary on "Marketing concepts for pharmaceutical service development"	NA	NA	NA	Dispensing and drug-knowledge-distribution	Target market and Marketing mix	Service, price, distribution, and promotion strategies that satisfies the target market	Pharmacies have an identity problem with the consumer of their services. The marketing concepts discussed in the article can serve as a model for the development, communication and sale of future pharmaceutical services. Pharmaceutical services designed in this way will help the pharmacy achieve strong value with consumers of its services.

Lee, 2010	USA	Survey	To investigate whether these mass-mediated, hybrid, and interpersonal health communication channels can empower patients with the knowledge to influence their physicians to prescribe a specific drug	762 Males: 242 Females: 520	18 - 85 years 48.02 (mean)	Patients who had visited the physician within 3 months and were exposed to direct-to-consumer ads on television, newspapers, and magazines before the survey	Orientation	Two-step flow model; multistep-flow model; direct-to-consumer prescription drug advertising	Empowerment of patients (through mass and hybrid media and through interpersonal communication); physicians' reaction to patients' requests; patients' reaction to physicians' responses	This study raises a pertinent concern seldom talked about in Direct-to-Consumer Prescription Drug Advertising (DTCPDA) regarding the influence of other health care providers such as other physicians and pharmacists. It is proven true that patients educated by DTCPDA and mass mediated drug, information did try to influence their physicians to prescribe drugs, but only patients who had consulted other health care providers got what they wanted from their physicians. The fact that one's own physician is not involved in this type of influence may mean that the physician is prescribing a drug that his or her patients want other than what he or she prefers. That means the physicians gave way to requests of patients advised by other physicians and pharmacists. In this regard, the influence of drug prescription behaviors certainly has come from interpersonal influence of health care providers other than from the mass or hybrid media only. The influence is so strong that patients would switch their own physicians who go against the advice given by pharmacists.

| Lindstrom; Casper; Green; Pedersen, 2007 | USA | Survey | To assess the preferences of grocery store patrons concerning pharmacy services, especially those beyond traditional dispensing activities, using a survey tool and identify study participant characteristics that may predict the success of pharmacy services in the community setting | 163 Males: 43 Females: 120 | range 19-87 (n=148) | General population, over 18 years | 24-hour pharmacy within 20 miles of home; 24-hour drug information; Heart disease education; Influenza and pneumococcal vaccinations; Cholesterol screening; Diabetes education; Automatic refills; Diabetes screening; Comprehensive medication reviews; Urgent care clinics inside of pharmacy; Osteoporosis screening; A1C testing; Fitness education; Pain management education; Travel vaccines; Liver function screening; Thyroid function screening; Memory screening; Weight and body fat analysis; Diabetes glucose meter trainings; Drive-through pharmacy; Blood pressure screening; Asthma education; Smoking cessation classes; Liquid medicine flavoring; Diabetic shoe fittings; Delivery service; Compounding medicine | Marketing of pharmacy services | Pharmacy, pharmacy services, patient preferences, marketing, advertising | A wide range of nontraditional pharmacy services could be incorporated into community pharmacies. However, pharmacies need to provide both traditional and expanded pharmacy services to meet the desires and expectations of their patients. In addition, pharmacy practitioners should expand their marketing options based on patient preferences and market popular services such as flu shots to atypical groups of people, such as those 25–34 years of age. The profession must ensure that the pharmacy services offered complement patient interest. |

| Chen; Ung; Chi; Wu; Tang; Hu, 2018 | China | Exploratory | This article aimed to explore consumers' perceptions regarding the pharmaceutical care that community pharmacists provide in relation to over-the-counter (OTC) drugs | 97 (the study did not set up a target sample size but stopped recruiting when theoretical data saturation was reached) Males: 43 Females: 54 | Over 18 years | People who were older than 18 years and had bought OTC drugs at community pharmacy in the past 6 months | Pharmaceutical care that community pharmacists provide in relation to OTC drugs; Consumer orientation | Qualitative marketing research | Expectations on pharmaceutical care; attitude toward pharmacist's competence; experience of self-medication; suggestions for improving pharmaceutical care | Consumers expected pharmacists to provide professional service about OTC drugs at community pharmacies. However, they were not keen on seeking pharmaceutical care from community pharmacists due to distrust in pharmacists' competence. Consumers' reliance on self-medication with OTC drugs caused them higher drug risks. Collective actions of pharmacists, community pharmacies, and government should be taken to rebuild consumers' trust in the competence of community pharmacist to improve the safe and appropriate use of OTC drugs at community pharmacy. |

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On the Possibility to Use Oxytocin as A Potential Therapeutic Approach for Memory-Related Psychological Disorders

Shahab A. Zarei [1,2], Carlos Tomaz [3*], Carlos Vasconcelos[4],
Maria Clotilde H. Tavares[5], Melika Sarani[6]

1. Institute of Neuroscience, The Center of Excellence in Brain and Intelligence Technology, State Key Laboratory of Neuroscience, Key Laboratory of Primate Neurobiology, Chinese Academy of Sciences, Shanghai, China.
   E-mail address: sh.zarei@sbmu.ac.ir
2. Department of Dana Brain Health Institute, Iranian Neuroscience Society-Fars Chapter, Shiraz, Iran.
3. Laboratory of Neuroscience & Behavior and Graduate Program in Environment, CEUMA University - UniCEUMA, S o Lu s 65075-120 MA, Brazil. E-mail address: ctomaz@ceuma.br
4. Federal University of Pernambuco, Health Sciences Center, Department of Nutrition, LNED, Recife, PE, Brazil. E-mail address: vasconcelos984@gmail.com
5. Laboratory of Neurosciences and Behavior, Department of Physiological Sciences, Institute of Biology, University of Brasilia, CEP 70910-900 Brasilia, DF, Brazil. E-mail address: mchtavares@gmail.com
6. Modeling in Health Research Center, Institute for Futures Studies in Health, Kerman University of Medical Sciences, Kerman, Iran. E-mail address: sh.sarani@yahoo.com

Abstract

Studies have indicated that oxytocin has an influence on cognitive functions such as attention, memory and emotional regulation, particularly in the context of social and communicative behavior. There is a growing interest in the use of oxytocin as a treatment for memory-related psychological disorders and social cognitive disorders. The ease of access to the brain intranasally, numerous positive evidences and widely advertised as a wonder drug, foster this interest. However, recent studies also have shown that the effect of oxytocin could varied, even leading to reverse results. The factors that lead to the effects of oxytocin and its underlying processes on such variables are still uncertain. The inconsistent evidence of general oxytocin effects on memory and neuropsychological conditions is an important issue in considering oxytocin as an adjunct therapy. Therefore, understanding the effects of oxytocin, within various emotional and social context, is important before oxytocin could be efficiently used for improving learning and communication impairment or managing neuropsychological disorders. Here, we intend to review various theories regarding the effect of oxytocin on memory, accompanied by its mechanisms which are proposed in human and animal experiments. Based on evidence from these studies, we explore the potentials and limitations of oxytocin's pharmacotherapeutic applications as a treatment to improve neuropsychological disorders.

Keywords: Oxytocin, Memory, Contextual factor, Psychological disorders, Cognitive function.

Introduction

Oxytocin is labeled as "love hormone" or "cuddle hormone", because it plays a determining role in social bonding, feelings of love and well-being. Oxytocin is a nonapeptide that is mostly produced by the supraoptic and paraventricular nuclei of the hypothalamus. It is store and secrete by the posterior pituitary gland. From the posterior pituitary, it is released into the bloodstream to act as a hormone and influence body functions [1].

For years, oxytocin was known as a crucial factor underlying childbirth, maternal behaviors, and, lactation [2]. As well as peripheral actions, oxytocin also has a neuromodulator and neurotransmitter actions in the brain. It has been observed that endogenous concentrations of oxytocin in the brain are as much as a thousand times greater than peripheral concentrations [3]. The main source of oxytocin in the brain is the dendritic release from hypothalamus into the extracellular space, as well as direct projection from parvocellular neurons in the paraventricular nucleus to other brain areas [4]. Oxytocin receptors are expressed in the spinal cord and many areas of the brain, including amygdala, suprachiasmatic nucleus, hippocampus, striatum, bed nucleus of stria terminalis and brainstem [5], which regulate motivations, emotions, reward processing and support mnemonic and executive functions [6]. Several studies have reported that oxytocin plays a key role in some behaviors, such as increasing of trust [7], empathy [8], sexual arousal [9], social behavior [10], cognitive function [9], modulating stress and metabolic/nutritional homeostasis system [11,12] and also some antisocial states such as fear, aggression, jealous and pride [13–15].

One important area where oxytocin plays a major role is its impact on learning and memory. Memory is a fundamental cognitive function that help people to constantly access relevant information and adjust their behavior appropriately after the encoding of experiences. In the social behavior, memory helps individuals to maintain relevant information in different social situations, and, consequently, adapt to social interactions in the future. Therefore, if oxytocin plays a significant role in human social cognition, it will also affect the encoding of new information [16]. These findings convey the feasibility of using oxytocin as a memory enhancer and potential treatment for memory-related disorder, such as amnesia, Alzheimer's disease, dementia, mild cognitive impairment and so on.

However, existing findings concerning oxytocin effects on memory and suggested mechanisms include numerous contradictions. This is an important issue in considering oxytocin as an adjunct therapy for cognitive deficits, because these disorders might be even exaggerated by using oxytocin. Therefore, understanding all aspects oxytocin' effects on cognitive functions, within various emotional and social context is important, before it can be efficiently used for improving learning and communication impairment or managing neuropsychological disorders.

Here, we compare the results of different healthy and clinical groups of humans, animal studies and also its suggested mechanisms for certifying the role of oxytocin in three hypotheses; Impairing hypothesis, facilitates hypothesis and selective hypothesis. We discuss therapeutic potentials as well as limitations of the (adjunct) use of oxytocin in treatment of neuropsychological disorders, with emphasis in memory.

Impairing Hypothesis

Several studies revealed the negative effects of oxytocin on memory processes. In a preliminary study on participants who performed a neutral verbal task, it was found that exogenous oxytocin had a negative effect on human memory performance in retaining a list of words [17,18]. Administration of high dosages of oxytocin to human subjects also showed that while learning did not appear to be affected, but subsequent recall (recalling 20 nonsense four-letter words and recognition of facial images earlier seen) was impaired [17]. In another study with verbal stimuli, oxytocin decreased memory efficiency for a category of sex- and baby-related phrases. [19].

In a clinical study on post-traumatic stress disorder (PTSD) patients, significant effects of a single dose of oxytocin on PTSD symptoms and on desire for social interaction were found [20]. It was concluded that oxytocin significantly decreased the frequency of recurrent thoughts about the traumatic experience. Mood was also elevated and feelings of anxiety reduced.

With regard to detrimental effects on certain memory-related functions, oxytocin may be engaged in the forgetting of mother-related delivery pain [21].

Animal studies have also shown that oxytocin consumption in inhibitory avoidance testing after exercise could significantly reduce memory efficiency in mice. While using an oxytocin receptor antagonist after practice, the authors observed enhanced memory performance [22]. Oxytocin also had a detrimental effect on the social memory in male rats, so that, rats who received oxytocin, were less likely to recall the mice that they had encountered before [23].

Although, the mechanism of Impairing hypothesis is not fully understood, several studies have indicated that oxytocin decreased the initial storage of information and the amount of storage [24]. In this line, studies also have suggested that reducing the speed and performance in tasks after administration of oxytocin was due to its sedative effects   [25,26]. Complementarily, it was proposed that oxytocin is an effective factor in these modifications by reducing the cortisol levels and anxiety in response to physical stress [27]. In humans, the observation of emotional visual stimuli was accompanied by activation of the amygdala, but oxytocin significantly reduced this activation [28] and enhanced information processing in other brain areas [29].

Developmental findings indicate that oxytocin has a physiological effect on mental functions during delivery and breastfeeding, by focusing maternal attention on the maternal-fetal and maternal-infant units. These effects would be achieved by oxytocin to isolate the mother from external stimuli [17].

With regard to these studies, some authors suggested that the detrimental effects of oxytocin on remembering past memories might help the situation for those who had an unpleasant memory of their lives such as social anxiety, post-traumatic stress disorder, and etc. However, there is still an urgency for understanding the exact mechanism and its implementation.

Facilitating Hypothesis

In fact, the above mentioned mechanisms did not cover the results of many other studies describing the role of oxytocin in facilitating recognition, learning, memory, and decision making [6,30]. Thus, in a study on schizophrenia patients, two cognitive tests were applied to test the amnesic effects of oxytocin treatment:

the California Verbal Learning Test and the Letter Number Sequence [31]. Tests were performed at the beginning and after 3 weeks of treatment by oxytocin. No evidence of an amnesic effect was observed. In the oxytocin condition, patients showed even better performance on two subtests. In a related vein, after using oxytocin, the amount of certain personal memory retrieval and its details increased in the autobiographical memory test [32]. Oxytocin has also shown its ability to intensify the men's early memories of their mothers [33].

Various studies have shown that oxytocin has distinct effects on memory performance for social behavior [34]. In particular, intranasal oxytocin administration could enhance recognition memory for faces regardless of emotion expression [35], and this improvement was not correlated to response biases, gender or mood changes [36]. In a clinic study schizophrenic patients showed that oxytocin administration improved emotion recognition (happiness, surprise, fear, sadness, disgust and anger) independent of type of emotion and morphing status [37].

In animal studies, oxytocin has demonstrated facilitatory effects on memory and social recognition. In a research on mice, during their maternity where the level of oxytocin was naturally high, their spatial memory improved significantly [38]. Oxytocin knock-out mice failed to recognize familiar conspecifics after repeated social exposures and social recognition [39]. It is reported that oxytocin was required for the normal development of social memory and the ability to identify a familiar individual in mice [40].

Moreover, it has been reported that oxytocin modulate reactions to fear by increasing social memory recall. Rats that are genetically modified to have a surplus of oxytocin receptors has shown a greater response to fear of a previously conditioned stressor [41].

A dominant mechanism proposed that oxytocin enhanced the salience of emotional and social information of stimuli which led to a faster response, since these signals are especially important for the survival and development of social behavior [42]. A related model suggested that oxytocin increased attention to emotional and social issues [43]. According to this hypothesis, oxytocin, through the dopaminergic mechanism of attention, regulate orientation towards stimuli that are perceived as socially salient [44]. On the other hand, attention to social cues was due to relationship of oxytocinergic circuits with the dopaminergic system. It has also been shown that oxytocin could increase dopaminergic activity in VTA in response to social symptoms [45]. Oxytocin could reduce amygdala activation, but increased functional connectivity between posterior amygdala and superior colliculus to enhance the proportion of the gaze shifts over negative and positive emotions towards the eyes. So, oxytocin may help detect fear or happiness from subtle cues around the eyes [46].

Results of several studies have demonstrated that oxytocin could enhance the social approach, intimacy and bonding by strengthening encoding through the recall of positive social information [47]. In contrary, some studies showed increased memory only for faces with neutral or negative expressions [34].

Intranasal administration of oxytocin rescued stress-induced impairments in long-lasting synaptic plasticity and recognition memory. The authors reported the rescue effect of oxytocin on synaptic dysfunction in hippocampal slices from stressed animals. These findings indicated that posttreatment with oxytocin after experiencing a stressful event may preserve synaptic plasticity and cognition function, suggesting the therapeutic potential of oxytocin for stress-related disorders, including posttraumatic stress disorder [48]. Therefore, a better understanding of the key role of oxytocin on the cognitive functions can provide an

impetus for more successful interventions for learning impairments and communication or management of psychological disorders. For example, using oxytocin for autism spectrum disorders (ASD) to enhance memory performance, attention to emotional and social cues and more attention towards the eyes.

Selective Hypothesis

Based on contradictory findings that highlighting the increased or reduced effects of oxytocin on memory, some studies suggested that oxytocin administration in humans can lead to both improvement or impairment in perception [49] and memory tasks [32,47] depending the cognitive demand. So that, oxytocin could significantly and specifically enhance recognition of happy faces, but not disgust, fear, anger and sadness [36]. In this regard, also, a study was shown that the effects of oxytocin on social stimuli (angry and smile faces) or nonsocial (colored lights) were different. Oxytocin intake could only promote socially reinforced learning but not neutral stimuli [8].

This dual effect of oxytocin also has been debated about inter- and intra-group behaviors, such as cooperation and competition between and within groups. The administration of oxytocin in humans in-group trust and collaboration, defensive and aggression toward competing out-groups [50] as well as human ethnocentrism [51]. In a recent study, functional MRI and measurements of endogenous oxytocin in participants who viewed an ingroup and an outgroup member's suffering were evaluated. It showed that intergroup conflict that experienced by the revenge group is associated with an increased level of oxytocin in saliva. Moreover, the medial prefrontal activity in response to ingroup pain in the revenge group, but not in the control group mediates the association between endogenous oxytocin and the propensity to give painful electrical shocks to outgroup members, regardless of whether or not they were personally involved in the conflict [52].

Oxytocin also modulate rodent and monkeys' performance in memory tasks, and both increased and reduced effects were reported [53–57]. The effects of oxytocin on the perception and evaluation of social stimuli greatly was dependent on the emotional/social valence of stimuli [58] and it is suggested that oxytocin's effect is context-dependently in monkeys [58,59]. In our recent study that associated with the effects of oxytocin on macaque monkeys' memory performance, findings showed that the effect of oxytocin was dependent on the emotional content of stimuli. Thus, the oxytocin increased the adverse effects of negative stimuli on recalling, but, moderated this effect for positive stimuli. The results of our research on monkeys did not support models indicating a general effect of oxytocin in enhancing salience or declining of attention to social stimuli. Instead, our findings showed that the cognitive effects of oxytocin were related to the emotional valence of contextual factors [60]. It proposed that the neuropeptide oxytocin modulates the salience of emotional/social stimuli and consequently influences the processes of perception, attention, and learning which underlie social behavior.

There are few explanatory mechanisms regarding this theory, however, in a study [61], elevated oxytocin levels showed reduced activation in the amygdala during infant laughter. But it enhanced functional connectivity between the amygdala and the orbitofrontal cortex, the hippocampus, the anterior cingulate, the supramarginal gyri, the precuneus and the middle temporal gyrus. Increased functional connectivity between the amygdala and regions involved in emotion regulation will reduce negative emotional arousal

while enhancing the infant laughter salience [61]. It appears that oxytocin has influenced the processing of both positive and negative information differently.

Other Variables

Despite all these results, oxytocin still showed a different effect depending of task demand and individuals [62]. Thus, inconsistencies in oxytocin effects on memory performance could be partly due to the stimuli and type of memory test [19]. In addition, the context- and person-dependent effects of oxytocin also affect the memory performance [63]. Therefore, the contradictory effects of the oxytocin might be due to the individual differences (e.g. different empathy score) and diverse populations (males, females, healthy, clinical, etc.). Studies in humans and other species show that the effects of oxytocin on the perception and assessment of social stimuli depend greatly on the emotional/social valence of stimuli [58,64], and the internal situation (having stress and anxiety) in which the subject encounters the emotional stimuli [65,66]. Several studies showed that female subjects responded differently to oxytocin administration than male. It might be due to sex differences in circulating levels of oxytocin (women tend to have higher levels of oxytocin than men) and due to the regulatory effect of sex hormones on the oxytocinergic system [67]. Since the menstrual cycle can affect the outcome of oxytocin administration, much more oxytocin studies have been conducted with male participants than with females. Nevertheless, the limited female research also showed contradictory findings.

The individual dependent nature of the effects of oxytocin administration has been observed in several studies. For instance, only in people with low subjective socioeconomic status (SES) backgrounds oxytocin boost emotional theory of mind. This shows that individual differences moderate oxytocin's role on social behaviors [68]. The attachment type (dependence, closeness and anxiety) also identified as a major personality regulator of oxytocin effects in humans [33,69–71] and it is confirmed by research regarding the effect of oxytocin on processing new information into memory. In humans, attachment style has been related to individual levels of oxytocin and genetic oxytocin receptor polymorphisms, so it seems to represent an endophenotype that defines the sensitivity of an individual's oxytocin system [44,70]. In fact, oxytocin improved memory accuracy for low-dependence score participants (people who feel insecure depending on others) but decreased memory accuracy for high-dependence score participants (people who feel relaxed depending on others). The authors claimed that oxytocin would have more beneficial effects for the less proficient than those of the more proficient [42]. It is also argued that the positive effects of oxytocin on prosocial behavior were only restricted to persons with supportive family backgrounds [72]. It has been indicated that positive oxytocin effects on neurobiology or behavior are reduced or absent in persons with negative caregiving experiences. Suffering in early life can alter the function of basal oxytocinergic system, and likely involves changes at the level of the oxytocin receptor. Altered receptor density, affinity or function at the level of oxytocin receptor may be linked to experience-dependent methylation level of the oxytocin receptor (OXTR) gene regulating the oxytocin system. In addition, differences in genetic expression can lead to reduced sensitivity to intranasal oxytocin [63]. From these studies, it may be concluded that oxytocin administration does not generate positive effects in individuals who as a consequence of unfavorable early caregiving.

Therefore, the inconsistencies of these results would probably be dependent of additional factors, including gene polymorphism, early life experiences as well as motivational status [73,74]. It showed that OXTR had genetic differences with different effects on individual behavior. The polymorphism of OXTR occurs in three types: GG, AG, AA. A-allele associated with more sensitivity to stress, fewer social skills, aggressive behavior and more mental health issues than the GG-carriers [75]. GG carriers, with their naturally higher levels of oxytocin, empathy and "Reading the Mind in the Eyes" test, better able to distinguish between emotions, more optimism, mastery, and self-esteem, higher in human sociality [76].

In a recent study it has been shown that subjects with the GA genotype have a poorer memory for surprise recognition than subjects with the GG genotype. Interestingly, subjects with the GA genotype showed faster recognition memory for fear than subjects with the GG genotype. This study indicates that polymorphisms may affect memory processes of emotion-recognition and can contribute to a further understanding of social behavior [77]. However, its effect on memory and cognitive functions need more investigations.

Conclusion

Taking into account the above revised studies, we propose that using oxytocin as a memory and cognitive modulator for treatment or adjunct therapy in some neuropsychological situation such as PTSD, amnesia, Alzheimer's disease, dementia and so on, is not far-fetched. The possibility to use oxytocin in the light of its great variability and even contradictory outcomes, showing that its administration must take into account some variables such as arousal-emotional state, past experience, motivation and lifestyle of the participants (their stress level, exercise, smoking food/drink and their sleep pattern). We hope this working hypothesis can generate studies to elucidate the neural mechanisms underlying oxytocin memory/cognitive properties.

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A study of the use of software related to phonic skills as part of the literacy programme in the infant department of a primary school in East Trinidad.

Adita Maharaj, Ph.D

University of Trinidad and Tobago

Abstract

Research abounds on the importance of phonic development as an integral aspect of reading success as well as the use of technology in schools for the promotion of key reading skills. This study focuses on the use of existing phonic software in a primary school as part of the literacy programme. It utilizes a mixed method approach to closely examine the responses of participants through careful observation of interactions with existing software in a prepared environment. The findings reveal that the software has a positive motivational impact on the majority of participants in the study. Coupled with this, the findings highlight the need for collaborative planning among staff members for proper assessment of phonic development. The findings of the study can provide some direction with respect to planning of the literacy curriculum for this and similar schools in the district.

Keywords: phonics, software, motivation, literacy

Introduction

It is apparent that phonic development must be an integral part of any balanced literacy programme. At the school in question, the problems faced with respect to literacy success are multidimensional in nature and are accounting for the general decrease in academic performance experienced at the school. A close examination, through observations and perusal of success reports of the school's performance, has indeed revealed some alarming statistics with respect to phonics.

Literacy researchers advocate a programme that is well balanced and employs an integrated, interactive approach to literacy instruction. The use of the computer is but one of these strategies that, not only appeals to the young learner in this technologically advanced world we live in, but can aid in the reinforcement needed to close performance gaps. This study sought to examine the use of the existing phonic software at the school as part of the activities offered in the literacy programme. In so doing, the teachers were also engaged in a reflection and review of the participants, both in the classroom and during the exposure to technology, as well as their own planning techniques.

Background

At Sunshine primary school, there are an increasing number of children who are being diagnosed as struggling readers, diagnostic tests conducted by Student Support Services from the Ministry of Education

reveal that these children frequently have deficiencies in phonemic awareness and phonetic ability. Personnel who are trained specialists and are outsourced by the Ministry of Education have also been at the school within the past two years in connection with all the children who seek special concessions for the Secondary Entrance Examination. Reports at the school from these sessions revealed that major gaps with respect to phonetic ability exist and are affecting the performance of children. Interviews with teachers at the lower junior levels have also indicated that weekly and end of term test results reveal lower test scores on the assessment that require children to utilize their phonic skills.

Statement of the Problem

This study will seek to examine the use of technology, specifically, existing phonic related software, as part of the literacy programme at Sunshine Primary School.

Purpose of the study

It has already been identified that children are lacking basic phonic skills at the early childhood level at Sunshine Primary School and this is hampering reading success. This study will examine the responses of two infant classes to the existing software, which emphasizes facilitating phonic skills. The data collected upon examination of the use of the software should highlight the motivational aspect of utilizing technology as part of the school's literacy programme as well as focus on the issue of collaborative planning amongst staff members.

Research Question

How is phonic related software, utilized as a part of the literacy programme in the infant department of Sunshine Primary School?

Sub Questions

-What specific phonic programme/ programmes are in use at the school and how, in detail, is/are they utilized?
-What are teachers' reactions to the use of the phonic related software?
-What are children's responses to the phonic related software?

Significance of the study

This study will examine the responses of children to existing software designed for building phonic skills. The existing literacy programme, through observations and perusal of schemes of work, has revealed that the strategies employed are confined to the classroom with no integration across disciplines and a heavy reliance on worksheets. There is limited use of the computer utilized as a tool for teaching. A study of children's responses to the use of technology will provide invaluable data for the school.

This study will serve to bring a critical view to the current methods utilized with respect to the teaching of phonics. It can also serve to highlight the issue of collaboration among staff members with respect to

curriculum planning and evaluation. The semi-specialist, namely, the Information Technology (IT) teacher, will also become involved with the classroom teachers in planning, designing and amending literacy curricular materials.

Methodology

This study was descriptive in nature and employed a mixed method approach to methodology. The study involved gathering data through observations, interviews and a questionnaire that described in detail, children's responses to phonic software focusing on the motivational aspect. This data was then arranged, tabulated and analyzed. Data was organized into patterns that emerged during analysis and was supplemented by the use of visuals to aid the reader.

As mentioned, the use of observations, interviews and questionnaires were the main avenues for gathering data. The following were utilized:

- An initial interview was set up with the teacher assigned to conduct computer classes at the school and apprise him of the study. This instrument was qualitative in nature as it was purely descriptive. The Information Technology(IT) teacher was able to indicate what program existed for phonic development along with a detailed description of such. This served to answer the sub research questions "What specific phonic programmes are in use at the school and how, in detail, are they utilized?"

- A questionnaire   for the teacher to gather evidence on the use of the computer for teaching phonics; this included the frequency, if any, her views on the use of such and how she felt it was impacting or will impact the children. This too, was qualitative in nature and consisted of pure narratives to document responses. This answered the question "What are teachers' reactions to the use of the phonic related software?"

- A mixture of narratives in the form of a structured observation form, interview and checklist to capture children's responses to the phonic programme currently being utilized. A structured observation form was used for the gathering of narratives to eliminate bias.

These were a mixture of quantitative and qualitative data, in addition to the description of events using anecdotal records, there were items on the checklist and structured observation forms that could be defined and measured. The interviews with the children were done to capture their feedback on the phonic exercise; these were qualitative in nature. Data gathered answered the sub question "What are children's responses to the phonic related software?" It is noteworthy to say that the responses examined were based on the answers given by the participants on tasks as well as the interest and motivation displayed whilst performing these tasks.

Sampling Procedure

In an attempt to avoid biases, a probability sampling method was used for selection of participants. A stratified sampling method was employed in this instance. This was chosen since the target participants

were a small subgroup of the entire school population and thus variability was lower. The school has thirty classes in total. Given the constraints of time, this population was too large to observe. There were six Second Year Infant classes each containing twenty five plus children at this school. Two classes were randomly chosen, after which, ten students each were randomly selected giving a total of twenty student participants.

Validation of Data Collection Instruments

Prior to the conduct of the study, the data collection instruments, namely, the questionnaire, structured observation form and interview questions were administered in the same way under similar conditions at a neighboring school. A debriefing session was done with the respondents to gather information on the clarity and usability aspect of the data gathering instruments. This proved to be a useful exercise since all the data gathering instruments were user friendly and achieved their objectives. Additionally, at the school in question, there was an appointed Head of Department who coordinates the activities related to curriculum for the infant department. The instruments and preliminary results were reviewed and information garnered from this officer's assessment indicated that the instruments did yield the type of data required for the study.

Procedure

- The interview with the Information Technology teacher was administered at the beginning of the research period. The name of the software in use was noted along with the objectives of the programme.
- The timetable for the computer classes was accessed and perused. The time slots for the classes in question were noted. Permission was sought from the Principal for the researcher to observe the children during the assigned times. During these times, the researcher utilized the structured observation form to carefully record children's responses to the tasks. The checklist was done weekly for each child.
- The questionnaire for the teachers was administered during the fourth week of the research period. This allowed teachers the opportunity to observe the participants closely since they may be unfamiliar with the participants in question (first term of academic year).
- In the sixth week of the research period, the interview with the children was conducted. The interview with each child was approximately fifteen (15) to twenty (20) minutes long.

Data Analysis

The analysis will be done according to three major categories, data collected from; the Information Technology teacher, the classroom teachers and the participants.

The Information Technology Teacher

The data collected from the initial interview with the Information Technology (IT) teacher revealed some very salient points. Firstly, the Information Technology (IT) teacher has a comprehensive technological

plan aligned to each class at Sunshine Primary School. His intentions are to liaise with the class teachers to ensure that the content of his programme supports the classroom teaching. This collaboration did not occur for this academic year and thus the phonic software in use was not explained or demonstrated to any of the classroom teachers in question. This is due mainly to a lack of non –contact teaching, collaborative planning sessions at the school, making meetings challenging. The Information Technology teacher continues to use the programme since it was sent by the Ministry of Education and it is assumed that the software was chosen by literacy specialists at the Ministry. It must be noted, however, that the programme was not in use for the past two years with no apparent reason given.

Secondly, the interview revealed that although the principal of the school has mandated that all teachers must accompany their children to all classes outside of the classroom e.g. computer, physical education etc., teachers accompanied the participants to the computer classes approximately 50% of the time. Throughout the six week research period, the researcher observed Teacher A accompany her class twice and Teacher B three times. The teachers normally assist with class control in the computer room but do not interact or assist the children with the phonic activities.

Thirdly, the success of the phonic activities is hinged on the children's ability to move through the activities and the teacher's feedback. The Information Technology teacher revealed that a meeting is carded for the end of the term in order to discuss the participants' progress as evidenced by his own record keeping and the participants' interactions in the regular classrooms. If this meeting does not come to fruition, then proper evaluation of the use of the programme cannot be done.

The Classroom Teachers

Both teachers are in agreement, that the use of the phonic software as part of the literacy programme in the school, has value. It is clear that in tandem with the comments made by the Information Technology teacher, the time constraints account for a lack of collaborative planning. The teachers' assessment of the value of the software is based on the children's apparent excitement to attend the classes and prior knowledge of the software based on previous classes they had.

The teachers were not very detailed with respect to how they view the use of the software benefitting the participants in the classroom but were very adamant that the children are eager to go to the computer lab and interact with the phonic software. The research question which requires an examination of teacher's response to the software therefore cannot be answered in detail without a longer research period for questioning and observations. The key point to note, however, is that the teachers are in favour of the programme. They send the participants regularly to the classes and in their opinion, the use of the software is motivating as it excites the children to learn when they return to the normal classroom setting.

The Participants

The structured observation form, checklist and interview with the participants all served to answer the question "What are the children's responses to the phonic software?"   The first category of observations required the researcher to log the events at the start of the sessions. It can clearly be seen that 60% of the participants displayed positive behaviours towards the software, 30% still awaited instructions in the

beginning but started to gain confidence after week two , as evidenced by their eagerness to open the programme and 10% was still hesitant, even at the end of the research period.

Documentation of participant's eagerness to commence also indicates a large percentage, namely 90% in the affirmative, it can be deduced that the participants who scored in the 60% category for positive behaviours, most likely would have been included in the 90%. Interestingly as well, 10% of the participants seems to be experiencing difficulty and needs to be assisted. This is similar to the 10% of the participants who were hesitant to commence the tasks.

One can see that a resounding 75% of the participants displayed some measure of competence as evidenced by their ability to complete the tasks on their own and move through the levels. The participants who fell in the 25% band were also able to complete the task but the major difference is that they required assistance from the teacher and their peers. Similarly, as in the last two categories, the larger percentages denoting positive behaviours are comparative to this category as well. A similar resultis also evidenced in another category where 82% of the participants scored high motivation and 18% scored mediocre. The subtle differences in the behaviours as described in the data presentation were mainly due to the fact that the participants in the 18% relied on the teacher more but were able to complete the task eventually, which again is in keeping with the results from other aforementioned categories.

The data from the checklist is also indicative of a larger percentage of the participants displaying behaviours in keeping with high motivation. It can be seen that 85%, 97% and 71% of the participants are using the computer with minimal assistance, responding to the activities and moving to challenging levels respectively in each category. This can be solidly compared to the 82% who are displaying the criteria for high motivation, the 90% depicting eagerness and displaying confidence. Additionally, if the tallies from the checklist reveals the mean score for each of the criteria would be 30 since the total tally possible is 60 and there are 2 categories of 'Yes' and' No'. It can clearly be seen that the tallies are above the mean mark for the following criteria:

-Participants are using the computer software with little or no assistance from the teacher

-Participants are responding to the activities required in the software programme

-Participants are motivated to move to challenging levels in the phonic programme

The one criterion below the mean mark was for the one which expressed children's frustration and inability to complete tasks which yielded 0% . This is definitely in keeping with the aforementioned analysis.

Concluding, the interview with the participants further depicted the qualitative aspect of this research study by comprehensively categorizing the descriptions of the participants. The data clearly indicates large percentages are again allotted for criteria such as enjoyment-100%, engaging in activities-95%, confidence-90% and a lower percentage for experiencing difficult-20%. It must be noted that the interviews revealed, that through the exposure to the activities using the phonic software, a larger number of the participants felt that they could better cope with regular classroom lietracy activities, as evidenced by the responses that they feel more compelled to participate and answer questions.

Discussion

Slavin, Lake, Davis & Maddin (2011) indicated that phonic software inclusion has the ability to convey concepts in new innovative ways that would otherwise not be possible, efficient, or effective with traditional instructional methods. The high affirmative percentages previously discussed are suggesting that the use of the phonic software was indeed a new, innovative way for these participants to be exposed to phonic activities. The fact that Teacher A indicated that the cramped conditions, noise level and lack of a computer in the classroom setting make it difficult to do interactive phonics lessons reinforces this statement.

Although this study was not a comparative one, the research conducted by Wild (2004) cannot be ignored. The findings of the study conducted by Wild (2004) clearly indicated that the students who were exposed to software were highly motivated and displayed higher incidences of enjoyment as opposed to those who were not exposed. So too, in this study, students displayed high percentages of motivation. This motivation was measured using certain criteria adopted from the work of Christopher (2010) who theorize that indicators of motivation include persistence-the ability to stay on task, choice of challenge-welcoming a task that is challenging, dependency on adults-low reliance is directly related to high intrinsic motivation and lastly, emotion-children show enjoyment and positive emotions when motivated. Each or a combination of most of the aforementioned data collection instruments and resulting data served to capture these indicators. It can be categorically stated that a majority of the participants were indeed motivated by the software.

There are certain issues arising out of the study which must be highlighted. The fact that there is no collaboration between the classroom teachers and the IT teacher, coupled with the fact that the teachers do not accompany the participants to all the computer classes are cause for discussion. If there is no collaborative planning, then the success of the programme may be compromised. This is supported by Vega (2013) who indicated that properly trained staff, adequate equipment, ongoing funding, and successful integration of technology into existing teaching are needed in order to maximize learning for students. Sunshine Primary School is fortunate to have a trained teacher with appropriate qualifications as well technological resources and software approved by the Ministry of Education. These, however, as indicated by Yu (2013) must be carefully integrated to ensure learning objectives are being met.

This study was riddled with the main challenge of time. Careful observation of a larger cross section of this and other primary schools in the area would have produced more definitive results upon which more generalizations on a district and national level could be made. The main research question, however, "How is phonic related software, utilized as a part of the literacy programme in the infant department of Sunshine Primary School?" was answered through the data collected on the various instruments. The definite pattern of high percentages for positive behaviours when exposed to the software can indeed be utilized by the Administrator and staff of the school to plan for the further integration of technology in the literacy programme.

Recommendations

The researcher proposes the following recommendations for Sunshine Primary School:

- Although the software was sent by the Ministry of Education, an attempt must be made to meet with the literacy specialist attached to the district to ensure the reliability and smooth integration of the phonic software as part of the entire literacy curriculum. The literacy specialist can assist in the formulation of a literacy team to ensure the success of the use of technology as a part of the programme.

- Regular, on- going collaborative sessions for the purposes of planning the literacy programme for the upcoming term as well as assessing the use of the software throughout the term.

- Individual record keeping by the Information Technology teacher as well as the classroom teacher on each child's progress with regards to phonic development

- Professional development sessions with all members of staff with respect to the type of software being utilized and its objectives

- Consistent use of all the software approved by the Ministry of Education. Regular liaising with literacy specialists in the district to ensure objectives of technological programmes are achieving the school's needs and major literacy objectives

- Research with primary schools across the district on the issue of phonic development. Concurrently, formulation of literacy teams within schools and at the supervisory level compiling administrators, school supervisors, university personnel /specialist, teachers and literacy coaches to conduct research, collect and collate data, analyse findings and lend further support to schools based on the district's research

Conclusion

The aforementioned recommendations are all hinged upon some very distinct findings in this study. It can be categorically stated that participants experience some level of enjoyment and by extension feel motivated when using technology as part of the literacy experiences at school. It is hoped that a further analysis of the findings and a critical evaluation of the school's practices may indeed further assist in improving the school's reading performance.

Indisputable   also are the views expressed by the classroom teachers that the use of the technology does indeed assist in the interactive sense for reinforcing phonic skills, which can be challenging in the classroom setting.   The fact that the school has a functional computer lab with a resource teacher is another advantage that this school has with respect to the continued use of the technology. On a larger scale, although the study was not in depth enough to generalize, it can be used as an example to other schools in the district with similar resources.

Concluding, the study suggested the need for a collaborative approach towards the planning and assessment of the use of the software. As educators, constant dialogue must be done in a bid to examine whether the literacy experiences being provided for children are achieving intended learning outcomes. A focus on the motivational aspect of children's learning is always a very rewarding experience as it emphasizes the vast power we have in creating and sustaining life-long learning.

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COVID-19: The Role of Leadership in Response to Disruption

Moncef Belhadjali, Sami Abbasi

Norfolk State University

USA

Abstract

COVID-19 has created unprecedented circumstances throughout the world that resulted in a disruption to "Business as Usual". The world economy has been shaken enormously, scores of lives have been lost, and a "New Normal" has been adopted by everyone. In this atmosphere, leadership becomes a high commodity, and a well-sought after skill. Therefore, individuals everywhere turn to decision-makers at the top of the hierarchy for their leadership skills. This paper provides examples to illustrate the importance of leadership to turning disaster into efficient response.

Keywords: COVID-19, leadership, pandemic, disruption

Introduction

By the end of 2019, the news spread throughout the globe that a virus started sweeping across Wuhan, China. This virus has become known as COVID-19. The scientific consensus is that this virus has a natural origin, and may have been the result of people processing bat carcasses and guano in the production of traditional Chinese medicines. The virus COVID-19 has common signs of an infection including respiratory symptoms and may cause death, for example, the New York Times printed the names and memories of 100,000 individuals that died as a result of being infected by this virus (NYT, 2020).

At the start of the year 2020, the World Health Organization (WHO) started disseminating information regarding COVID-19 to the United Nations' (UN) countries (WHO, 2020). Throughout the world warnings to "Business as Usual" have been issued. A number of countries closed their borders; many airlines made a considerable reduction in their national and international flights; almost all sports events and competitions were cancelled or suspended; educational institutions closed their doors and sent students home; and businesses deemed unessential were required to close their doors by official government agencies. For example, the U.S. Homeland Security Department identified 19 guidelines on essential services such as financial institutions, medical and health care, food and agriculture, and law enforcement (Milliken, 2020). The World Economic Forum surveyed 350 senior risk professionals. This is to assess their perceptions regarding the most worrisome for their companies (Clift & Court, 2020).The results of this survey revealed that the top concerns were (prolonged recession of the global economy, 63.3%); (surge in bankruptcies, 52.7%); (cyberattacks and data fraud due to sustained shift in working patterns, 50.1%); and (failure of industries or sectors in certain countries to properly recover, 50.1%).

March 2020, Gallup.com published the results of a survey on what employees need from leaders, in response to COVID-19. The results revealed that employees strongly agreed with the survey statements as follows: (the employer communicated a clear plan, 39%); (I feel well-prepared to do my job, 54%); (My

immediate supervisor kept me informed about what is going on, 48%); (the organization cares about my overall well-being, 54%) (Harter, 2020).

Under these conditions of disruption caused by COVID-19, organizations turn to decision-makers at the top of the hierarchy, and rely on their leadership skills. This paper provides examples to illustrate the importance of leadership to turning disaster into efficient response.

Leaders and Risk Mitigation

As the coronavirus continues to spread, leaders need to evaluate their disaster recovery and pandemic plans. This will help them more in preparing for and responding to challenges. Overall, leading through a crisis requires taking the long view, as opposed to manage the present. However, leaders need to recognize that the return to work should happen in stages, and pandemic management protocols should be reviewed and refined. To help turn disruptions into productive and proactive business operations, and to maximize the odds of success, a set of steps were suggested (EY Americas, 2020). These include:

(1) Create a coronavirus crisis management plan, and recognize the difference between traditional disruption and pandemic-related disruption.

(2) Appoint a crisis management team with representatives from each business function with direct line to the CEO.

(3) Establish communication plan for employees, customers, venders, and the public.

(4) Determine the potential impact of COVID-19 on disrupting your operations.

In the context of disruption to operations, especially the impact on the workplace, the MIT Sloan Management Review run a survey (Smarp, 2020). The results revealed that the top five issues that employees have on their minds are job security, personal health, childcare & home schooling, personal finances, and remote work. The authors of the report appear to suggest that the best way to manage a crisis is to stay ahead of it. To maintain operations, there is a need to determine which parts of the organization to prioritize. For this purpose, a recovery playbook was suggested (Renjen, 2020). This playbook suggested a mapping between six macro outcomes and their corresponding core strategic questions. These outcomes mainly relate to profitability, digital transformation, workforce support, and stakeholders' expectations. The core strategic questions relate to the impact of this disruption on consumer behavior, the move toward digital transformation, the social contract with workers, and social and institutional expectations.

Turning Disaster into Efficient Response

The COVID-19 pandemic have changed the workplace, and disrupted the functioning of organization. One consequence of this disruption is the struggle to lead employees. Leadership in not synonymous with management. In this pandemic experience, leadership takes you into a new territory. Specifically, a leader's response to a crisis is much more than speeches. Neuroscience research shows that people learn and pay attention to the emotions a leader exhibits. Positive emotions spread, but negative emotions travel faster and further (Becker & Cropanzano, 2020).

Crisis like this may force leaders to change and adapt at extraordinary speed. According to McKinsey report, the business implications of the coronavirus outbreak highlighted first and foremost a human tragedy (Watson, 2020). Therefore, empathy and flexibility are important leadership qualities all the times. This is significant when employees experience sudden and radical change- such as the need to work remotely or in highly restricted workplace for extended period (Strack, et. al., 2020). One study showed that 48 percent of employees will likely work remotely at least part of the time, and 32 percent of organizations are replacing full-time employee with contingent workers as a cost-saving measure (IW Staff, 2020).

To succeed in a world of increased remote work, employees need to know that they are the most valued company asset. This can be demonstrated through the promise of avoiding layoffs and doing what they can do to minimize financial hardship (Strack, et. al., 2020). Employee's experience- a combination of culture, trust, and work style- is linked to competitive position, company growth, and employee sentiment (Insley, 2020).

Conclusion

Essential to effective leadership is the awareness that there is no easy route through this pandemic. While being isolated from friends, extended family, and colleagues, employees are expecting their leaders to be open without ambiguity about the evolving nature of the crisis. In addition, leaders should display fact-based communications, empathy, flexibility and adaptability, humility, and active listening (Brownlee, 2020; De Cremer, 2020; Gelles, 2020). Overall, leadership is the engine that moves people to produce outstanding results. Furthermore, the post COVID-19 workplace will put a premium on efficiency and agility (Schwantes, 2020).

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Application of solid-liquid extraction with organic acids for recovery of precious metal from technological waste in disuse

Antônio Vanderlei dos Santos

Dept. of Engineering and Computer Science, Regional Integrated University of Alto Uruguay and Missions,
Santo Ângelo, Brazil.

(55) 99945-3252, vandao@san.uri.br, Rua dos Andradas, 830, Santo Ângelo, Rio Grande do Sul, Brazil.

Dinalva Schein

Dept. of Engineering and Computer Science, Regional Integrated University of Alto Uruguay and Missions,
Santo Ângelo, Brazil.

Mauro Cesar Marchetti

Dept. of Engineering and Computer Science, Regional Integrated University of Alto Uruguay and Missions,
Santo Ângelo, Brazil.

Estela Bresolin Pereira

Dept. of Engineering and Computer Science, Regional Integrated University of Alto Uruguay and Missions,
Santo Ângelo, Brazil.

Arthur Rolim Stasiak

Dept. of Engineering and Computer Science, Regional Integrated University of Alto Uruguay and Missions,
Santo Ângelo, Brazil.

Abstract

The electro and electronic industry has been increasing gradually, causing an increase in the generation of waste of electrical and electronic equipment, which have several components that have added value such as - for example - gold. Aiming at environmental protection, measures are sought for the recovery of these metals, through tests with several technologies such as leaching. This consists in separating the component from the solid part, transferring it to the liquid part, using acids. It is necessary to study acids that are less harmful to the environment. Thus, microprocessors of obsolete computers were collected, their characterization was carried out and the elements present in the pins were identified. After the characterization, the leaching stage was carried out, firstly with aqua regia ; then with acetic and citric

acids. The leaching results presented about 10 mg / L of gold with aqua regia and about 0.5 mg / L with citric acid.

Keywords: Obsolete technological waste; Leaching; Gold; Microprocessors.

1. Introduction

Brazil has been facing a major problem over the years: the accumulation of waste due to population growth, urbanization and the technological revolution. All these factors are related - also - to the lifestyle and consumption of the population [GOUVEIA, 2012].

Among the several wastes, the most important are WEEE (Waste Electrical and Electronic Equipment) [WANG, 2008]. This accumulation is due to the end of the useful life of the equipment, and may also be defective, wear or often become aesthetically obsolete, still due to the technologies that have been emerging - gradually - over the years [NNOROM; OHAKWE; OSIBAJNJO, 2009]. These residues have been identified as secondary sources of several metal [WILLIAMS; OGONDO; CHERRETT, 2011]; when unrecovered, cause damage to the environment, special treatment is required for these wastes at the end of their useful life and studies for the evaluation of operations and tests that enable the recovery or recycling of these materials for new uses [NNOROM; OHAKWE; OSIBAJNJO, 2009].

According to the United Nations of Brazil (ONUBR), in 2015, the electronics industry generates - each year - around 41 million tons of electronic waste, from computers and smartphones; this number has been increasing gradually over the years [ONUBR].

According to the Ministry of Environment, the National Solid Waste Policy (PNRS), approved in 2010, provides for the prevention and reduction of waste generation. Based on this policy, the metals present in microprocessors of obsolete computers were studied by leaching with acids such as royal water and also organic acids, which are less harmful to the environment [MINISTÉRIO DO MEIO AMBIENTE].

For the identification of the elements present in the microprocessor, it is made use of the Scanning Electron Microscopy (SEM) equipment, which is able to identify and quantify the chemical elements present in the sample. In addition, it is capable of producing a high magnification image, up to 300,000 times and also high resolution.

Leaching, also called solid-liquid extraction, consists in separating a desired component from a solid phase, transferring it to a liquid phase, while the solid is contacted with the liquid phase so that leaching can occur. Both phases are in an intimate contact where the solute can diffuse from the solid to the liquid phase, which will allow a separation among the components of the solid phase [GEANKOPLIS, 1993].

Therefore, it is important to study new technologies for the leaching of this high value-added metal such as - for example - leaching using environmentally friendly acids. After the leaching, it is necessary to analyze the samples obtained in the atomic absorption equipment (AAS), where it is possible to determine the amount of analyte present in solution.

2. Experiments

Face to the reality described above, a partnership was established with the Information Technology sector

of University in order to collect the microprocessors of obsolete university computers that would be sent to discard. Microprocessors of a particular brand were collected; then a sample of the pins was removed with the help of pliers to analyze and characterize them in the SEM. Subsequently, the leaching was performed according to the flowchart shown in Figure 1.
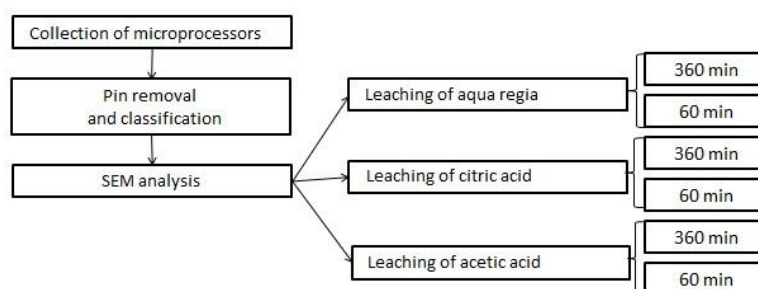
Figure 1. Flowchart ofthe tests performed

Based on the methodology described by Côrtes et al. (2014), leaching with aqua regia (HCl e HNO_3 P.A 3:1) was started in batch, 25 ° C, in which 1 g of pins were added in contact with 50 mL of aqua regia solution, shaking the sample [CORTES et al., 2014].

During this step, other samples were leached with organic acids; the first containing 1g of pins, 0.30g of ferric sulphate and citric acid with a concentration of 20g /L and the second replacing the citric acid with glacial acetic acid, concentration 20g /L. At the end of the leaching, the solution was filtered using a vacuum pump (Prismatec), the solution stored in a dark vial to avoid contact with sunlight to avoid possible degradation and the samples were analyzed for absorption of the brand GBC - Scientific Equipament.

3. Results and discussion

3.1 Characterization of pins

When analyzing a sample of microprocessor pins in the SEM, its morphology was observed and it was scanned to analyze and identify the elements present in the sample. The analyzed areas can be observed in Figure 2, and the values in percentage corresponding to the mass of the existing components presented in Table 1.
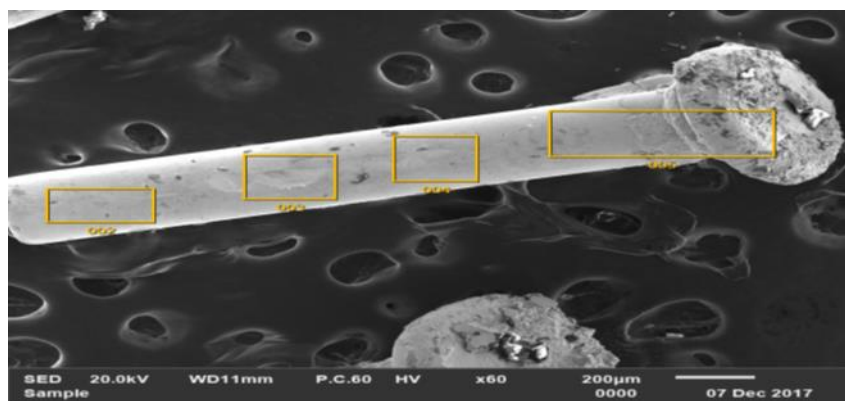
Figure 2. Points analyzed from the microprocessor pin 2.

Table 1. Percentage of components present in each analyzed area.

Points	O	Au	C	Na	Al	Sn
001	20.40	20.51	47.75	-	-	11.33
002	-	99.68	-	-	0.32	-
003	-	99.70	-	-	0.30	-
004	-	99.63	-	-	0.37	-
005	-	49.57	-	0.46	-	49.97

During the analysis, the presence of Oxigen (O), Gold (Au), Carbon (C), Sodium, Aluminum (Al) and Tin (Sn) were observed. Gold presented the highest percentage in mass; however, it is also observed that, in the upper and lower parts, the percentage was not high. In view of this, the assumption is made that the pins of these microprocessors are only gold-plated and composed of another metal in their inner part as - for example - Al and Sn.

3.2 Leaching

The leaching tests were carried out with the three acids: regia, citric and acetic water, analyzing them at different times - 60 and 360 minutes. After filtration of the solution obtained by the leaching, it was observed that the aqua regia had dissolved in solution all the pins; in tests with citric and acetic acids; however, the same can not be observed, since the pins still remained practically in their initial form, as shown in Figure 3.

In order to verify the amount of gold solution obtained from the leach, the samples were analyzed in atomic absorption spectrophotometry. From these results, it was verified that acetic acid did not present concentration of gold; the concentration in mg / L of gold presented in aqua regia and citric acid, however, can be verified in Table 2.

Figure 3. Comparative after filtration of the solution obtained by leaching.

Table 2. Concentration of gold in mg/L.

Timing (min)	Acid	Concentrarion
60	Aqua regia	10,045
360		10,342
60	Citric acid	0,550
360		0,493
60	Acetic acid	0
360		0

Observing the results obtained by leaching with aqua regia   from Côrtes et al. (2015), the authors obtained about 42 mg / L in a time of approximately 30 minutes [CORTES et al., 2014], a superior result when compared to that presented in Table 2. These values are due to different conditions used in the accomplishment of the tests; among them, the agitation that was not the same when compared with that of the authors. The percentage of gold used to coat the pins of the microprocessors may have been reduced over the years. Concentrations in g / kg were then calculated for water and citric acid, as shown in Table 3.

Table 3. Concentration of gold in aqua regia and citric acid at different times.

Timing (min)	Acid	Concentrarion
60	Aqua regia	6,1745
360		6,25
60	Citric acid	0,0332
360		0,02955

It is observed   that the highest concentration of gold was for the time of 360 minutes when aqua regia was used; however, from the shortest time to the greatest, there were no significant increases in the concentration extracted. Due to this fact , the leaching in a time greater than 60 minutes would not be economically feasible when applied industrially because of to the high energy costs, among others, to carry out the leaching.

In the leaching with citric acid, a lower result was obtained compared to what was obtained when using aqua regia, but it is observed that from 60 min to 360 min the concentration remained practically the same, also not having a significant increase in the concentration of gold in solution.

It is observed that - although the result with citric acid has a low concentration - it can extract gold from the microprocessor pins. In this connection, it is necessary to investigate other leaching tests as well as other organic acids, which may be extracted into the liquid phase.

3.2.1 Scanning electron microscopy analysis after leaching

The SEM analyses   were performed after leaching in order to observe if any changes occurred in the external composition of the pins. Figure 4 shows the pins leached with acetic acid in 60 minute (a) and 360 minute (b) times, and the scan was performed as analyzed in Table 4.
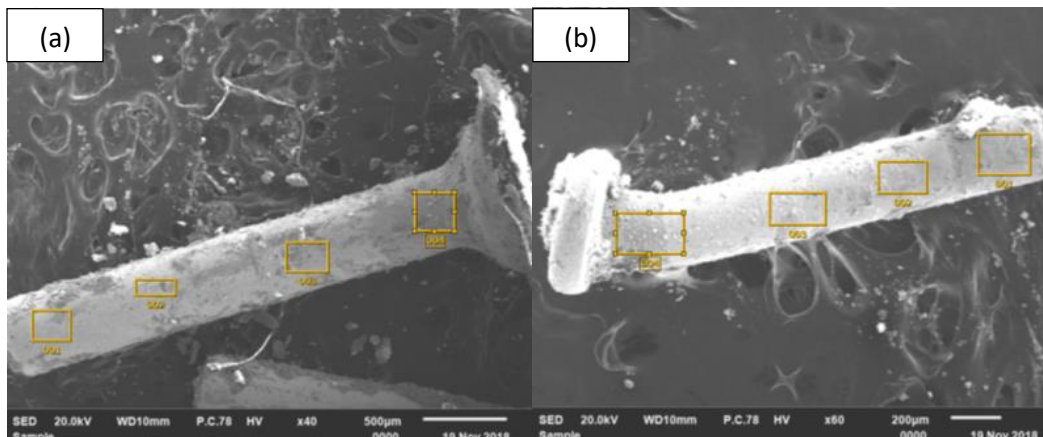
Figure 4. SEM analysis after leaching with acetic acid 60 min (a) and 360 min (b).

Table 4. Percentage of components present in each analyzed area.

	60 minutes						360 minutes		
Points	O	Au	Al	Cl	Sc	Sn	O	Au	Sn
001	-	99,66	0,34	-	-	-	10,17	89,83	-
002	14,61	85,39	-	-	-	-	8,42	91,58	-
003	12,33	87,67	-	-	-	-	13,33	86,67	-
004	8,08	-	-	2,33	2,08	87,52	18,07	42,94	38,98

When analyzing the results obtained compared to the previous analysis of the leach, it is observed that the percentage of gold remained practically in the same range. This fact was already expected, due to the low extraction performed by acetic acid. It is also observed that there is a greater number of metals and other elements in the analysis of 60 minutes, a fact that does not occur for the analysis of 360 min: this only presents Au and Sn of metals.

SEM analyses were performed after leaching - also for the leached pins with citric acid analyzed in 60 minutes (c) and citric acid in 360 minutes (d), as can be verified in   Figure 5. Then, the scanning was performed   as shown in Table 5.
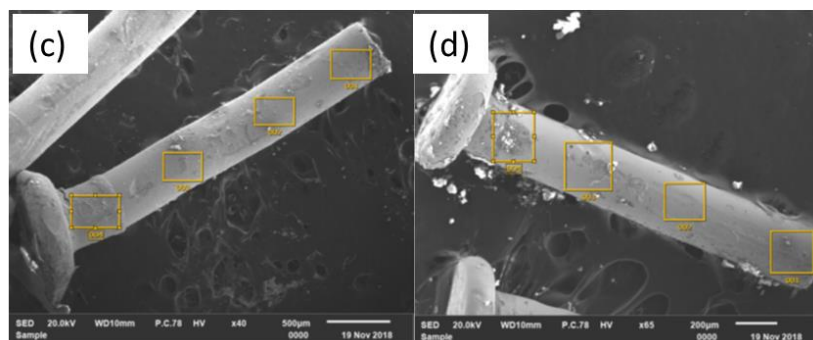
Figure 5. Percentage of components present after leaching with citric acid 60 min (c) and 360 min (d).

Table 5. Percentage of components present after leaching with citric acid.

Points	60 minutes						360 minutes		
	O	Au	Al	Si	Sc	Sn	O	Au	Sn
001	14,16	85,64	-	-	-	-	-	99,70	0,30
002	-	99,63	0,37	-	-	-	-	100,00	-
003	-	99,53	0,47	-	-	-	-	99,68	0,32
004	4,15	15,04	-	1,22	2,24	77,34	27,61	72,39	-

Analyzing the results from the leaching with citric acid, it is also discussed   that the Au values remained in the same percentage range when compared with those obtained with the non-leached strip. It is also seen the presence of other metals in the 60 min analysis that are not present in the 360 min sample. It is believed that for both acetic and citric acid the presence of more metals in the first time than in the second one is due to the leaching time, in which more metals can be leached in 360 minutes, which were not analyzed in atomic absorption to verify the present concentration.

5. Conclusion

By performing the analysis of the obsolete microprocessors through the SEM, it is verified that there is a high percentage of Au at the analyzed points, which justifies the interest in recovery of this high value-added metal. In addition to Au, Al and Sn were also present. After the leaching at 60 and 360 min, the concentration of Au present in the solution of aqua regia, citric acid and acetic acid could be analyzed in atomic absorption spectrophotometry. The concentrations of Au present in water solution ranged from 10,045 mg / L and 10,342 mg / L for the 60 and 360 minute times, respectively. For citric acid, the concentrations presented were 0.550 mg / L for 60 minutes and 0.493 mg / L for 360 minutes; however, for acetic acid, it did not present Au in solution, thus concluding that acetic acid was not able to extract Au from the microprocessors. From the above, it can be considered that - with the use of organic acids - it is possible to perform Au extraction from obsolete microprocessors; however, it is necessary to carry out more in-depth studies to improve the extraction conditions, allowing a more efficient extraction.

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Epidemiological, Sociodemographic And Clinical Profile Of Men With Cancer In Rondônia, Brazilian Amazon

Carlos Alberto Paraguassu-Chaves[1], Allan Kardec Duailibe Barros Filho[2], Carlos de Andrade Macieira[3] Fabrício Moraes de Almeida[4], Lenita Rodrigues Moreira Dantas[5], João Viana Fonseca Neto[6] Alcione Miranda dos Santos[7] Maria da Conceição Ribeiro Simões[8]

[1]PhD in Health Sciences - University of Brasília - UnB, Brazil; PhD in Science - University of Havana (Cuba); Post-Doctor in Health Sciences - UnB and Degli Studi D'Aquila University - IT. Professor at the Federal University of Maranhão, Brazil. E-mail: carlos.paraguassu@gmail.com. [2]PhD in Information Engineering. Universidade de Nagoya – Japan; Post-Doctor. The Institute of Physics and Chemistry (RIKEN), Japan. Professor at the Federal University of Maranhão, Brazil.   [3]Specialist in Internal Medicine and Nephrology -   Federal University of Rio de Janeiro, Brazil. Nephrologist at the University Hospital of the Federal University of Maranhão – HUUFMA, Brazil.

[4]PhD in Physics (UFC), with post-doctorate in Scientific Regional Development (DCR/CNPq). Researcher of the Doctoral and Master Program in Regional Development and Environment (PGDRA/UNIR). Leader of line 2 - Technological and Systemic Development, and Researcher of GEITEC ― Federal University of Rondônia, Brazil. E-mail: dr.fabriciomoraes001@gmail.com.   [5]Graduated and Specialist in Geography. Graduated in Law. Researcher at the Higher Institute of Health Sciences and Environment of the Amazon – AICSA, Brazil. [6]PhD in Electrica Engineering. Federal University of Paraíba, Brazil. Professor at the Federal University of Maranhão, Brazil. [7]PhD in Production Engineering - Federal University of Rio de Janeiro. Professor at the Federal University of Maranhão, Brazil. [8]PhD in Health Sciences - University of Brasília - UnB, Brazil. Coordinator of the medical course - University Center Aparício Carvalho - FIMCA, Brazil.

ABSTRACT

Objective: to analyze the epidemiological, sociodemographic and clinical profile of men in Rondônia, Western Amazonia (Brazil), diagnosed with the main types of cancer, during a period of 2 (two) years. Materials and Methods: it is an epidemiological, descriptive, cross-sectional and quantitative study, with the systematization of primary data according to the methodological model recommended by Paraguassu-Chaves et al [6].   We used an instrument developed by Paraguassu-Chaves et al [5], semi-structured composed of a series of epidemiological, clinical and sociodemographic variables. The research project is in compliance with Resolution 196/96 of the National Health Council of Brazil, taking into account the ethical aspects of research in Brazil. Main results: the 10 (ten) main types of cancer diagnosed by the location of the primary tumor in men were analyzed, corresponding to 1,163 (74.9%) cases of cancer in men, over a period of 2 (two) years. The 10 (ten) most common types of cancer in men were: prostate (30.9%), non-melanoma skin (22.9%), stomach (11.7%), bronchi and lungs (6.7%), colon (5.8%), leukemia (5.8%), esophagus (4.4%), central nervous system (4.2%), rectum (3.9%) and bladder (3.6%). The age group of 50 to 79 years old reaches 76.4% of the 10 main types of cancer in men. They are more frequent

in brown (64.6%) and white (28%) men and with low education. 73.2% of men with cancer are married. 44.9% of men with cancer work in agriculture. 45.6% of men with cancer have a family history of cancer. The sum of smokers and ex-smokers reaches a relative frequency of 43.7%. 19.5% consume alcoholic beverages and 17.2% are ex-consumers. In 40.1%, "other isolated therapeutic procedures" were applied in the first treatment. 14.2% of diagnosed patients died from the disease. Conclusions: The scenario of cancer projection in men in Rondônia is worrying and requires an urgent redirection of actions and strategies for cancer prevention, control, assistance and treatment.

I. INTRODUCTION

Cancer is the main public health problem in the world [1] and is already among the top four causes of premature death in most countries. This means that cancer is responsible for the fourth leading cause of death in the population under 70 years of age. Cancer incidence and mortality has increased worldwide. One explanation for the significant increase in the incidence of cancer lies in the increased exposure of cancer risk factors.

According to Paraguassu-Chaves et al [2] the redefinition of living standards, based on the standardization of working conditions, nutrition and consumption triggered by the global industrialization process, has important repercussions on the epidemiological profile of populations. And, as a consequence, the increase or decrease in cancer incidence and mortality.

The most recent global estimate (year 2018) pointed out that 18 million new cases of cancer occurred worldwide (17 million without counting the cases of non-melanoma skin cancer) and 9.6 million deaths (9.5 million excluding non-melanoma skin cancer) [1].

According to a study "Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries" authored by Bray et al [3], lung cancer is the most incident in the world (2.1 million), followed by breast (2.1 million), colon and rectal cancer (1.8 million) and prostate (1.3 million). The incidence in men (9.5 million) represents 53% of new cases, slightly higher than in women, with 8.6 million (47%) of new cases. Worldwide, the most common types of cancer in men were lung cancer (14.5%), prostate cancer (13.5%), colon and rectum (10.9%), stomach (7.2%) and liver (6.3%).

According to the INCA estimate for each year of the 2020-2022 period, 625,000 new cases of cancer will occur in Brazil [1]. Non-melanoma skin cancer will be the most incident (177 thousand), followed by breast and prostate cancer (66 thousand each), colon and rectum (41 thousand), lung (30 thousand) and stomach (21 thousand). The most common types of cancer in men, with the exception of non-melanoma skin cancer, are prostate (29.2%), colon and rectum (9.1%), lung (7.9%), stomach (5.9 %) and oral cavity (5.0%) [1].

In the northern region of Brazil (where Rondônia is geographically located, more precisely in the Western Amazon, the incidence rates per 100 thousand inhabitants and the number of new cases of cancer in men are estimated for 2020, according to the main location of the neoplasia (except non-melanoma skin cancer),

in the following decreasing order: prostate 2,770 new cases (28.7), stomach 1,110 new cases (11.5), trachea, bronchi and lung 870 new cases (9.0), colon and rectum 490 new cases (5.1), leukemia 410 new cases (4.2), oral cavity 340 new cases (3.5), central nervous system 300 new cases (3.1), esophagus 250 new cases (2.6), larynx 240 new cases (2.5) and non-Hodgkin's lymphoma 210 new cases (2.2) [1].

The National Cancer Institute of Brazil estimated for the State of Rondônia, for the year 2020, the incidence rates per 100 thousand inhabitants and the number of new cases of cancer in men (except non-melanoma skin cancer), according to the primary location of the malignancy, the following cancers: prostate 310 new cases (32.40), trachea, bronchi and lung 110 new cases (11.85), stomach 80 new cases (8.90), colon and rectum 60 new cases (6.36), oral cavity 50 new cases (5.71), leukemia 40 new cases (4.61), esophagus 40 new cases (4.52), central nervous system 40 new cases (4.26), larynx 30 new cases (3.28), bladder 30 new cases (2.86) and non-Hodgkin's lymphoma 20 new cases (2.46) [1].

According to Paraguassu-Chaves et al [4] epidemiological, sociodemographic and clinical studies on cancer in Rondônia and the Brazilian Amazon are still scarce. According to this author and his collaborators, few references are known for this set of diseases that presents itself in a scenario of public health problems for the population residing in this Region of Brazil.

There is recognition of the efforts of a group of volunteer researchers under the coordination of professor Dr. Paraguassu-Chaves and his contribution in the direction of new research on the socio-demographic profile, clinical profile, epidemiological profile, production and territorial and spatial distribution of cancer in Rondônia, Western Amazon.

Among his studies, although of epidemiological focus, they stand out for the understanding of cancer in Rondônia, such as the description of the distribution and magnitude of cancer in the population of Rondônia, both at the municipal level and throughout the State of Rondônia; the systematization of essential data for the planning, execution and evaluation of cancer promotion, prevention, control and treatment actions in Rondônia, as well as for the establishment of priorities; the approximation of the identification of the etiological factors in the genesis of cancers in Rondônia; the provision of an educational tool and product that can be used as instructional material for teaching purposes at the reach of all people, regardless of school level or cultural education; the availability of data and information to support the development of studies and applied research on the production and distribution of cancers in Rondônia.

The National Cancer Institute of Brazil (INCA) recognizes that the prevention and control of cancer in our country, of continental dimensions and strong regional differences, because it houses a population of behaviors, beliefs and attitudes in a very diverse way, currently represents great challenges public health. The description of the distribution of the most incident types of cancer, over time, has been one of the main strategies for the establishment of guidelines in public policies and, mainly, for the planning of cancer prevention and control actions [5].

The book "Epidemiological profile of cancer in Rondônia: Brazilian Amazon", by Paraguassu-Chaves et al [6] records a historic milestone in the systematization and analysis of cancer data in Rondônia. It is relevant for the effort to try to understand the behavior of cancer, the sociodemographic, epidemiological and clinical profile of part of the population of Western Amazonia diagnosed with cancer.

In recent years, cancer has been incorporated into the fear of the population of the Brazilian Amazon. The majority of the population is not aware of neoplasms, which led people to live in fear of the disease and fear of death [4].

Given this scenario, resources and efforts must be directed to guide cancer prevention and control strategies at all levels (health promotion, early detection, patient care, câncer surveillance and its risk factors, training of human resources, communication and social mobilization, research and management of the Unified Health System (SUS).

Despite the implementation of the High Complexity Unit - UNACON, to catalog the data supporting the Hospital Cancer Information System - SISRHC / INCA, as systematic sources of information, based on medical records regarding the registration and use of admitted cases, evaluating quantity, quality of survival and, indirectly, the quality of care provided in the hospital, and this information is a primary source not only for epidemiological research on cancer determinants, but also for the prevention, diagnosis and treatment of the disease [5], [6], [7], it was found in previous research that the information system has several flaws in filling out medical records, which can hinder a safer and more efficient analysis or even the interpretation of data about the disease [4].

There is unanimity among this group of researchers coordinated by Paraguassu-Chaves of the awareness that the practice of health research is a fundamental aspect in the improvement of health systems and policies, and that it is a determining factor in the development of Brazil, and in particular of the Amazon Region. Given this reasonable justification, the objective of this study is to analyze the epidemiological, sociodemographic and clinical profile of men in Rondônia, Western Amazonia (Brazil), diagnosed with the main types of cancer, over a period of 2 (two) years.

II. MATERIALS AND METHODS

2.1 Study Type

This is an epidemiological, descriptive, cross-sectional and quantitative study, with the systematization of primary data according to the methodological model recommended by Paraguassu-Chaves et al [6]. The data were systematized from the primary data organized by the Hospital Epidemiology Nucleus - NHE of the Hospital de Base Dr. Ary Pinheiro and the Hospital de Câncer de Barretos - Porto Velho Unit, based on the diagnoses performed, for a period of 2 (two) years.

2.2 Model of Semi-structured Instrument Paraguassu-Chaves

We used an instrument developed by Paraguassu-Chaves et al [5], semi-structured and adapted for this research with the following variables: localization of primary tumor in men; age group during cancer diagnosis; ethnicity / color; degree of education; marital status; professional occupation; family cancer history; smoking; alcoholism; first treatment received; cancer death; forwarding source; entry clinic and 1st care clinic; previous diagnosis and treatment; cancer by clinical stage; bost important basis of diagnosis; primary numbers of tumors; topography of the occurrence of the 1st metastasis; cancer whose initial treatment cannot be performed according to reason for not treating; cancer status at the end of the 1st treatment; time interval according to the average, median, fashion, quartile, minimum and maximum, and

time interval (in days) elapsed, according to the median, between: 1st consultation-1st diagnosis; 1st diagnosis - start of treatment; 1st consultation and start of treatment, according to the clinic responsible for the 1st treatment.

2.3 Sampling Number

The research was carried out with the database of 1,552 male patients diagnosed with cancer in Rondônia, corresponding to the period of 2 years. Of this total, 1,163 new cases of cancer in men (74.9%) were selected, corresponding to the 10 (ten) main types of cancer diagnosed by the location of the primary tumor.

2.4 Inclusion and exclusion criteria and ethical aspects

All medical records diagnosed with cancer admitted to Dr. Ary Pinherio and Barretos / Rondônia base hospitals were included. Data without information or data that does not apply (discarded) due to inconsistency or incomplete records was excluded. The research project is in compliance with Resolution 196/96 of the National Health Council of Brazil, taking into account the ethical aspects of research in Brazil.

III. RESULTS

Of a total of 1,552 new cases of cancer diagnosed in men during the study period, 1,163 (74.9%) corresponds to the 10 (ten) main types of cancer diagnosed by the location of the primary tumor.

Proportional distribution of the 10 (ten) most frequent types of cancer in men by location of the primary tumor.

Of the proportional distribution of the most frequent cancers in men in the two-year period reported at the Barretos hospital (Porto Velho Unit) and at the Dr. Ary Pinheiro base hospital, prostate cancer has the highest frequency (30.9%), followed by non-melanoma skin cancer (22.9%) and stomach cancer (11.7%). The proportional distribution of the 10 (ten) most common types of cancer in men was: prostate (30.9%), non-melanoma skin (22.9%), stomach (11.7%), bronchi and lungs (6.7%), colon (5.8%), leukemias (5.8%), esophagus (4.4%), central nervous system (4.2%), rectum (3.9%) and bladder (3.6%). The 10 most common cancers in men in this study represent 74.9% of all cancers diagnosed in men. (Table 1).

Table 1: Proportional distribution of the 10 (ten) most frequent types of cancer in men by location of the primary tumor.

Localization of Primary Tumor in Men	Fa*	Fr %
Prostate (C61)	359	30.9
Non-melanoma skin (C44)	267	22.9
Stomach (C16)	136	11.7
Bronchus and Lung (C33-C34)	78	6.7
Colon (C18)	68	5.8
leukemias (C91-C95)	68	5.8

Esophagus (C15)	51	4.4
Central Nervous System (C70-C71-C72)	49	4.2
Rectum (C20)	45	3.9
Bladder (C67)	42	3.6
Total	**1.163**	**100.0**

Fa* Absolute frequency   **Fr%** Relative frequency

Distribution of the 10 main neoplasms of men in the State of Rondônia by age at diagnosis of cancer.

According to national and international literature, age is still one of the most important risk factors for cancer in men. Incidence rates rise rapidly after 50 years of age. In Rondônia, the age group of 50 to 79 years old reaches 76.4% of the 10 main types of cancer in men, with respectively 20.4% (aged between 50 and 59 years old), 26% (aged between 60 and 69 years old) and 30% (between 70 and 79 years old).

Prostate cancer has a high frequency from the age of 50. The highest prevalences are in the age groups from 60 to 69 years old with 38.5% and from 70 to 79 years old with 32.5% of new cases.

Non-melanoma skin cancer is the second most common in men with 20.2% of new cases (aged between 50 and 59 years), 11% of new cases (aged between 60 and 69 years), 37% (between 70 and 79 years) and 13.9% of new cases in patients over 80 years of age.

Stomach cancer is more common in men over 40 years of age. Stomach cancer has a frequency of 16.1% of new cases in patients aged between 40 and 49 years, 19.6% (aged between 50 and 59 years), 28.6% (aged between 60 and 69 years) and 26.8% (age between 70 and 79 years). Bronchial and lung cancer in men is more prevalent in patients over 50 years old, with 20.8% in the 50 to 59 age group, respectively, 45.8% in the 60 to 69 age group and 16.7% in the age group of 70 and 79 years. Colon cancer has a high incidence in the 30 to 39 age group (15.4%), reaching its highest incidence (23.1%) in the 50 to 59 age group.

Esophageal cancer concentrates the highest incidence in the age group of 50 to 59 years (40.9%) and 60 to 69 years (31.8%). Rectal cancer is most frequently found with 25% of new cases in the age group of 40 to 49 years and with 30% in the age group of 60 to 69 years. Bladder cancer maintains the highest concentration of new cases in the 50 to 59 age group (27.3%) and the same relative frequency (27.3%) in the 70 to 79 age group. (Table 2).

The data referring to cancers of the leukemias were excluded due to the lack of available information or because of inconsistent information.

Table 2: Distribution of the 10 main neoplasms of men in the State of Rondônia by age at diagnosis of cancer.

Age Range Cancer Diagnosis	<29 years	30 – 39	40 – 49	50 – 59	60 – 69	70 – 79	> 80 years	Ignored
Prostate (C61)	0.0	1.8	1.8	18.0	38.5	32.5	6.6	1.8
Non-melanoma skin (C44)	2.3	2.3	10.4	20.2	11%	37%	13.9	2.9
Stomach (C16)	0.0	5.3	16.1	19.6	28.6	26.8	3.6	0.0
Bronchus and Lung (C33-C34)	0.0	0.0	12.5	20.8	45.8	16.7	4.2	0.0
Colon (C18)	3.8	15.4	19.2	23.2	19.2	15.4	3.8	0.0
Esophagus (C15)	0.0	0.0	9.1	40.9	31.8	18.2	0.0	0.0
Rectum (C20)	5.0	10.0	25.0	10.0	30.0	10.0	10.0	0.0
Bladder (C67)	4.5	0.0	4.5	27.3	18.2	27.3	18.2	0
Leukemias (C91-C95)	**	**	**	**	**	**	**	**
Central Nervous System (C70-C71-C72)	**	**	**	**	**	**	**	**
Fr%	**1.4**	**3.1**	**9.0**	**20.4**	**26.0**	**30.0**	**8.9**	**1.2**

Fr% Relative frequency. ** No information available.

Distribution of the 10 main neoplasms in men, by ethnicity / color.

Table 3 shows the distribution of the 10 main neoplasms in men in the State of Rondônia by Ethnicity / Color. Neoplasms diagnosed in brown (64.6%) and white (28%) men are more frequent than in other ethnicities, such as: black, yellow and indigenous.

Of the 10 main types of cancer, brown men predominated, in all types of cancer in the following decreasing order: esophagus (77.3%), colon (69.2%), stomach (67.9%), bronchi and lungs (66.6%), non-melanoma skin (66%), rectum (65%) and prostate (63.3%). The only exception was bladder cancer, which predominated in white patients.

The second highest frequency of cancer by skin color is concentrated in white patients with 28% of new cases among the 10 main types of cancer in men in Rondônia. Among white patients, the relative frequencies are more significant in bladder cancer with 45.4%, rectal cancer with 35%, prostate cancer with 29.5%, bronchial and lung cancer with 29.2%, cancer of non-melanoma skin with 28.5%, stomach cancer with 19.6%, colon cancer with 19.2% and esophageal cancer with 18.2% of new cases. Black patients have a significant frequency in cancer of the colon (11.6%), stomach (10.7%) and bladder (9.1%). (Table 3).

Table 3: **Distribution of the 10 main neoplasms in men, by ethnicity / color.**

Ethnicity / Color	Brown	White	Black	Yellow	Indigenous
Prostate (C61)	63.3	29.5	7.2	0.0	0.0
Non-melanoma skin (C44)	66.0	28.5	5.5	0.0	0.0
Stomach (C16)	67.9	19.6	10.7	0.0	1.8
Bronchus and Lung (C33-C34)	66.6	29.2	0.0	4.2	0.0
Colon (C18)	69.2	19.2	11.6	0.0	0.0
Esophagus (C15)	77.3	18.2	4.5	0.0	0.0
Rectum (C20)	65.0	35.0	0.0	0.0	0.0
Bladder (C67)	40.9	45.5	9.1	4.5	0.0
Leukemias (C91-C95)	**	**	**	**	**
Central Nervous System (C70-C71-C72)	**	**	**	**	**
Fr%	**64.6**	**28.0**	**6.1**	**1.1**	**0.2**

Fr% Relative frequency. ** No information available.

Distribution of the 10 main neoplasms in men by level of education.

The education of men diagnosed with cancer is 18.3% illiterate, 43.6% with incomplete primary education, 18.5% with complete primary education, 15.6% with secondary education and 4% with complete higher education. The frequency of cancer in men with less education is much higher than the cases diagnosed in men with more education.

Prostate cancer concentrates its highest incidence in patients with low education (76.5%), thus distributed by educational level, 12% illiterate, 40.4% incomplete elementary school and 24.1% complete high school, as shown in table 4.

The same situation occurs with non-melanoma skin cancer (79.8%) of patients with low education, distributed as follows: 14.7% illiterate, 50.4% of patients with incomplete elementary school and 14.7% with elementary school complete. In the same trend of low schooling, stomach cancer patients are 26.8% illiterate, 32.1% have incomplete elementary school and 19.7% have completed elementary school. Patients with bronchial and lung cancer, 91.6% were patients with education level up to complete elementary school.

They remain in the same condition as patients with low education, patients with colon cancer with 88.6% with education level up to complete elementary school, esophageal cancer with 86.4% with up to complete elementary school, cancer of the rectum with 60 % of patients with complete primary education and bladder cancer with 81.8% of patients with complete primary education. (Table 4).

Table 4: Distribution of the 10 main neoplasms in men by level of education.

Degree of Education	Illiterate	Incomplete elementary school	Complete elementary school	Complete high school	Graduated
Prostate (C61)	12.0	40.4	24.1	17.5	6.0
Non-melanoma skin (C44)	14.7	50.4	14.7	14.7	5.5
Stomach (C16)	26.8	32.1	19.7	14.3	7.1
Bronchus and Lung (C33-C34)	29.1	54.2	8.3	4.2	4.2
Colon (C18)	7.7	46.2	34.6	7.7	3.8
Esophagus (C15)	22.7	36.4	27.3	13.6	0.0
Rectum (C20)	15.0	35.0	10.0	35.0	5.0
Bladder (C67)	18.2	54.5	9.1	18.2	0.0
Leukemias (C91-C95)	**	**	**	**	**
Central Nervous System (C70-C71-C72)	**	**	**	**	**
Fr%	**18.3**	**43.6**	**18.5**	**15.6**	**4.0**

Fr% Relative frequency.　　** No information available.

Distribution of the 10 main neoplasms in men by conjugal state.

The distribution of the top 10 types of cancer in men shows that 73.2% of men with cancer are married. The highest frequencies of cancer in men were found in married men, without exception, distributed as follows: bladder cancer (86.5%), prostate (78.9%), non-melanoma skin (77.1%), rectum (72.7%), stomach (71.5%), bronchi and lungs (68.8%), esophagus (68.2%) and colon (61.8%). The second highest frequency is made up of single patients with 11.6% of men with cancer among the 10 most common types of cancer in Rondônia. (Table 5).

Table 5: Distribution of the 10 main neoplasms in men by conjugal state.

Marital Status	Married	Single	Widowed	Separated / Divorced	Consensual Union
Prostate (C61)	78.9	5.4	9.0	4.2	2.4
Non-melanoma skin (C44)	77.1	11.0	4.6	2.7	4.6
Stomach (C16)	71.5	10.7	8.9	0.0	8.9
Bronchus and Lung (C33-C34)	68.8	18.7	12.5	0.0	0.0
Colon (C18)	61.8	17.6	8.8	5.9	5.9
Esophagus (C15)	68.2	9.1	9.1	13.6	0.0

Rectum (C20)	72.7	18.2	0.0	9.1	0.0
Bladder (C67)	86.5	4.5	4.5	0.0	4.5
Leukemias (C91-C95)	**	**	**	**	**
Central Nervous System (C70-C71-C72)	**	**	**	**	**
Fr%	**73.2**	**11.9**	**7.2**	**4.4**	**3.3**

Fr% Relative frequency. ** No information available.

Distribution of the 10 main neoplasms in men, by occupation.

Men diagnosed with cancer who work in agriculture represent 44.9% of the 10 most common types of cancer in men in Rondônia. Next are men occupying the professions of commerce, banks, transport and others with 22.7%, public agents or employees of the federal, state and municipal public service with 10.8% and independent professional, professor or technician with 10.8%.

The proportional distribution of cancer in men by occupational activity is very well defined with agricultural activity, mainly in relation to cancers of the prostate (73.5%), bladder (66.6%), non-melanoma skin (65.1%), bronchi and lungs (40%), stomach (39.4%) and esophagus (31.8%) are the most frequent.

Among men working in commerce, banking, transportation and other similar activities, rectal cancer (45%), colon cancer (38.5%), stomach (23.2%), esophagus (18.2%), bronchi and lungs (16%), bladder (14.3%) non-melanoma skin (13.8%) and prostate (11.5%) are the most prominent. The group of professional public officials and the group of independent professionals, teachers or technicians have a considerable incidence in stomach cancer (8.9% and 14.3% respectively), bronchial and lung cancer (16% and 12% respectively), colon cancer (11.5% and 15.4% respectively), esophageal cancer (13.6% and 18.2% respectively) and rectal cancer with 15% and 10% respectively. (Table 6).

Table 6: Distribution of the 10 main neoplasms in men, by occupation.

Professional occupation / Cancer	Agriculture	Industry	Commerce, Bank, Transport and Others	Public agent	Independent Professional, teacher or technician	Works at Home
Prostate (C61)	73.5	3.6	11.5	4.8	5.4	1.2
Non-melanoma skin (C44)	65.1	2.8	13.8	7.3	6.4	4.6
Stomach (C16)	39.4	7.1	23.2	8.9	14.3	7.1
Bronchus and Lung (C33-C34)	40.0	8.0	16.0	16.0	12.0	8.0
Colon (C18)	23.1	3.8	38.5	11.5	15.4	7.7
Esophagus (C15)	31.8	9.1	18.2	13.6	18.2	9.1
Rectum (C20)	20.0	5.0	45.0	15.0	10.0	5.0
Bladder (C67)	66.6	0.0	14.3	9.5	4.8	4.8

Leukemias (C91-C95)	**	**	**	**	**	**
Central Nervous System (C70-C71-C72)	**	**	**	**	**	**
Fr%	**44.9**	**4.9**	**22.7**	**10.8**	**10.8**	**5.9**

Fr% Relative frequency. ** No information available.

Distribution of the 10 main neoplasms in men by family cancer history.

Regarding the family history of cancer, 45.6% of men with cancer in Rondônia have a family history of cancer. The greatest evidence of cancer with a family history was found in esophageal cancer with 63.7% and rectal cancer with 50%. All 10 main types of cancer in men are related to family history of cancer, in the following order: cancer of the esophagus (63.2%), rectal cancer (50%), stomach cancer (48.2%), cancer of the stomach colon (46.2%), bronchial and lung cancer (45.8%), bladder cancer (45.5%), non-melanone skin cancer (34%) and prostate cancer (31.9%). (Table 7).

Table 7: Distribution of the 10 main neoplasms in men by family cancer history.

Family Cancer History	Yes	Not	Fr%
Prostate (C61)	31.9	68.1	100.0
Non-melanoma skin (C44)	34.0	66.0	100.0
Stomach (C16)	48.2	51.8	100.0
Bronchus and Lung (C33-C34)	45.8	54.2	100.0
Colon (C18)	46.2	53.8	100.0
Esophagus (C15)	63.7	36.3	100.0
Rectum (C20)	50.0	50.0	100.0
Bladder (C67)	45.5	54.5	100.0
Leukemias (C91-C95)	**	**	**
Central Nervous System (C70-C71-C72)	**	**	**
Fr%	**45.6**	**54.4**	**100.0**

Fr% Relative frequency. ** No information available.

Distribution of the 10 main neoplasms in men by smoking.

The relative incidence of men who declared smokers was 22.8% and 20.9% ex-smokers. The sum of smokers and ex-smokers reaches a relative frequency of 43.7% of men with cancer in Rondônia.

The sum of smokers (29.2%) and ex-smokers (45.8%) represents the highest relative incidence in patients with bronchial and lung cancer. Esophageal cancer has the second highest relative incidence of smoking and ex-smoking patients with respectively (45.4%) and (27.3%). In descending order, the 10 main types of cancer in men are directly related to smoking, distributed as follows: bronchial and lung cancer, 29.2% smokers and 45.8% ex-smokers; esophageal cancer, 45.4% smokers and 27.3% ex-smokers; stomach cancer, 23.2% smokers and 19.6% ex-smokers; colon cancer, 23.1% smokers and 19.2% ex-smokers; bladder cancer, 18.2% smokers and 22.7% ex-smokers; rectal cancer, 20% smokers and 10% ex-smokers;

non-melanoma skin cancer, 9.2% smokers and 17.4% ex-smokers; and, prostate cancer with 14.5% of smokers and 5.4% of ex-smokers. (Table 8).

Table 8: **Distribution of the 10 main neoplasms in men by smoking.**

Smoking	Yes	Ex-consumer	Never
Prostate (C61)	14.5	5.4	80.1
Non-melanoma skin (C44)	9.2	17.4	73.4
Stomach (C16)	23.2	19.6	57.2
Bronchus and Lung (C33-C34)	29.2	45.8	25.0
Colon (C18)	23.1	19.2	57.7
Esophagus (C15)	45.4	27.3	27.3
Rectum (C20)	20.0	10.0	70.0
Bladder (C67)	18.2	22.7	59.1
Leukemias (C91-C95)	**	**	**
Central Nervous System (C70-C71-C72)	**	**	**
Fr%	**22.8**	**20.9**	**56.3**

Fr% Relative frequency. ** No information available.

Distribution of the 10 main neoplasms in men due to alcoholism.

According to table 9, considering all types of cancer in men, alcoholism tends to be a determining factor for cancer in men in the State of Rondônia. Of the men diagnosed with cancer, 19.5% consume alcoholic beverages and 17.2% are ex-consumers. The frequency of men who have never consumed alcoholic beverages is 63.3%. Men diagnosed with cancer who consume alcoholic beverages are distributed in the following decreasing order: cancer of the esophagus (36.4%), cancer of the bronchi and lungs (25%), stomach cancer (24.6%), colon cancer (23.1%), prostate (14.5%), bladder (13.6%), rectal cancer (10%) and non-melanoma skin cancer (9.2%).

Among ex-consumers of alcoholic beverages are more frequent, patients with bronchial and lung cancer (33.3%), bladder cancer (22.8%), esophageal cancer (18.2%), stomach cancer (15.8%), colon cancer (15.4%), rectal cancer (15%) and non-melanoma skin cancer (13.7%). (Table 9).

Table 9: **Distribution of the 10 main neoplasms in men due to alcoholism.**

Alcoholism	Yes	Ex-Consumer	Never
Prostate (C61)	14.5	3.0	82.5
Non-melanoma skin (C44)	9.2	13.7	77.1
Stomach (C16)	24.6	15.8	59.6
Bronchus and Lung (C33-C34)	25.0	33.3	41.7

Colon (C18)	23.1	15.4	61.5
Esophagus (C15)	36.4	18.2	45.4
Rectum (C20)	10.0	15.0	75.0
Bladder (C67)	13.6	22.8	63.6
Leukemias (C91-C95)	**	**	**
Central Nervous System (C70-C71-C72)	**	**	**
Fr%	**19.5**	**17.2**	**63.3**

Fr% Relative frequency.   ** No information available.

Proportional distribution of cancer according to the first treatment.

As for the 1st treatment received, "Other isolated therapeutic procedures" had a higher frequency, with 40.1%. The second highest frequency was the surgery procedure with 20.4%, followed by chemotherapy with 7.4% and radiation therapy with 1.8% of the first treatments received by men diagnosed with cancer. Patients who have not received any type of therapeutic treatment, even after diagnosis, reach 30.3%. Patients who received "other isolated therapeutic procedures" are in decreasing order: cancer of the esophagus (45.5%), bladder (39.2%), non-melanoma skin (33%), rectal (30%), prostate (28 , 9%), colon (26.9%), bronchi and lungs (20.8%) and stomach (17.9%).

Cancer patients who received surgery treatments were: colon cancer (30.9%) bladder (30.4%), non-melanoma skin (27.5%), rectal cancer (25%), stomach cancer (21.4%) and prostate cancer (15.1%). Received no treatment, 45.5% of patients with esophageal cancer, 39.2% of bladder cancer, 33% of non-melanoma skin cancer, 30% of rectal cancer, 28.9% of prostate cancer, 26.9% colon cancer, 20.8% bronchial and lung cancer and 17.9% stomach cancer. (Table 10).

Table 10: Distribution of cancer according to first treatment received.

First treatment received	Surgery	Chemotherapy	Radiotherapy	Other therapeutic procedures	No treatment
Prostate (C61)	15.1	7.8	1.8	46.4	28.9
Non-melanoma skin (C44)	27.5	6.5	0.0	33.0	33.0
Stomach (C16)	21.4	7.1	0.0	53.6	17.9
Bronchus and Lung (C33-C34)	8.3	25.0	4.2	41.7	20.8
Colon (C18)	30.9	3.8	3.8	34.6	26.9
Esophagus (C15)	4.5	9.1	4.5	36.4	45.5
Rectum (C20)	25.0	0.0	0.0	45.0	30.0
Bladder (C67)	30.4	0.0	0.0	30.4	39.2
Leukemias (C91-C95)	**	**	**	**	**
Central Nervous System (C70-C71-C72)	**	**	**	**	**
Fr%	**20.4**	**7.4**	**1.8**	**40.1**	**30.3**

Fr% Relative frequency. ** No information available.

Distribution of the 10 main neoplasms in men by death / cancer.

By analyzing the distribution of the 10 most common types of cancer in men and the cause of death from cancer, it can be identified that 14.2% of diagnosed patients died from the disease.

The main victims of deaths were men with stomach cancer (28.3%), esophageal cancer (27.3%) and bronchial and lung cancer with 16.7%. Bladder cancer (13.6%) and rectal cancer (10%) also have a significant frequency of death. Colon cancer with 7.7%, prostate cancer with 5.3% and skin cancer without melanoma with 4.5% complete the list of types of cancer that led men to death. (Table 11).

Table 11: Distribution of the 10 main neoplasms in men by death / cancer.

Death / Cancer	Yes	Not	Fr%
Prostate (C61)	5.3	94.7	100
Non-melanoma skin (C44)	4.5	95.5	100
Stomach (C16)	28.3	71.7	100
Bronchus and Lung (C33-C34)	16.7	83.3	100
Colon (C18)	7.7	92.3	100
Esophagus (C15)	27.3	72.7	100
Rectum (C20)	10.0	90.0	100
Bladder (C67)	13.6	86.4	100
Leukemias (C91-C95)	**	**	**
Central Nervous System (C70-C71-C72)	**	**	**
Fr%	**14.2**	**85.8**	**100.0**

Fr% Relative frequency. ** No information available.

Proportional distribution of cancer by origin of the referral.

Of a universe of 1,552 diagnosed cases, 1,549 were reported by the Unified Health System - SUS, corresponding to 99.8% of patients admitted to the Hospital de Barretos and Bo Hospital de Base Dr. Ary Pinheiro / RO. In total, only 0.2% of all cancer cases registered in men at Hospital de Barretos (Unit of Hospital de Barretos in Porto Velho) and Hospital de Base Dr. Ary Pinheiro were not reported by SUS. (Table 12)

Table 12: Proportional Distribution of Cancer by Origin of the Referral.

Forwarding source	Fa*	Fr%
SUS	1.549	99.8
Not SUS	3	0.2

Fa* Absolute frequency.   **Fr%** Relative frequency

Proportional distribution of cancer according to entry clinic and clinic responsible for the 1st service.

In the 2 years of studies on the distribution of cancer according to the entrance clinic at the Barretos hospital (Porto Velho Unit) and at the base hospital, Dr. Ary Pinheiro, follows the pattern of the annual frequency distribution.

Clinical oncology is the gateway for cancer patients in men in these 2 (two) referral hospitals for cancer diagnosis and treatment in the State of Rondônia. The oncology clinic was responsible for 81.8% of all male cancer patients.

Clinical oncology with 28.1% of all cases, urology with 12%, gastroenterology with 11.9% and head and neck clinic with 8.7% of all new cases are, respectively, the main clinics responsible for first appointments at Barretos hospital (Porto Velho) and Dr. Ary Pinheiro hospital (Table 13).

Table 13: Proportional distribution of cancer according to entry clinic and clinic responsible for the 1st service.

Entrance Clinic	Fr%	1st Service Clinic	Fr%
Clinical Oncology	81.8	Clinical Oncology	28.1
Gastroenterology	3.1	Urology	12.0
Neurology	1.8	Gastroenterology	11.9
Urology	1.5	Head and neck	8.7
Pneumology	0.6	Clinical Histology	2.7
Dermatology	0.4	General surgery	1.8
Other Clinics	10.7	Neurosurgery	1.5
Screening	0.1	Other Clinics	32.8
No information	0.0	No information	0.5
F%	**100.0**	**F%**	**100.0**

Fr% Relative frequency

Proportional distribution of cancer by entry clinic, according to previous diagnosis and treatment.

According to table 14 of the distribution of cancer by the entry clinic, according to previous diagnosis and treatment, 67% of patients were diagnosed and without previous treatment, 17.3% with diagnosis and previous treatment and 15.5% without diagnosis and without previous treatment.

Of the patients seen at the oncology clinic, 8.2% of the patients have already been diagnosed and received previous treatment. However, 69% of patients already diagnosed, but without previous treatment and 12.6% without diagnosis and without previous treatment.

Of the patients who entered the various clinical specialties, the frequency of patients who enter the medical and hospital service without diagnosis and without prior treatment stands out.

In the neurology clinic, 22.9% had no diagnosis and had no previous treatment, in the hematology clinic 41.6% without diagnosis and without previous treatment, in the urology clinic 41.6% without diagnosis and without previous treatment, in the clinic of urology 14.6% without diagnosis and without previous treatment, in gastroenterological clinic 39.4% without diagnosis and without previous treatment and in head and neck clinic 28.9% without diagnosis and without previous treatment.

In the other entry clinics, 25.8% of the patients were not diagnosed and had not undergone any previous treatment. (Table 14).

Table 14: Distribution of cancer by entry clinic, according to previous diagnosis and treatment.

Entrance Clinic	With Diag / With Trat	With Diag / Without Trat	Without Diag/ Without Treat	No Infor	Fr%
Clinical Oncology	18.2	69.0	12.6	0.2	100.0
Neurology	11.5	65.6	22.9	0	100.0
Clinical Hematology	29.2	29.2	41.6	0	100.0
Urology	10.4	75.0	14.6	0	100.0
Gastroenterology	9.6	51.0	39.4	0	100.0
Head and neck	8.9	62.2	28.9	0	100.0
Other Clinics	13.2	60.3	25.8	0.7	100.0
Fr%	**17.3**	**67.0**	**15.5**	**0.2**	**100.0**

Fr% Relative frequency

Proportional distribution of cancer by clinical stage, according to previous diagnosis and treatment.

Nine hundred and forty-three (943) new cases of cancer by clinical stage were excluded (ignored) due to inconsistency in the patient's medical record. For this variable, there was a failure in the health information system. Therefore, only the medical records correctly filled in all mandatory fields were considered.

Table 15 represents the proportional distribution of cancer by clinical stage, according to previous diagnosis and treatment. Excluding the sub-stratification of patients without information, there was a predominance of patients (62.1%) with unknown disease stage.

The distribution of cancer by clinical stage, according to previous diagnosis and treatment, is increasing from stages I to stage IV, in the following proportion: stage I (6.1%), stage II (9.2%), stage III (10.3%) and stage IV (12.3%), with predominance in stages III and IV.

Of the total of 316 patients with diagnosis and without treatment, 59.2% were unaware of the disease stage (unknown stage), 13.6% the disease was in stage IV and 11.4% in stage III.

Of the 152 patients with diagnosis and previous treatment, 52.6% were unaware of the disease stage (unknown stage), 14.5% were in stage IV, 13.8% in stage III and 11.8% in stage III.

Of the 141 patients without diagnosis and without previous treatment, 78.7% were unaware of the disease stage (unknown stage), 7.1% were in stage IV, 4.2% in stage III and 5.7% in stage III. (Table 15).

Table 15: Proportional distribution of cancer by clinical stage, second to previous diagnosis and treatment.

Diagnosis	Stage I	Stage II	Stage III	Stage IV	unknown stage	Fa*
With Diag / Without Trat	6.3	9.5	11.4	13.6	59.2	**316**
With Diag / With Trat	7.2	11.8	13.8	14.5	52.6	**152**
Without Diag / Without Treat	4.3	5.7	4.2	7.1	78.7	**141**
Fa*	**37**	**56**	**63**	**75**	**378**	**609**
Fr%	**6.1**	**9.2**	**10.3**	**12.3**	**62.1**	**100.0**

Fa* Absolute frequency   **Fr%** Relative frequency

Proportional distribution of cancer, by examination performed for diagnosis, number of primary tumors and topography of the occurrence of the first metastasis.

According to the results of the study, 92% of the patients had their diagnosis confirmed by histological examination of the primary tumor. A single primary tumor was identified in 100% of the tests. Of the topographies of occurrence of the 1st metastasis, there was a predominance of cancer of the liver and intrahepatic biliary tract with 25% of the occurrences, bronchi and lungs with 23.1%, bones, joints and articular cartilages of the limbs with 23.1% and meninges 11.5% of occurrences. (Table 16).

Table 16: Proportional distribution of cancer, by examination performed for diagnosis, number of primary tumors and topography of the occurrence of the first metastasis.

Most important basis of diagnosis	Fr%
Clinic	0.1
Clinical research	0.2
Examination by Image	4.8
Tumor Markers	1.6
Cytology	1.0
Primary Tumor Histology	92.0
No information	0.3
Primary Tumor Numbers	**Fr %**
Single Primary Tumor	100.0
Topography of the occurrence of the 1st metastasis	**Fr* %**
Liver and Intrahepatic Bile Ducts	25.0
Bronchi and Lungs	23.1

Heart, Mediastinum and Pleura	3.9
Bones, Joints and Joint Cartilage of Limbs	23.1
Malignant Neoplasm of Bones and Articular Cartilages from Other Unspecified Locations	1.9
Kidney	1.9
Meninges	11.5
Brain	3.9
Thyroid gland	1.9
Other locations and ill-defined locations	3.8

Fr% Relative frequency

Proportional distribution of cancer due to not undergoing treatment.

Fourteen hundred and fifty-one (1,451) new cases of cancer whose initial treatment cannot be performed according to the reason for non-treatment were excluded (ignored) due to inconsistency in the patient's medical record.

According to available data and information, 83% of patients who abandoned treatment justified "Other reasons" without convincing details or explanations. Nine percent justify that they undergo treatment in another state of Brazil and 3% abandoned treatment without any explanation. Regarding the state of the disease at the end of the 1st (first) treatment, it is observed that 74% of the patients had disease progression, 13% with stable disease, 2.2% partial remission of the disease, 1% total remission (cure) and 6.8% died. (Table 17).

Table 17: Proportional Distribution of Cancer Cases Whose Initial Treatment, According to the Reason for Not Performing the First Treatment and Disease Status at the End of the First Treatment.

Cancer whose initial treatment cannot be performed according to reason for not treating	Fr%
Treatment in another State	9.0
Advanced Illness, Lack of Clinical Conditions or Other Associated Diseases	2.0
Treatment Abandonment	3.0
Refusal of Treatment	1.0
Other reasons	83.0
No information	2.0
Cancer status at the end of the 1st treatment	**Fr%**
Complete Remission	1.0
Partial Remission	2.2
Stable Disease	13.0

Disease in progress	74.0
Oncological Therapeutic Support	0.3
Death	6.8
Not applicable	2.7

Fr% Relative frequency

Time interval according to the average, median, fashion, quartile, minimum and maximum.

One of the factors in assessing the quality of care of a reference institution in cancer treatment is the time interval between the three most important moments in caring for a patient: admission date, diagnosis date and treatment start date. Due to inconsistency in the patient and hospital records, the data and information available do not distinguish by gender; therefore, table 10 makes a general reference between men and women.

The average time since registration / diagnosis is 19.5 days, the maximum is 209.5 days and the median is 10 days. The diagnosis / treatment period has an average of 79 days, a maximum of 2,444 days and a median of 40.5 days, while the registration / treatment period has an average time of 5.5 days, a maximum of 129.5 days and the median of 2 days. In the third quartile, the time between enrollment and diagnosis is 28 days and between diagnosis and treatment it reaches 82.5 days. (Table 18).

Table 18: Time interval (in days) elapsed, according to the average, median, mode, quartile, minimum and maximum, between: 1st consultation-1st diagnosis, 1st diagnosis-beginning of treatment, 1st consultation-beginning of treatment.

Indicator	Registration / Diagnosis	Diagnosis / Treatment	Registration / Treatment
Maximum	209.5	2.444	129.5
Average	19.5	79	5.5
Median	10	40.5	2
Minimum	0	0	0
Mode	1	0	0
First Quartile	3.5	13.5	0
Third Quartile	28	82.5	4

Time interval between the 1st consultation and the 1st diagnosis; 1st diagnosis - start of treatment; 1st consultation and start of treatment in the main entry clinics for men with cancer.

The entry clinics with medians between registration and diagnosis with the longest time elapsed are: general surgery with 38 days, gastrosurgery clinic with 18.5 days, clinical oncology with 14.7 days and head and neck clinic with 11 days.

The clinics with the most significant median between diagnosis and 1st treatment, in decreasing order, are: dermatology 106 days, urology 61 days, clinical oncology 49.5 days, head and neck clinic 43.5 days,

general surgery 31.7 days, gastroenterology 27.5 days, gastrosurgery 24.5 days and neurology 23 days. (Table 19).

Table 19: Time interval (in days) elapsed, according to the median, between: 1st consultation-1st diagnosis; 1st diagnosis - start of treatment; 1st consultation and start of treatment, according to the clinic responsible for the 1st treatment.

Entrance Clinic	Median Registration / Diagnosis	Median Diagnosis / Treatment	Median Registration / Treatment
Head and neck	11	43.5	2
General surgery	38	31.7	20.2
Dermatology	0	106	0
Gastrosurgery	18.5	24.5	3.5
Gastroenterology	6.5	27.5	2
Clinical Hematology	4.5	2.5	4
Neurosurgery	7	15.2	2.7
Neurology	5.2	23	3
Clinical Oncology	14.7	49.5	1
Pneumology	8	10.2	7.2
Urology	11.5	61	1

IV DISCUSSION

The objective of this research was to analyze the epidemiological profile of the 10 (ten) most frequent types of cancer in men treated at 2 (two) referral hospitals for cancer treatment in the State of Rondônia, Western Amazon (Brazil), in a period equivalent to 2 (two) years.

The research was conducted with a database organized by the Núcleo Hospitalar de Epidemiologia - NHE of the largest public reference hospital in the State of Rondônia. The incidence of cancer as a public health problem in Rondônia motivated the search to know the epidemiological profile of men diagnosed with cancer.

Proportional distribution of the 10 (ten) most frequent types of cancer in men by location of the primary tumor.

Of a total of 1,552 new cases of cancer diagnosed in men during the study period, 1,163 (74.9%) correspond to the 10 (ten) main types of cancer diagnosed by the location of the primary tumor. Therefore, 1,163 patients correspond to the research sample. In this research, prostate cancer is more frequent (30.9%), followed by non-melanoma skin cancer (22.9%) and stomach cancer (11.7%). The proportional distribution of the 10 (ten) most common types of cancer in men was: prostate (30.9%), non-melanoma skin (22.9%),

stomach (11.7%), bronchi and lungs (6.7%), colon (5.8%), leukemias (5.8%), esophagus (4.4%), central nervous system (4.2%), rectum (3.9%) and bladder (3.6%).

According to INCA [1], the incidence rates of 100 thousand inhabitants and the number of new cases of cancer in Rondônia, according to sex and location of the tumor, for the year 2020, will reach 1,530 new cases of cancer in men. Also according to INCA [1], the 10 highest frequencies in men will be non-melanoma skin cancer (380 new cases), prostate (310 new cases), bronchi and lungs (110 new cases), stomach (80 new cases) , colon and rectum (60 new cases), oral cavity (50 new cases), esophagus (40 new cases), central nervous system (40 new cases), leukemia (40 new cases) and larynx (30 new cases).

The study by Paraguassu-Chaves et al [6] found 10 neoplasms more frequent in men in the following order: prostate cancer (33%), non-melanoma skin (22%), stomach (12%), bladder (5.2%), bronchi and lungs (5.2%), colon (4.8%), rectum (4.8%), esophagus (4.5%), liver and intrahepatic bile ducts (4.1%).

In the research "Cancer in men: a study with patients seen at a hospital in the city of Porto Velho, Brazilian Amazon" by Paraguassu-Chaves et al [2], prostate cancer is more common in 33.9% of new cases, followed by non-melanone skin cancer in 22.2% of cases and stomach cancer in 11.4% of cases.

Paraguassu-Chaves et al [4] in "Epidemiological and sociodemographic characterization of women and men with cancer in a State in the Brazilian Amazon" found the following results: prostate cancer (30.9%), non-melanoma skin cancer (22.9%), stomach cancer (11.7%), bronchial and lung cancer (5.7%), colon cancer (5.8%), cancer of the retoculoendotial hematopoietic system (5.8%), cancer of the esophagus (4.4%), brain cancer (4.2%), cancer of the rectum (3.9%) and bladder cancer (3.6%).

In the reference studies in Rondônia, there is no significant difference in the most common types of cancer in men. Therefore, the 10 (ten) most common types of cancer remain almost in their totality and frequency over the last few years.

The world estimate points to prostate cancer as the second most common cancer in men in the world [1]. It is a highly prevalent disease [8]. It ranks second among malignant neoplasms that affect men, worldwide, behind lung cancer only. Estimated 1,280,000 new cases of prostate cancer, or the equivalent of 7.1% of all cancer values considered [3], [9].

In Brazil, prostate cancer is the cancer with the highest incidence among men (except non-melanoma skin cancer) [10], [11], [12]. In Brazil, there are an estimated 65,840 new cases of prostate cancer for each year of the 2020-2022 triennium. This value corresponds to an estimated risk of 62.95 new cases per 100 thousand men [1]. In Brazil, in 2017, there were 15,391 deaths from prostate cancer, equivalent to the risk of 15.25 / 100 thousand men [13].

The main risk factor is age and its incidence increases significantly after 50 years [14]. Other known risk factors that increase the risk of the disease are: family history, hereditary genetic factors (for example, Lynch syndrome and mutations in BRCA1 and BRCA2) [15].

Smoking and excess body fat are risk factors [16]. Exposure to aromatic amines, arsenic and petroleum products are also risk factors [14]. Family history in the first degree (father, siblings or children) has a positive association to increase the risk of developing this neoplasm [17]. Skin color / ethnicity is relevant in the etiology of prostate cancer [18]. There are other associations of controversial risk factors, such as sex hormones, elitism, eating patterns and obsesity [8], [19] e [20].

Of all the malignancies diagnosed in the world, non-melanoma skin cancer is the most common type in both sexes [3] e [9]. Non-melanoma skin cancer is the most common tumor among men and women in Brazil [21]. In 2018, 1.04 million (5.8%) of new cases of non-melanoma skin were estimated worldwide, with 640 thousand new cases in men (16.6 / 100 thousand) [1].

In Brazil, the number of new cases of non-melanoma skin cancer expected, for each year of the 2020-2022 triennium, will be 83,770 in men, corresponding to an estimated risk of 80.12 new cases per 100 thousand men [1]. In Brazil, 1,301 deaths from non-melanoma skin cancer occurred in men in 2017. This value corresponds to the risk of 0.92 / 100 thousand [22].

The main risk factors for skin cancer are prolonged exposure to the sun (ultraviolet rays - UV), especially in childhood and adolescence, exposure to tanning beds and family history of skin câncer [15]. Skin cancers are more common in people with fair skin over 40 years of age, except for those who already have skin diseases [23]. This statement is corroborated by studies related to sun exposure as an extremely relevant risk factor [24]. In addition to these, there are also environmental and occupational factors.

In Rondônia, workers who carry out their activities outdoors, such as construction workers, farmers, fishermen, health workers, among others, have a higher risk of non-melanoma skin cancer.

It is difficult to estimate non-melanoma skin cancer, as not all cancer records are collected [1]. Despite the low lethality, its high incidence is the cause of the occurrence of deaths from non-melanoma cancer, almost identical to melanoma skin cancer [25].

Of all cancers that occur in the world, stomach cancer ranks fifth [26], [27]. In men the frequency is twice as high as in women [8]. Stomach cancer in both sexes is the third leading cause of death worldwide, with 8.8% of all deaths. In Brazil, in 2017, there were 9,206 deaths from stomach cancer in men, these values corresponded to the risk of 9.12 / 100 thousand [22], [23], [24]. For Brazil, it is estimated, for each year of the 2020-2022 triennium, 13,360 new cases of stomach cancer among men. This value corresponds to an estimated risk of 12.81 per 100 thousand men [1].

Helicobacter Pylori infection comprises a cause more strongly associated with the risk of developing stomach cancer [8], [28], [29].

Other environmental factors include nutritional habits, such as diets rich in smoked or salt-preserved foods, obesity, alcohol and tobacco consumption [8], [30]. On the other hand, the intake of fruits and vegetables, cereals and seafood has been reported as a protective factor. Hereditary factors contribute to a lesser extent to the burden of this type of cancer, such as previous family history, around 2% [8]. Just as the incidence may be affected by the Region's development, the level of education appears to be associated with risk; therefore, more advanced levels of education can be a protective factor [31], [32].

In the world, lung cancer is among the main incidences, occupying the first position among men. In 2018, lung cancer represented 1.37 million new cases in men, corresponding to an estimated risk of 35.5 / 100 thousand men. For Brazil, 17,760 new cases of lung cancer in men are estimated for each year of the 2020-2022 period. This value corresponds to an estimated risk of 16.99 new cases per 100 thousand men [1].

In Brazil, in 2017, there were 16,137 deaths from lung cancer in men, which represents an estimated risk of 15.98 / 100 thousand men [1], [13], [14]. Smoking and passive tobacco exposure are the main risk factors for the development of lung cancer. 85% of diagnosed cases are associated with tobacco use [14]. Smoking and passive tobacco exposure are the main risk factors for the development of lung cancer [33], [34]. Other

risk factors are occupational exposure to chemical or physical agents (asbestos, silica, uranium, chromium and radon) and high doses of beta-carotene supplements in smokers and ex-smokers [1], [14], [33].

It is estimated for Brazil, for each year of the 2020-2022 triennium, 20,520 cases of colon and rectal cancer in men. This value corresponds to an estimated risk of 19.63 new cases per 100 thousand men [1]. The most recent world estimate indicates that 1 million new cases of colon and rectal cancer have occurred in men [1]. It is the third most incident tumor among all cancers, with an estimated risk of 26.6 / 100 thousand. In terms of mortality, in Brazil, in 2017, there were 9,207 deaths due to cervical and rectal cancer (9.12 / 100 thousand) in men [1], [23].

The pattern of colon and rectal cancer incidence differs between the sexes, with much higher rates for men [9], [35]. The main factors related to the increased risk of developing colon and rectal cancer are: age 50 years or older, obesity, physical inactivity, prolonged smoking, high consumption of processed meat, low calcium intake, excessive alcohol consumption and diet low in fruits and fiber [1], [4], [15]. Colon and rectal cancer is a multifactorial disease influenced by genetic, environmental and lifestyle factors [36], [37]. Leukemia is a disease that occurs most often in adults over 55, but it is also the most common cancer in children under 15 [14]. There are more than 12 types of leukemia, the main four being: acute myeloid leukemia (MLA), chronic myeloid leukemia (CML), acute lymphocytic leukemia (ALL) and chronic lymphocytic leukemia (LLC) [1]. A worldwide estimate shows that there were 249,000 new cases of leukemia, the tenth most incident tumor among all cancers, with an estimated risk of 6.5 / 100,000 men [3], [9].

The number of new leukemia cases expected for Brazil, for each year of the 2020-2022 triennium, will be 5,920 cases in men. This value corresponds to an estimated risk of 5.67 new cases per 100 thousand men [1]. In 2017 there were 4,795 deaths from leukemia in Brazil with a mortality rate of 4.75 / 100 thousand men [1], [14]. The risk factors for leukemia are not yet well defined, but there is a suspicion of an association between risk factors with a greater chance of developing some types of diseases, among them: smoking (AML); ionizing radiation (X-rays and gamma); chemotherapy - some classes of drugs used to treat cancer and autoimmune diseases (AML and ALL); occupational exposure to formaldehyde in industries (chemical, textile, among others); rubber production (leukemias); Down syndrome and other inherited diseases (AML); myelodysplastic syndrome and other blood disorders (AML); family history; and, finally, exposure to pesticides, solvents and infection by hepatitis B and C viruses (leukemias) [1].

The world estimate pointed to 572 thousand new cases of esophageal cancer in the world, the incidence being twice as high in men as in women [1]. In men, 400 thousand new cases were registered, occupying the seventh position among all cancers, with an estimated risk of 10.4 / 100 thousand men. Approximately 70% of cases occur in men [3], [9]. The number of new esophageal cancer cases estimated for Brazil, for each year of the 2020-2022 triennium, will be 8,690 cases in men. This value corresponds to an estimated risk of 8.32 new cases per 100 thousand men [1].

The observed incidence and mortality rates are very close, of intermediate magnitude. Esophageal cancer is considered a disease of low prevalence and relatively low survival [8]. Esophageal cancer has the sixth leading cause of cancer death worldwide [3], [9]. In Brazil in 2017, there were 6,647 deaths from esophageal cancer with a crude mortality rate of 6.58 / 100 thousand in men [13].

Excessive consumption of alcoholic beverages and smoking are the main risk factors for esophageal cancer. Among other risk factors associated with the development of esophageal cancer, are obesity, Barret's syndrome (due to gastroesophageal reflux disease), hereditary tylosis syndrome (thickening of the skin on the palms and soles of the feet), achalasia (lack of sphincter relaxation between the esophagus and the stomach), causal lesions (burns) in the esophagus and Plummer-Vinson syndrome (iron deficiency) [3], [38]. Other relevant risk factors also stand out, such as a diet with a low intake of fruits, vegetables and whole fibers, consumption of processed meats and risk factors associated with occupational exposure, such as building dust, coal and metal, fossil fuel vapors, oil mineral, herbicides, sulfuric acid and carbon black [3], [38].

Worldwide, in terms of incidence, cancer of the central nervous system ranks thirteenth in men   [1]. In 2018, 162 thousand new cases were estimated in men. This value corresponds to an estimated risk of 4.2 / 100 thousand men [3], [9]. For Brazil, 5,870 new cases of cancer of the central nervous system in men are estimated for each year of the 2020-2022 triennium [1]. This value corresponds to an estimated risk of 5.61 new cases per 100 thousand men. In Brazil, 4,795 deaths in men occurred in 2017, corresponding to the risk of 4.75 / 100 thousand [13].

As for risk factors, this disease is caused by the sum of changes acquired over time due to genetic predisposition or exposure [14]. The most well-known risk factors are exposure to ionizing radiation, deficiency of the immune system, environmental exposures (arsenic, lead and mercury), occupational exposures (workers in the petrochemical, rubber, plastic and graphic industries) and obesity [15].

Bladder cancer is one of the most common cancers of the urinary tract, being more common in men than in women. Incidence rates are much more frequent in men, two to four times higher than in women.

The most recent world estimate points out that bladder cancer was the sixth most frequent, with an estimate of 424 thousand new cases, with an estimated risk of 11.0 / 100 thousand men [1]. In terms of mortality, in Brazil, 3,021 deaths from bladder cancer occurred in 2017 (2.99 / 100 thousand) in men [13]. The number of new cases of bladder cancer estimated for Brazil, for each year of the 2020-2022 triennium, will be 7,590 cases in men. This value corresponds to an estimated risk of 7.23 new cases per 100 thousand men [1].

Bladder cancer is most often diagnosed in the 60 and 70 year old age groups [39]. However, the age range of patients varies between 45 and 75 years, with a higher incidence in the age group of 66 and 68 years [40].

The main risk factor for bladder cancer is smoking and is associated with the disease in 50% to 70% of cases [14], [41]. The risk of developing this disease among smokers is two to six times higher compared to nonsmokers [8]. There is also an association with risk factors related to occupational and environmental exposure that increase the risk of developing the disease [24].

Distribution of the 10 main neoplasms of men in the State of Rondônia by age at diagnosis of cancer.

Incidence rates increase rapidly after 50 years of age. In Rondônia, the age group of 50 to 79 years old reaches 76.4% of the 10 main types of cancer in men, with respectively 20.4% (between 50 and 59 years old), 26% (between 60 and 69 years old) and 30 % (between 70 and 79 years old). Prostate cancer has a high frequency from the age of 50. Non-melanoma skin cancer is the second most common in men aged 37% (between 70 and 79 years old). Stomach cancer is more common in men over 40 years of age.

Stomach cancer has the highest frequency 28.6% in the age between 60 and 69 years. Bronchial and lung cancer in men is more prevalent in patients with 45.8% in the 60 to 69 age group. Colon cancer has the highest incidence in the 50-59 age group (23.1%). Esophageal cancer concentrates the highest incidence in the age group of 50 to 59 years (40.9%). Rectal cancer is found more often in 30% in the 60 to 69 age group. Bladder cancer maintains the highest concentration of new cases in the 50 to 59 age group (27.3%) and the same relative frequency (27.3%) in the 70 to 79 age group.

Age is still one of the most important risk factors for cancer in men, according to national and international literature. In the study by Paraguassu-Chaves et al [6], there was a predominance in the profile of male patients aged between 55 and 74 years (54.5%). In another study by Paraguassu-Chaves et al [4], there was a predominance of cancer in men, aged between 55 and 59 years (14.6%), 60 to 64 years (14%), 65 to 69 years (12.2%), 70 to 74 years (12%) and extends to 75 to 79 years (11.3%). A study by Paraguassu-Chaves et al [42] found similar results, regardless of the type of cancer.

According to INCA [14], the main risk factor for prostate cancer is age and its incidence increases after 50 years. Also according to INCA [23] skin cancer is more common in people over 40 years of age, except for those who already have skin diseases. The age of 50 years or more is a risk factor for colon and rectal cancer [1], [4], [15]. Leukemia is a disease that occurs most frequently in adults over 55 years of age [14]. Bladder cancer is most often diagnosed in the 60 and 70 year old age groups [39]. The age of confirms with risk factor for most of the cancers studied in this work.

Distribution of the 10 main neoplasms in men, by ethnicity / color.

Neoplasms diagnosed in brown (64.6%) and white (28%) men are more frequent than in other ethnicities. Of the 10 main types of cancer, brown men predominated in all types in the following decreasing order: esophagus (77.3%), colon (69.2%), stomach (67.9%), bronchi and lungs (66.6%), non-melanoma skin (66%), rectum (65%) and prostate (63.3%). The only exception was bladder cancer, which predominated in white patients. This proportional distribution by ethnicity / skin color is similar to those found by Paraguassu-Chaves et al [2], [4], [5], [6], [42].

A study by Paraguassu-Chaves et al [2] found neoplasms diagnosed in brown (64.2%) and white (28.3%) men as the most frequent than in other ethnicities, such as: black, yellow and indigenous. Of the 10 main types of cancer in men, brown color predominated, in the following decreasing order: kidney (73.7%), esophagus (73.7%), colon (68.4%), stomach (66.7%) , non-melanoma skin (65.9%), prostate (62.8%), bronchi and lungs (62.5%), rectal cancer (62.5%) and liver (61.5%). The only exception was bladder cancer, which predominated in white people (47.4%).

In practically all types of cancer, there was a predominance of brown patients, justified by the fact that Rondônia has the majority of the population of that color [42]. For Nakandi H et al [18], skin color is relevant in the etiology of prostate câncer.

Distribution of the 10 main neoplasms in men by level of education.

The education of men diagnosed with cancer is 18.3% illiterate, 43.6% with incomplete primary education, 18.5% with complete primary education, 15.6% with secondary education and 4% with complete higher

education. The frequency of cancer in men with less education is much higher than the cases diagnosed in men with more education.

Prostate cancer concentrates its highest incidence in patients with low education (76.5%). For Alicandro et al [31] and Reques et al [32], the level of education seems to be associated with the risk factor for stomach cancer; according to these authors, the most advanced levels of education can be a protective factor. The same situation occurs with non-melanoma skin cancer (79.8%) of patients with low education. In the same trend of low education, patients with stomach cancer are 26.8% illiterate, 32.1% have incomplete primary education. Bronchial and lung cancer patients, 91.6% were educated patients up to complete elementary school. Colon cancer patients (88.6%) with educational level up to complete elementary school, esophageal cancer with 86.4% up to complete elementary school, rectal cancer with 60% of patients with elementary school and bladder cancer with 81 , 8% of patients with complete elementary education.

These findings are corroborated by Paraguassu-Chaves et al [2], [4], [5], [6], [42]. It is possible to identify that the cancer rate in men with less education is much higher than the cases diagnosed in men with more education. Understanding this information is an effective way to prevent and treat disease. Prostate cancer concentrates its highest incidence in patients with low education. The same situation occurs with non-melanoma skin cancer, with stomach cancer patients, in patients with bronchial and lung cancer, esophagus, colon cancer, bladder cancer and liver cancer [2].

Distribution of the 10 main neoplasms in men by conjugal state.

The highest frequencies of cancer in men were found in married men with 73.2% (without exception), distributed as follows: bladder cancer (86.5%), prostate (78.9%), non-melanoma skin (77.1%), rectum (72.7%), stomach (71.5%), bronchi and lungs (68.8%), esophagus (68.2%) and colon (61.8%). These results were similar to those found by Paraguassu-Chaves et al [4] in 2 years of studies in Rondônia.

Another study found that married people have the highest frequencies (74.9%). The highest frequencies of cancer in men were found in married men, without exception, distributed as follows: rectal cancer (90%), kidney (87.5%), esophagus (80%), prostate (77.2%), non-melanoma skin (76.4%), colon (75%), stomach (73.7%), liver (66.7%), bronchi and lungs (60%) and bladder (60%) [2].

Distribution of the 10 main neoplasms in men, by occupation.

Men diagnosed with cancer who work in agriculture represent 44.9% of the 10 most common types of cancer in men in Rondônia. Next, men who occupy the professions of commerce, banks, transport and others with 22.7%, public agents or employees of the federal, state and municipal public service with 10.8% and independent professional, teacher or technician with 10.8% %.

The proportional distribution of cancer in men by occupational activity is very well defined with agricultural activity, especially in relation to prostate cancers (73.5%), bladder (66.6%), non-melanoma skin (65.1%) , bronchi and lungs (40%), stomach (39.4%) and esophagus (31.8%) are the most frequent.

In the study by Paraguassu-Chaves et al [2] men who work in agriculture represent 67.7% of the cases diagnosed with cancer, followed by men who occupy the professions of commerce, banking, transport and others with 26.7%. The proportional distribution of cancer in men by occupational activity in agricultural

activity, cancer of the bronchi and lungs (88.9%), bladder (80%), esophagus with (80%), prostate (66.7%), kidney (66.7%), non-melanoma skin (63.3%), colon (30%) and liver (55.5%) are the most frequent [2]. In Rondônia cancer predominates in workers in agricultural activities, with 43.4%. The main hypothesis for the high frequency of cancer in agricultural workers is due to the fact of the economic vocation (agricultural activities) of the State of Rondônia. What should lead public health authorities to prioritize protection and assistance policies for this population group [4].

Distribution of the 10 main neoplasms in men by family cancer history.

Regarding the family history of cancer, 45.6% of men with cancer in Rondônia have a family history of cancer. The greatest evidence of cancer with a family history was found in esophageal cancer with 63.7% and rectal cancer with 50%. All 10 main types of cancer in men are related to family history of cancer, in the following order: cancer of the esophagus (63.2%), rectal cancer (50%), stomach cancer (48.2%), cancer of the stomach colon (46.2%), bronchial and lung cancer (45.8%), bladder cancer (45.5%), non-melanone skin cancer (34%) and prostate cancer (31.9%). These findings are corroborated by Paraguassu-Chaves et al [2], [4], [5], [6], [42].

Among the 10 main neoplasms in men with a family history of cancer, 34.6% of men with cancer have a family cancer history. Fifty percent of men with liver and rectal cancer have a family history of cancer. The greatest evidence of cancer with a family history was found in esophageal cancer, where 66.7% of patients have a family history of cancer. All 10 main types of cancer in men are related to family history of cancer, in the following order: stomach (47.7%), colon (45%), bronchi and lungs (42.8%), bladder (38.5%), prostate (26.8%), non-melanone skin cancer (24.6%) and kidney (22.2%) [2].

The American Cancer Society [15] recognizes family history and hereditary genetic factors as a risk factor for prostate cancer. For the American Cancer Society, a family history of skin cancer is an important risk factor for non-melanoma skin cancer [15]. According to Stewart and Wild [8], the family cancer history contributes less to stomach câncer (2%). According to Boyle [36] and Sandler [37], colon and rectal cancer is a multifactorial disease and is influenced by genetic factors. Family history was seen as a risk factor for leukemia [1]. INCA [14] attributes genetic predisposition as a risk factor for esophageal cancer. Therefore, the family history of cancer is one of the risk factors for most neoplasms in this study.

Distribution of the 10 main neoplasms in men by smoking.

The relative incidence of men who declared smokers was 22.8% and 20.9% ex-smokers. The sum of smokers and ex-smokers reaches a relative frequency of 43.7% of men with cancer in Rondônia. The sum of smokers (29.2%) and ex-smokers (45.8%) represents the highest relative incidence in patients with bronchial and lung cancer. Esophageal cancer has the second highest relative incidence of smoking and ex-smoking patients with respectively (45.4%) and (27.3%).

The main types of cancer in men are directly related to smoking, distributed as follows: bronchial and lung cancer (29.2% of smokers and 45.8% of ex-smokers); esophageal cancer (45.4% smokers and 27.3% ex-smokers); stomach cancer (23.2% smokers and 19.6% ex-smokers); colon cancer (23.1% smokers and 19.2% ex-smokers); bladder cancer (18.2% smokers and 22.7% ex-smokers); rectal cancer (20% smokers and 10%

ex-smokers); non-melanoma skin cancer (9.2% smokers and 17.4% ex-smokers); and prostate cancer (14.5% smokers and 5.4% ex-smokers).

According to Maule and Merletti [16], smoking is a risk factor for prostate cancer. Other factors such as tobacco use are at risk for stomach cancer [8], [30]. Eighty percent of bronchial and lung cancer cases are associated with tobacco use [14]. For INCA (1) smoking is associated with leukemia. Excessive smoking is one of the main risk factors for esophageal cancer [3], [38]. The main risk factor for bladder cancer is smoking and is associated with the disease in 50% to 70% of cases [14], [41].

Smoking as a risk factor for some types of cancer has been identified in the Amazon. The studies by Paraguassu-Chaves et al [2], [4], [5], [6], [42] have already shown smoking as a direct factor for the main neoplasms in men in Rondônia.

Distribution of the 10 main neoplasms in men due to alcoholism.

Of the men diagnosed with cancer, 19.5% consume alcoholic beverages and 17.2% are ex-consumers. The frequency of men who have never consumed alcoholic beverages is 63.3%. Men diagnosed with cancer who consume alcoholic beverages are distributed in the following decreasing order: cancer of the esophagus (36.4%), cancer of the bronchi and lungs (25%), stomach cancer (24.6%), colon cancer (23.1%), prostate (14.5%), bladder (13.6%), rectal cancer (10%) and non-melanoma skin cancer (9.2%).

Studies by Paraguassu-Chaves et al [2], [4], [5], [6] and [42] corroborate these findings. In their studies, alcohol consumption was predominant among men with cancer in Rondônia.

One of the studies carried out in Rondônia, showed that of the men diagnosed with cancer, 17.5% use alcohol and 12.9% are ex-consumers, 35.3% of patients with esophageal cancer consume alcoholic beverages, bronchi and lungs (27.8%), liver (26.7%), colon (23.8%), stomach (23.4%), kidney (15.8%), prostate (14.7%) and skin without melanoma (11.8%) are consumers of alcoholic beverages [2].

Other factors for stomach cancer include alcohol consumption [8], [30]. Among the main factors related to the increased risk of developing colon and rectal cancer is excessive alcohol consumption [1], [4], [15]. Excessive consumption of alcoholic beverages is a major risk factor for esophageal câncer [3], [38]. These are some references that associate the consumption of alcoholic beverages as a risk factor for the development of cancer in men.

Proportional distribution of cancer according to the first treatment.

As for the 1st treatment received, "Other isolated therapeutic procedures" had a higher frequency, with 40.1%. The second highest frequency was the surgery procedure with 20.4%, followed by chemotherapy with 7.4% and radiation therapy with 1.8% of the first treatments received by men diagnosed with cancer. Patients who have not received any type of therapeutic treatment, even after diagnosis, reach 30.3%. Patients who received "other isolated therapeutic procedures" are in decreasing order: cancer of the esophagus (45.5%), bladder (39.2%), non-melanoma skin (33%), rectal (30%), prostate (28.9%), colon (26.9%), bronchi and lungs (20.8%) and stomach (17.9%).

A study by Paraguassu-Chaves et al [2] shows that "Other isolated therapeutic procedures", prevailed with 47.8% of the 1st treatment received by the patient. The second highest frequency was surgery with 18.2%

of the procedures. 27.3% of patients, even after diagnosis, did not receive treatment. These findings are also corroborated by Paraguassu-Chaves et al [4], [5], [6].

Distribution of the 10 main neoplasms in men by death / cancer.

By analyzing the distribution of the 10 most common types of cancer in men and the cause of death from cancer, it can be identified that 14.2% of diagnosed patients died from the disease. The main victims of deaths were men with stomach cancer (28.3%), esophageal cancer (27.3%) and bronchial and lung cancer with 16.7%. Bladder cancer (13.6%) and rectal cancer (10%) also have a significant frequency of death. Colon cancer with 7.7%, prostate cancer with 5.3% and skin cancer without melanoma with 4.5% complete the list of types of cancer that led men to death.

In the study by Paraguassu-Chaves et al [2], 9% of men diagnosed with cancer in Rondônia died of the disease. The main victims of death were men with liver cancer (28.6%), esophagus (27.3%), stomach (23.2%), bronchi and lungs (16.7%), kidney (8.3%) and colon (7.7%). These findings are corroborated by Paraguassu-Chaves et al [4], [5] e [6].

Proportional distribution of cancer by origin of the referral.

Almost 100% (99.8%) of patients admitted to Hospital de Barretos / Rondônia and Hospital de Base Dr. Ary Pinheiro were notified by the Unified Health System - SUS. In the study by Soares et al [43] 68.1% of cancer patients come from the Public Health System. The study by Mascarello et al [44] found that 84.2% of cancer patients are referred by the Unified Health System (SUS). Out of a universe of 3,333 diagnosed cases, 3,316 were reported by the Unified Health System - SUS, corresponding to 99.5% of patients admitted to Hospital de Barretos / Rondônia and Hospital de Base Dr. Ary Pinheiro [4].

The National Cancer Prevention and Control Policy guarantees comprehensive care to any cancer patient, through the High Complexity Assistance Units in Oncology (UNACON) and the High Complexity Assistance Centers in Oncology (CACON), which leads to looking for care with SUS.

This situation requires that the managers of the Unified Health System (SUS) make an immense effort to offer adequate care to the population. This perspective makes clear the need for major investments in health promotion, in the quest to modify the patterns of exposure to risk factors for cancer.

Proportional distribution of cancer according to entry clinic and clinic responsible for the 1st service.

The oncology clinic was responsible for 81.8% of all male cancer patients. Clinical oncology with 28.1% of all cases, urology with 12%, gastroenterology with 11.9% and head and neck clinic with 8.7% of all new cases are, respectively, the main clinics responsible for first appointments at Barretos hospital (Porto Velho) and Dr. Ary Pinheiro hospital.

In the study by Paraguassu-Chaves et al [4] the Oncology clinic was responsible for the entry of more than 80% of male patients. Gastroenterology, neurology, urology, pneumology and dermatology clinics are clinics that are also the gateway for male cancer patients. The sum of all other clinics corresponds to 10.7%. The oncology clinic, urology clinic, gastroenterology clinic, head and neck clinic, histology clinic, general surgery clinic and neurosurgeon clinic are the main clinics responsible for the first treatment of the patient [4].

Proportional distribution of cancer by entry clinic, according to previous diagnosis and treatment.

Of all patients, 67% were diagnosed and without previous treatment, 17.3% with diagnosis and previous treatment and 15.5% without diagnosis and without previous treatment. At the oncology clinic, 69% of patients have already been diagnosed, but without previous treatment.

In the neurology clinic, 22.9% had no diagnosis and had no previous treatment, in the hematology clinic 41.6% without diagnosis and without previous treatment, in the urology clinic 41.6% without diagnosis and without previous treatment, in the clinic of urology 14.6% without diagnosis and without previous treatment, in gastroenterological clinic 39.4% without diagnosis and without previous treatment and in head and neck clinic 28.9% without diagnosis and without previous treatment.

According to Soares et al [43], the prolonged time between clinical suspicion and confirmation of the diagnosis, diagnosis and non-immediate treatment are factors that hinder the treatment of the disease.

Proportional distribution of cancer by clinical stage, according to previous diagnosis and treatment.

There is a predominance of patients (62.1%) with unknown stage of the disease. Of the total of 316 patients with diagnosis and without treatment, 59.2% were unaware of the disease stage (unknown stage), 13.6% the disease was in stage IV and 11.4% in stage III. Of the 152 patients with previous diagnosis and treatment, 52.6% were unaware of the disease stage (unknown stage), 14.5% were in stage IV, 13.8% in stage III and 11.8% in stage III. Of the 141 patients without diagnosis and without previous treatment, 78.7% were unaware of the disease stage (unknown stage), 7.1% were in stage IV, 4.2% in stage III and 5.7% in stage III.

The few reference studies in the Amazon already warn about the lack of knowledge about the stage of the disease and the diagnosis of advanced cancer. The advanced stages of the disease make treatment difficult and, consequently, can cause a large number of deaths [43]. There was a predominance of patients (non-stage), that is, patients without defining the stage of the disease.

In the diagnostic categories of cancer stages studied by Paraguassu-Chaves et al [4] in Rondônia, there was a predominance in stages III and IV, considered advanced stages of the disease.

Proportional distribution of cancer, by examination performed for diagnosis, number of primary tumors and topography of the occurrence of the first metastasis.

According to the results of the study, 92% of the patients had their diagnosis confirmed by histological examination of the primary tumor. A single primary tumor was identified in 100% of the tests. Of the topographies of occurrence of the 1st metastasis, there was a predominance of cancer of the liver and intrahepatic biliary tract with 25% of the occurrences, bronchi and lungs with 23.1%, bones, joints and articular cartilages of the limbs with 23.1% and meninges 11.5% of occurrences.

In a study by Paraguassu-Chaves et al (4), ninety-two percent of patients had their diagnosis confirmed by histological examination of the primary tumor. A single primary tumor was identified in 99.96% of the tests. From the topographies of occurrence of the 1st metastasis, there was a predominance of cancer of the liver and intrahepatic biliary tract with 25% of the occurrences and bronchi and lungs with 23%. These results are almost the same as the current research.

Proportional distribution of cancer due to not undergoing treatment.

According to the survey data, 83% of patients who abandoned treatment justified "Other reasons" without convincing details or explanations. The abandonment of treatment after the first treatment of the patient, shows an extremely worrying situation. Well, it is a set of diseases that if not treated correctly can fatally lead the patient to death.

What is known that a small portion of these patients with better financial conditions abandon treatment in Rondônia and seek large centers specializing in cancer in other States.

Time interval according to the average, median, fashion, quartile, minimum and maximum.

The average time since registration / diagnosis is 19.5 days, the maximum is 209.5 days and the median is 10 days. The diagnosis / treatment period has an average of 79 days, a maximum of 2,444 days and a median of 40.5 days, while the registration / treatment period has an average time of 5.5 days, a maximum of 129.5 days and the median of 2 days. In the third quartile, the time between registration and diagnosis is 28 days and between diagnosis and treatment it reaches 82.5 days.

Previously, the time interval between the three most important moments in the care of a patient was not known in detail: date of admission, date of diagnosis and date of beginning of treatment. This information is crucial in assessing the quality of care at a referral hospital for cancer treatment.

Time interval between the 1st consultation and the 1st diagnosis; 1st diagnosis - start of treatment; 1st consultation and start of treatment in the main entry clinics for men with cancer.

The entry clinics with medians between registration and diagnosis with the longest elapsed time are: general surgery with 38 days, gastrosurgery clinic with 18.5 days, clinical oncology with 14.7 days and head and neck clinic with 11 days. The clinics with the most significant median between diagnosis and 1st treatment, in descending order, are: dermatology 106 days, urology 61 days, clinical oncology 49.5 days, head and neck clinic 43.5 days, general surgery 31.7 days, gastroenterology 27.5 days, gastrosurgery 24.5 days and neurology 23 days.

According to some experts, these mediators are reasonable, that is, they are on an intermediate scale. Little was known about the time interval between the first consultation and the first diagnosis; 1st diagnosis - start of treatment; 1st consultation and start of treatment at the main entrance clinics for men with cancer in Rondônia.

V. CONCLUSIONS

The present study concludes that, of the sample of 1,163 (74.9% of the total cancer in men) corresponds to the 10 (ten) main types of cancer diagnosed by the location of the primary tumor in men. The sample was obtained from data in 2 (two) referral hospitals for cancer treatment in Rondônia, for a period of 2 (two) years.

The 10 (ten) most common types of cancer in men were: prostate (30.9%), non-melanoma skin (22.9%), stomach (11.7%), bronchi and lungs (6.7%), colon (5.8%), leukemia (5.8%), esophagus (4.4%), central nervous system (4.2%), rectum (3.9%) and bladder (3.6%).

There was a predominance of the age group from 50 to 79 years old, reaching 76.4%, being 20.4% (between 50 and 59 years old), 26% (between 60 and 69 years old) and 30% (between 70 and 79 years old). old). elderly), respectively, men with brown (64.6%) and white (28%) skin color, low education, 73.2% of men with cancer are married, 44.9% of men work in agriculture, 45, 6% of men with cancer have a family history of cancer, 22.8% smokers and 20.9% ex-smokers and 19.5% consume alcohol and 17.2% are ex-alcohol users. In all types of diagnosed cancer, there is a relationship with smoking and alcohol consumption.

The first treatment received more frequently (40.1%) was "other isolated therapeutic procedures", followed by the surgical procedure with 20.4%. Of the 10 types of cancer in this study, 14% of patients died of the disease, 99.8% of patients were notified by the Unified Health System - SUS and the oncology clinic was responsible for 81.8% of all cancer patients and 28.1% for the first treatments. 67% of patients were diagnosed and without previous treatment, 17.3% with diagnosis and previous treatment and 15.5% without diagnosis and without previous treatment. There was a predominance in stages III and IV of the disease. Of the total of 316 patients with diagnosis and without treatment, 59.2% were unaware of the disease stage (unknown stage). These findings are extremely worrying. 92% of the patients had their diagnosis confirmed by histological examination of the primary tumor and a single primary tumor was identified in 100% of the tests.

From the topographies of occurrence of the 1st metastasis, there was a predominance of cancer of the liver and intrahepatic biliary tract (25%), bronchi and lungs (23.1%), bones, joints and articular cartilages of the limbs (23.1%) and meninges (11, 5%) of occurrences. 83% of patients who abandoned treatment justified "Other reasons" without convincing details and explanations. The average time since registration / diagnosis is 19.5 days, the maximum is 209.5 days and the median is 10 days, and the entry clinics with medians between registration and diagnosis with the longest elapsed time are: general surgery (38 days), gastrosurgery clinic (18.5 days), clinical oncology (14.7 days (and head and neck clinic (11 days). According to some experts, time considered intermediate. The results are similar to those found by Paraguassú-Chaves et al [2], [4], [5] and [6] in Rondônia.

For research carried out in Rondônia, the Hospital Cancer Registry (RHC) represents an extremely important tool for the knowledge and monitoring of cancer morbidity and mortality and that can provide hospital staff and management with information on the frequency and possible trends of the most types of diseases. cancer diagnosed and / or treated at the health facility and estimated patient survival. However, you may encounter some problems (inefficiency) in filling out medical records and other important information, which can compromise any analysis or interpretation more safely and efficiently.

The scenario of cancer projection in men in Rondônia is worrying and requires an urgent redirection of actions and strategies for cancer prevention, control, assistance and treatment.

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Integrating technology in secondary education: an experience of flipped classroom and Inquiry-Based Learning for a science class

Susana Medeiros Cunha, MSc

Science, Technology and Health Center, Federal University of Santa Catarina,
Araranguá 88900-000, Brazil.

Isabela Nardi da Silva, MSc

Department of Education, Social Service of Industry
Criciúma 88802-330, Brazil.

Ladislei Marques Felipe Castro

Science, Technology and Health Center, Federal University of Santa Catarina,
Araranguá 88900-000, Brazil.

Juarez Bento da Silva, Dr

Science, Technology and Health Center, Federal University of Santa Catarina,
Araranguá 88900-000, Brazil.

Simone Meister Sommer Bilessimo, Dr

Science, Technology and Health Center, Federal University of Santa Catarina,
Araranguá 88900-000, Brazil.

Abstract

The continuous advance of digital technologies reinforces the need to provide more attractive teaching environments. Compatible environments, not antagonistic, with the way children and adolescents learn. This work presents an experience of integrating technology in the science discipline in elementary school. 44 students from the 5th year of a public school participated in the research. Methodologically, the inverted classroom technique was chosen. To support the activities and make the contents available, a didactic sequence based on Inquiry-Based Learning, made available in a VLE. Two questionnaires were applied: one with 12 items, which aimed to obtain registration data and identify the students' profile; and another, which sought to identify the students' perception of the new didactic experience. This second had 18 items, arranged on a 5-point Likert scale, divided into 4 domains (Usability, Perception of Learning, Satisfaction and Utility). The average obtained from the items was 4.28 points on the Likert scale. This revealed that the experience was well evaluated and approved by the participants, and that the presented model of learning was pleasant, in addition to arousing the students' interest in research.

Keywords: Flipped classroom; Inquiry-Based Learning; Secondary education;

1. Introduction

The Digital Technologies of Information and Communication (TDIC) designate a set of technological innovations and tools that allow a redefinition of the functioning of society. These technologies are an integral part of the society in which we live and have impacted on people's way of life. Smartphones, notebooks and a multitude of computing devices and devices surround our activities, inevitably reaching the educational level. Teaching and learning processes are no longer limited to classroom time and space. The concept of ubiquity (COPE and KALANTIZS, 2009) has been installed in a society that learns and absorbs data and information all the time and everywhere, and this also has a direct effect on the way in which teaching should be viewed in this context. This context, which, pressed by the advancement of new technologies, proposes new and continuous challenges for teachers, students, institution managers and the institutions themselves.

Recently, the National Education Council, through Resolution No. 1, of February 2, 2016, defined the national operational guidelines for institutional accreditation and the offer of distance education courses, within the scope of Basic Education (Brazil, 2016). In line with the provisions of art. 80 of Law nº 9.394 / 96 and with Decree nº 5.622 / 2005, the resolution understands the Distance Education modality as a way of developing the teaching and learning process mediated by technologies, which allow the direct action of the teacher and the student in different physical environments [4]. The technological resources that mediate this type of teaching and learning consider a multiplicity of platforms, media and media such as the Virtual Learning Environment (AVEA), transmission of classes via satellite, internet, video lessons, MOOCS, cell phones, social networks, applications mobile learning, digital TV, radio, print and others that make up the possibilities of ICT. These possibilities may be appropriate and appropriate to different models and formats of pedagogical mediation, in order to ensure that it fully meets the new location in which it intends to operate, being able to enable transmission and mediation [3].

The integration of DICT into the educational system is not a new phenomenon, however, it is a complex theme and its success does not only involve equipping schools with technological tools, as technology, although a valuable tool, is not a solution in itself. If it is accompanied by an effective didactic strategy and which seeks to integrate content, pedagogical and technological knowledge, it can become an innovative and effective proposal [16].

The Flipped Classroom is an active methodology that aims to change the way the teaching and learning process takes place in the classroom. The main idea is that the student has a prior study of the content outside the classroom environment, so that later, in the classroom, he can perform other more dynamic activities, clarify doubts, group work, field trips, projects, among other activities that previously could not be carried out, because they were copying material from the board or doing readings and studies in the classroom [1].

It is important to note that a Didactic Sequence (SD), can be defined as a set of activities that are ordered, structured and articulated to fulfill a given educational objective. However, with determined beginning and end, for the teacher and the student. SD is a didactic resource that makes it possible for the teacher to question scientific knowledge and for students to study and discuss a certain theme in more depth [18]. The use of DS favors the use of real situations, similar to those that students live in their daily lives, since, part

of the problematization, and leads the student to observe and confront his previous knowledge as the new information presented to him [13]. Thus, it can be said that an SD can be an alternative to overcome some barriers of traditional teaching, where classes are taught practically or totally oral, full of concepts, phenomena, nomenclatures, formulas and theories, charged in the form of tests and tests [8].

In addition, Research-Based Learning (ABI) is a model that emerged in the late 1990s, out of criticism by the American educator Ernest Boyer, about the lack of student participation in research activities and the consequent lack of skills related to it. According to León et al. [7], scientific literacy or the development of research capacity is indispensable given the challenges that are currently present both globally and locally. Many authors refer to ABI as a didactic approach that allows the use of active learning strategies to develop in students, skills that allow them to carry out creative research. Besides favoring in particular the autonomy of students to build their own knowledge [17]; [15].

Pedaste [11] presented a systematic review of the literature, where he selected 32 articles for in-depth analysis. In these, it sought to identify the various steps pointed out by the authors to develop ABI, making comparisons and establishing relationships between them. Based on this study, he concluded that Research-Based Teaching (inquiry) can be structured "into five general phases: orientation, conceptualization, investigation, conclusion and discussion" [11]. This model was the guide for the didactic sequence implemented in this research.

This article reports the experience of integrating technology in education with students from two classes of 5th grade, from elementary school, from a municipal public school, in Imbé/RS - Brazil. For the development of this study, an "Investigative Didactic Sequence" was created, inspired by a "Research-Based Learning" model, made available on Moodle and its application was based on the "Inverted Classroom" approach in science teaching. In the following sections of this document, the research methodology, the results obtained, as well as their discussion, and the section dealing with the conclusion will be presented.

2. Materials and Methods

This research is classified, in terms of its nature as applied research, in view of being a proposal for a practical-theoretical study, with the development and application of a didactic sequence, of a descriptive exploratory nature. And, as a case study, with a qualitative approach, since it aimed to compare theory and practice, as well as, to perceive the satisfaction of the participants regarding the use of digital information and communication technologies in science education [5].

The research was applied, in science classes, in the third quarter of 2018, 44 students from two classes of the 5th year of Elementary School, from a municipal public school in Imbé/RS - Brazil participated in the research. According to the School Census / INEP 2018, the school had 229 students enrolled in the initial years and 158 in the final years. In the period, it also had 41 civil servants, including teachers and technicians. Regarding infrastructure, the school does not have a library, a science laboratory or a computer laboratory. Even having an Internet connection, it has a very limited resource (2Mb) [2]. Thus, for the application to be possible, five notebooks were used (two from the researcher, one from the teacher and two from the school), and when available, the thirty tablets from the Remote Experimentation Laboratory

(RExLab) from Federal University of Santa Catarina (UFSC).

As for the Basic Education Development Index (IDEB), in the period evaluated in the Census, the school obtained 5.1 and 4.7, indicators below the goals for the school, which were 5.9 and 5.3, respectively for the initial and final years. In relation to proficiency, the percentage values in Portuguese and mathematics were 63% and 28% for the 5th year and 51% and 26% for the 9th year [2].

Two questionnaires were applied, which were answered by the students through the project's VLE. It is also worth noting that the two were based on similar ones built by the team of researchers from RExLab, from UFSC, and widely used and validated in other research. RExLab received authorization to use and adapt them through partnerships between the researchers who developed this instrument. The first questionnaire, called "Student Profile" with 12 items, aimed to obtain registration data and identify the students' profile. The second, called "Evaluation of the use of VLE", had 18 items, closed questions, divided into 4 domains (Usability (4), Perception of Learning (6), Satisfaction (6) and Utility (2). The VLE refers to the online environment in which the contents were made available and the objective of the questionnaire was to observe the perception of the students involved in the research regarding the use of the resources offered in science classes. For the calculation of scores, in the second questionnaire, a 5-point Likert scale was used, formed by several elements in the form of statements. In order to carry out the analysis, the following numbers were adopted (Chart 1): Totally Agree (CT), Partially Agree (CP), No Opinion (SO), Partially Disagree (DP) and Totally Disagree (DT), in which the students should express their degree of agreement with the statement, thus, it would be possible to measure the respondent's attitudes and degree of compliance with the statement, thereby showing more specifically how much they agreed or disagreed with an attitude or action, or the how satisfied or dissatisfied with the statement [14].

Table 1. Agreement levels

	Totally agree	Partially agree	Partially disagree	Totally disagree	No opinion
Initials	CT	CP	DP	DT	SO
Value	5	4	3	2	1

Source: authors

For this study, an investigative didactic sequence (SDI) was created for integration in the science classes, of the 5th grade class of elementary school I. Its construction was based on systematization, already validated by the research project Go-Lab: orientation, contextualization , investigation, discussion and conclusion [15]. The research was carried out in four steps (Figure 1).

STEP 1: PROJECT	STEP 2: DEVELOPMENT	STEP 3: APPLICATION	STEP 4: ANALYSIS
• Bibliographic research • Definition of the case study • Methodological development • Definition of the target audience, digital technologies to be used and theme to be worked on	• Creation of the virtual classroom in the VLE • Research and selection of materials • SD development in VLE • Presentation of SD and validation of teaching content	• Presentation of the research to the subjects • Application of the "Student Profile" questionnaire • Application of the methodology • Support for students • Application of the evaluation questionnaire	• Compilation and analysis of collected data • Making the report

Figure 1. Research Steps
Source: authors

1 - Planning: the main stage of the research, in which the case study was defined and the necessary adjustments were made to the project, the exploratory search for literature on bases and portals was made to deepen the theme; it was also in this stage the definition by Moodle, of the InTecEdu program, to be used as support and repository of SDI. In June 2018, the project was presented to the principal and teacher, in which the application at the school was approved; after that, the content "Water and Soil" was defined with the teacher to be approached in the investigative didactic sequence, considering that this was the content that would work in the third quarter, period in which the application would be carried out.

2 - Development: this stage started with the creation, in Moodle, of the virtual classroom, that is, a space that would be used by the students, for early studies on the content to be discussed and worked on in the classroom. Concomitantly to this, research and selection of teaching materials (digital games, simulators, videos, activities, etc.) were carried out on the theme "Water and Soil, which, after being presented and defined with the teacher, started the sequence development process. investigative didactics, in the VLE.

3 - Application: the application started with the presentation of the study to the students; as the first activity, they were asked to complete the diagnostic assessment instrument "Student profile", in order to get to know the participants and their knowledge about digital technologies. The application also included assistance in the development of the research proposed in SDI for the Science Fair. Finally, the student's satisfaction survey instrument was applied, with the objective of identifying the impact of the application and the participants' perception of digital technological resources.

4 - Analysis: analysis of the diagnostic and final evaluation instruments, and other research materials, in order to verify the results of the research application, which would be used for the finalization and conclusion of this study.

3. Results and Discussion

The active methodology used was Flipped Classroom. In this method, the teaching and learning process was completely reversed to the organization of the traditional classroom. A virtual classroom was opened at VLE - Moodle - InTecEdu (Project for the Integration of Technology in Secondary Education, from RexLab / UFSC, made available to the public network) (Figure 2).
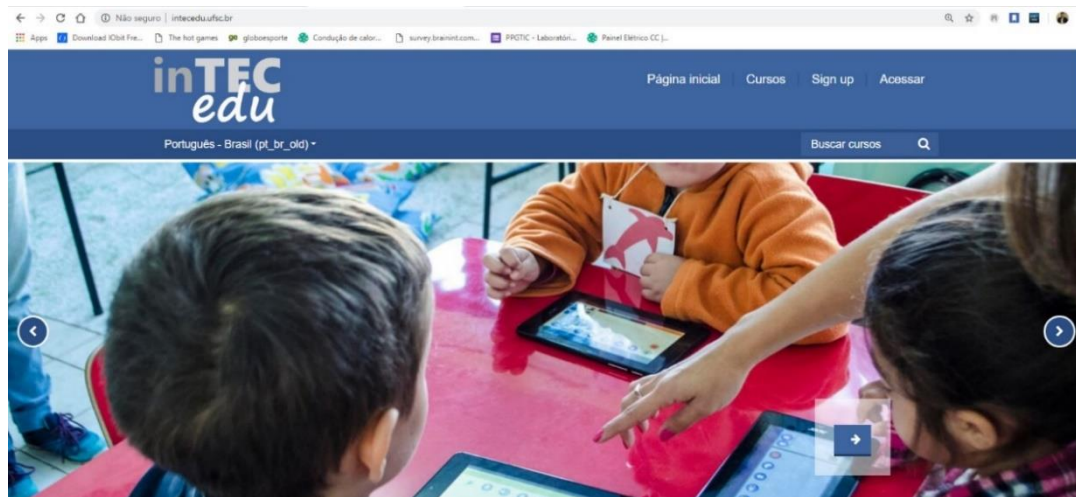
Figure 2. InTecEdu Program Homepage (at http://intecedu.ufsc.br)

Source: authors

The space was designed for students to access the content at home, as the school no longer had a computer lab. In this VLE the student had the SDI available with all the content on the subject being studied, in this case "water and soil", using different materials and resources, such as: videos, animations, games, simulations, hypertexts, presentations, in addition to individual and group activities to perform (forums, objective and dissertative evaluation activities, activities to be developed and posted later).

The technological environment was organized in a unique layout, in which the SDI was arranged in tabs with the contents and activities that the student should browse and access the materials.

The structure was divided into nine tabs, namely:

1 - Presentation: It is the first page that appeared to the student when he accessed the VLE (Figure 3).

Figure 3. Course presentation
Source: authors

2 - Guidelines: In this tab, students had all the information and guidance on what they needed to do in the virtual classroom (Figure 4)

Figure 4. Course guidelines
Source: authors

3 - Contextualization: Here the proposal was that the student should be sensitized to the theme that would be studied, for that, animation videos, music clips and documentaries on the theme "water" were used (Figure 5).

Figure 5. Course contextualization
Source: authors

4 - Contents: the tab was divided into six sub-tabs (Figure 6) - Water, Soil, Pollution, Recycling, Site Tips and Tutorials, to better organize the materials to be studied. The contents were made available during the application of the research, that is, one tab per week, so that they could access the materials, study, carry out the activities and later, in the classroom, discuss the subject studied. The "Website Tips" and "Tutoriais" tabs were designed to support the development of the activities proposed in the working groups.

Figure 6. Course content
Source: authors

5 - Science Fair: in this tab, twelve working groups were created (Figure 7), where each group was challenged to answer an investigative question, to present in a future "Science Fair", which was up to the students to plan and organize the event. In addition, the idea was for them to produce some material (PPT, video, model, etc.) explaining the investigations and the results found.

Figure 7. Science Fair tab

Source: authors

6 - Curiosities: In the "Curiosities" tab, animated videos were made available with curiosities that were related to the theme worked on. Figure 8 shows some of the videos available in the curiosity step.

Figure 8. Curiosities - Examples

Source: authors

7 - Discussion: the purpose of this tab was to establish the debate, through a forum for discussions on the topic, as well as to provide opportunities for the interaction of students and teachers (Figure 9).

Figure 9. Course discussion

Source: authors

8 - Conclusion: to conclude the studies, discursive evaluative activities on what students learned in relation to the topic were proposed in this tab (Figure 10).

Figure 10. Course conclusion

Source: authors

9 - Ending: This tab ended the application of the research, with the students answering the questionnaire about their perception of the use of VLE. (Figure 11).
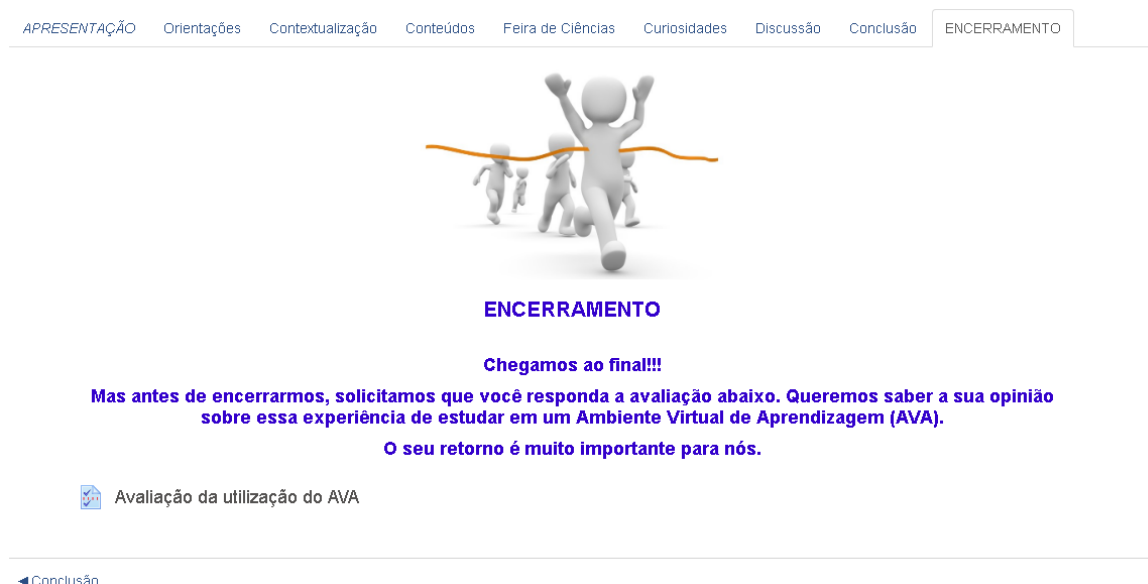
Figure 11. Course ending

Source: authors

3.1 Case Study

The case study was carried out from September 3 to November 5, 2018. During this period, students were constantly urged to access AVEA at home, interact with materials and colleagues, take notes on their doubts, for further discussion in class.In the classroom, it was time to discuss the topic of the week, where students explained what they understood, exchanged ideas and cleared up their doubts. As for technological resources for student use, five notebooks were made available (two from the researcher, one from the teacher and two from the school), and in some meetings, thirty RexLab Tablets were used to carry out activities, evaluations and group research, on your research topic for the Science Fair. Throughout the application of the study, the teachers (researcher and conductor) helped students with their practical and research activities. Regarding the technological resources used, this improvisation was necessary, considering that at the time of the case study, the school did not have a computer laboratory.

3.1 Questionnaire

The research data were collected through questionnaires, applied at the beginning and at the end of the research. On the first day of application, students were asked to answer the "Student Profile" questionnaire in the "Guidelines" tab. In this questionnaire, it was possible to identify the profile of the research's target audience. In total, 44 students participated in the research, half of whom were male and the other half were female. Regarding the age group of students, the percentages were as follows: 55% aged 11 years, 27% aged 10 years or less and 18% aged 12 years or over. According to the Ministry of Education of Brazil (2009), in relation to the 5th of elementary school, the corresponding age at the beginning of the school year, without age/year distortion), must be 10 years. Since, the questionnaire was answered in the second semester, it is possible to argue that 81.52% are close to the correct age/year, however, around 18.18% present distortion in age/grade.

Question 4 asked about "Which subjects do you like best?". Relating the question to the research objectives, the importance of the activities carried out was evident, since only 27.27% of the respondents expressed "liking more" about the STEM subjects (in English, Science, Technology, Engineering, and Mathematics), being 6, 82% replied that they like science and 20.45% mathematics (Figure 12).
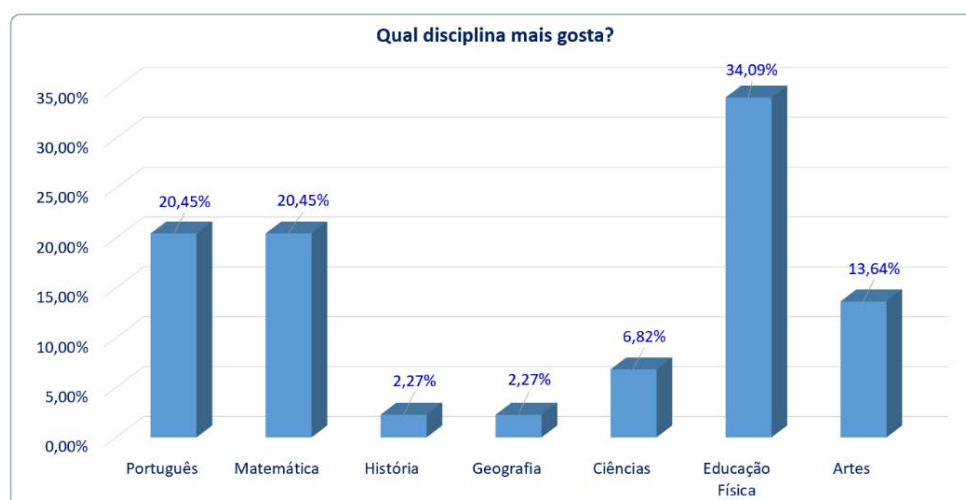
Figure 12. Most liked subjects

Source: authors

The questions in the "Student profile" questionnaire, from 5 to 12, referred to technological issues.

Question 5 was written as follows: "Do you have a computer?". Of the respondents, 40.91% said yes and 59.09% no. Even though less than half the class, the number of students who have a computer at home, can be considered high, given that the school is located in a low-income community. The next question was written as follows: "Do you have access to the internet?". In this, 93.18% answered yes, and only 6.82% did not.

However, when asking which "preferentially access the internet", 79.55% answered using mobile devices and only 20.45% answered the computer, contradicting the previous answer, where 40.91% answered that they had a computer. Regarding the "internet access location", the percentage of 79.55% is repeated, in the response that they access at home, 11.36% at school and 9.09% in other places.

When asked if "do you access the Internet for school activities?", 79.55% answered yes and 20.45% no. And, when answering yes, they should answer the next question, "use the internet for", 51.52% said "use it to do research", 30.30% to do work on a topic, 9.09% to do work group and 9.09% for lessons or exercises that the teacher passes.

Question 10, "What activity do you do most when accessing the Internet?" the result showed: 63.64% to watch videos, 18.18% to social networks, 9.09% to search for information on Google or another search engine, 4.55% to post a video that he created, 2.27% to use online text editor and 2.27% read a book online (Figure 13). To finalize the analysis of the items in the "Student Profile" questionnaire, the percentages of question 9 are presented, regarding the "frequency of internet access". Of the respondents, 77.27% stated that they access more than once a day, 15.91% at least once a day, therefore, 93.18% connect to the internet at least once a day, the other 6, 82% answered that they access at least once a week (Figure 13).
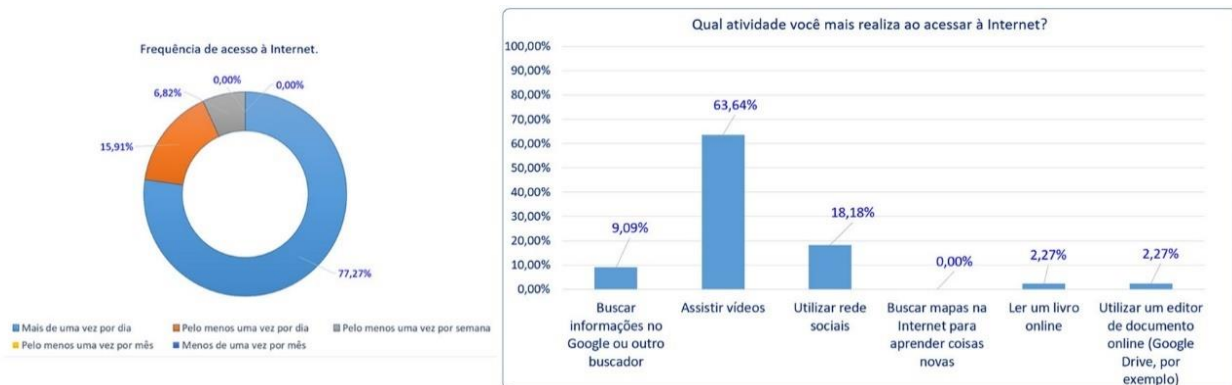
Figure 13. Activities and frequency of Internet access
Source: authors

In view of the result presented in the responses of the student's profile, the possibility of carrying out activities using digital technologies is notorious, considering that the students, despite being of low income, have access to the internet, are familiar with the technology and already used for school activities.

The second questionnaire, called "Assessment of the use of AVEA", was applied at the end of the research and was answered by 42 students, representing 95.45% of the total enrolled in the science discipline. The questionnaire covered 18 questions built according to the model of an additional 5-point Likert scale, in order to understand what students think about the use of digital resources in classes. The questions that

accompany the items of the answers were evaluated with weights from 1 to 5. The students expressed their degree of agreement or rejection, through a scale that had five numerical values, with defined scores. Possible responses and scores were as follows: Totally Agree (CT) = 5, Partially Agree (CP) = 4, No Opinion (SO) = 3, Partially Disagree (DP) = 2 and Totally Disagree (DT) = 1 (Chart 1).

For analysis purposes, the answers to the 18 questions in the questionnaire were divided into the following domains:

1. Usability: referred to the ease of use of digital resources and if there were no problems to perform the desired actions;

2. Perception of Learning: sought to indicate whether the student, through the resources made available, realized if his learning improved and the acquired skills were valuable for learning;

3. Satisfaction: sought to understand the motivation for using resources and for studies;

4. Usefulness: whether it was useful and whether the tools used provided new forms and opportunities for learning.

For the purpose of validating the questionnaire, the total consistency coefficient of Cronbach's alpha was superimposed on all of its questions. The Cronbach's alpha coefficient calculated for the applied questionnaire, in its total (18 items), was 0.8905. The Standard Deviation for the average of the eighteen items was 0.345 and the Coefficient of Variation was 8.08%. The average of the items was 4.28 points on the Likert scale.

Figure 14 shows percentage values by domain. There is a very positive trend in relation to the position of students for the resources used. For "Utility" the percentages were 76.79% for CP/CT and 22.62% for DP/DT. For "Satisfaction": 86.90% for CP/CT and 11.90% for DP/DT, "Perception of Learning": 87.70% for CP/CT and 11.51% for DP/DT and "Usability": 88.10% for CP/CT and 4.46% for DP/DT.
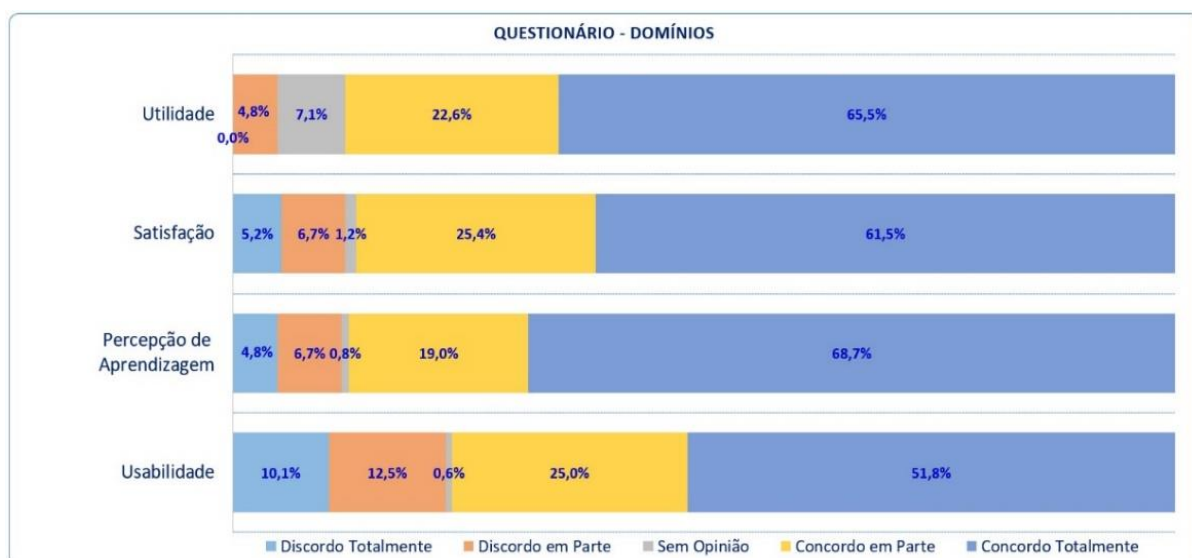
Figure 14. Results for questionnaire about the VLE

Source: authors

The Average Score (EMd) was also calculated for the answers acquired in the questionnaire, using the 5-point Likert scale. To find out, whether attitudes were positive or negative, through the EMd, the following conditions were imposed: values less than 3 presented adverse attitudes and greater than 3, favorable, while

value 3 was estimated "without opinion". The average total score, for the 18 items analyzed, was 4.28, on the Likert scale. Figure 15 presents graphically the scores obtained, by domain.
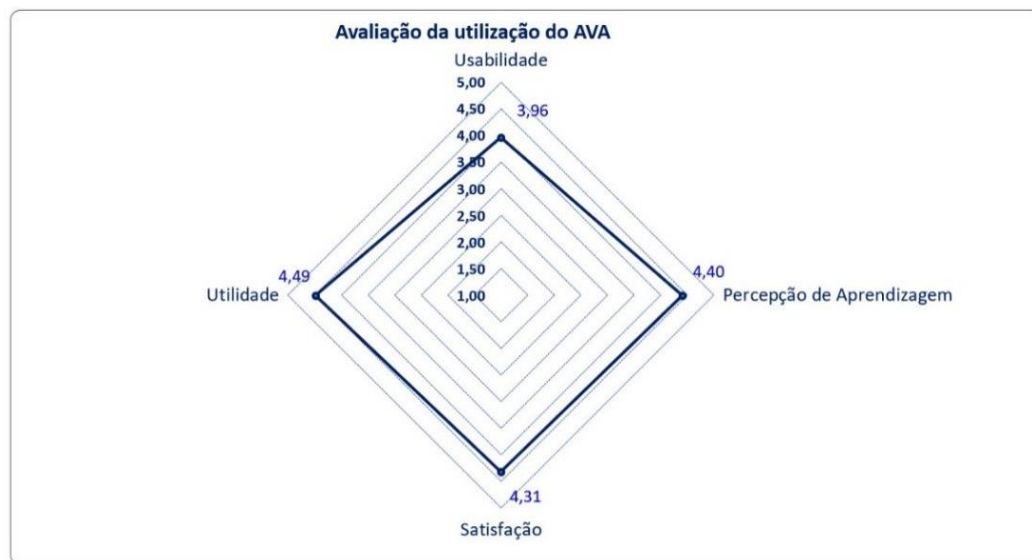
Figure 15. Evaluation of VLE usability
Source: authors

For Perception of Learning, six items were formulated, whose Cronbach's alpha coefficient calculated for this domain was 0.83. The EMd obtained for the six items was 4.40, Standard Deviation of 0.14 and Coefficient of Variation of 3.32%. Regarding the items:

1. The use of VLE improved my understanding of the theoretical concepts that were addressed in practice = 4.48.

2. Accessing the virtual teaching-learning environment (AVEA) helped to relate the concepts studied in the classroom with my daily life = 4.48.

3. The use of resources made available in AVEA contributed to my learning = 4.38.

4. The use of VLE was an effective learning experience = 4.29;

5. The skills acquired were valuable for my learning = 4.60.

6. The way the VLE was used in the classroom contributes to problem solving = 4.19.

The percentage of 87.70% for CP + CT stands out positively. Manifesting a very positive attitude on the part of the students, in relation to the perception of learning.

For Perception of Satisfaction, six items were formulated, whose Cronbach's alpha coefficient calculated for this domain was 0.77. The EMd obtained for the six items was 4.31, Standard Deviation 0.29 and Coefficient of Variation 6.83%. Regarding the items:

1. The skills acquired were valuable for my learning = 4.45.

2. The use of VLE was relevant to my studies = 4.50.

3. The use of VLE increased my motivation to learn = 4.60.

4. I would advise my colleagues to use VLE = 4.40.

5. VLE helped to communicate with my colleagues = 3.81.

6. I would like to use VLE in other disciplines = 4.12.

The percentage of 86.90% for CP + CT stands out positively. Expressing a very positive attitude on the part

of the students, regarding the perception of satisfaction. Because, only one item analyzed had a score below 4. Item 5 presented a percentage of 73.81% for PC and CT grouped, indicating the need to implement more actions that encourage communication between students.

For Perception of Utility, two items were formulated, whose Cronbach's alpha coefficient calculated for this domain was 0.19. The EMd obtained for the two items was 4.49, Standard Deviation 0.01 and Coefficient of Variation 0.38%. Regarding the items:

1. The possibility to access the VLE at any time of the day and from anywhere is very useful to better plan the study time = 4.50.

2. VLE can provide new ways of learning = 4.48.

The percentage for grouped CP + CT was 88.10%. Item 1 stands out, which dealt with availability for access to the VLE, with 92.86%, for grouped CP + CT.

Over the weeks (9/3 to 10/22), in addition to the virtual activities, during the face-to-face classes, the students researched the questions proposed in the virtual classroom (VLE), applying the knowledge in the development of the materials for the exhibition at the Science Fair. On the day of the Science Fair (29/10/18), all students, were committed to the organization of the event. The groups were able to explain and present their investigations and the results obtained to the visitors (colleagues, teachers, staff from the education and community department) of the said exhibition (Figure 16).

Figure 16. Students at the Science Fair
Source: authors

5. Conclusion

In view of the results presented in the research, it can be concluded that it is possible to use digital technologies even in communities with few resources, considering that we are living in a time when technologies, as well as the internet, in a way or on the other hand, they are accessible to everyone, including student access.

The interest and motivation of the participants in investigating, researching and solving problems was observed with the application of the research. Therefore, it was found that it is essential to instigate work with investigative didactic sequences, in order to stimulate students to question, to raise hypotheses and to research. With that, we stimulated the interest in the STEM disciplines, which look for the formation of critical citizens and researchers. We clearly realized that the use of the inverted classroom methodology, with the use of a virtual teaching and learning environment, through a planned investigative didactic

sequence, it is possible to integrate technologies in any curricular component, including science teaching, as the research results demonstrate.

To emphasize [9] and Prensky [12] reveal to us the importance of considering that digital natives - the Z generation, being necessary an appropriate approach to this generation, using these resources in line with educational interests, as they learn through digital media, after all, were born in the technological world. They also reveal that playful learning, through an interactive world, transforms the instigating and fun teaching and learning process. Thus, the student is more interested in studying and researching, learning to plan and search for information, going from being just a listener and recipient of information, to the protagonist of his teaching and learning process. Based on the statements above, it can be considered that the research reached its objectives, meeting the interests of students, through a more interesting and meaningful teaching and learning process, and with that, they learned the proposed contents in a different way.

Therefore, it is concluded that, although this study faces some difficulties for its realization, considering the problems faced with the lack of technological equipment and the precariousness with respect to the speed of broadband (WI-FI) at the institution, we can consider that the research was successful, reaching its objectives and leaving a technological "seed" of innovation in the school. It is worth mentioning that, based on this experience, the teacher of science education will be able to continue to enjoy the virtual classroom created for this research, which was made available free of charge. Still remaining, the expectation that she will spread her experience to the other professors of the institution, encouraging them to use digital technologies in their classes.

In time, it is worth mentioning how gratifying to end a study where the results are positive, especially for the school community. Even more, consider a public school where resources are scarce, especially technological ones. Therefore, the aim is to improve this investigative didactic sequence and develop new learning objects, in order to continue providing science teachers with resources to use in their classes. Finally, feeling challenged to encourage other teachers to use TDICs in studies that make up the school curriculum.

With the study, it was certain that researching and applying TDICs in basic education is extremely important, in view of the difficulty in finding studies on the theme, focused on education in the early years. In addition, the reality shows that educational institutions, especially the public network, are still "to whom" in a connected school. As the data obtained in the research demonstrate, students are receptive and "thirsty" for a differentiated teaching and learning process, based on "digital technologies", as it is the language and daily life of this generation. Therefore, we need, in terms of teachers, to appropriate and take advantage of the interest and ease of this generation with digital technologies, to encourage them to a more meaningful learning. The study also demonstrated that despite all the difficulties of the school institution, it is possible to carry out projects and interventions using digital technologies, breaking the paradigms of the traditional school. Therefore, we must continue showing that the use of TDICs in the classroom is possible and that it is efficient, thus, we will be contributing to a change in the teaching-learning process, of the different curricular components.

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Construction of an experimental apparatus to simulate the greenhouse effect and global warming for educational use

Paulo Renda Anderson

Mestre em Ensino de Física pela Universidade Federal de Rondônia.

Instituição: Instituto Federal de Rondônia, Campus Porto Velho Calama.

Endereço: Av. Calama, 4985 - Flodoaldo Pontes Pinto, Porto Velho - RO, Brasil

E-mail: paulo.anderson@ifro.edu.br

Carlos Mergulhão Júnior

Doutoroado em Física pela Universidade de São Paulo – USP

Instituição: Universidade Federal de Rondônia – UNIR, departamento de Física.

Endereço: Ji-Paraná, RO, Brasil.

E-mail: carlos.mergulhao@unir.br

Moacy José Stoffes Junior

Mestre em Ensino de Física pela Universidade Federal de Rondônia.

Instituição: Instituto Federal do Paraná, Campus Telêmaco Borba.

Endereço: Rodovia PR 160, km 19,5 – Jardim Bandeirantes, Telêmaco Borba – PR, Brasil

E-mail: moacy.stoffes@ifpr.edu.br

Clever Reis Stein

Doutor em Física Pela Universidade de Brasília – UnB.

Instituição: Instituto Federal de Rondônia, Campus Porto Velho Calama.

Endereço: Av. Calama, 4985 - Flodoaldo Pontes Pinto, Porto Velho - RO, Brasil

E-mail: clever.stein@ifro.edu.br

Abstract

This article describes the construction of a complete experimental apparatus to simulate the greenhouse and global warming for educatioal use. These demonstrations are fundamental for people understand the importance of greenhouse effect to keep that life continues on earth and, know about climate change and the causes of global warming. For development of this devise we used an Arduino UNO, temperature and pressure sensors, and low cost products. The experimental results showed that the average atmosphere temperature increases with the increasing concentration of carbon dioxide (CO_2). Moreover, this apparatus can be used in classroom to demonstration these important global phenomena.

Keywords: Experimental apparatus; Greenhouse; Global warming; Arduino.;

1. Introduction

The study of climate change has attracted much interest in the last years, in view of their increasingly modification [1,2]. This change has caused many environmental disasters, because of that, the medium temperature of earth is increasing and if this scenario does not change in a little time other change will have happened. One of the main factors has been causing this, is the strikingly high atmospheric greenhouse gas concentrations [3].

A balanced environment is essential for the continuity of human life on Earth [4]. However, the impacts of human activities on nature have been accentuated, especially since the Industrial Revolution, which occurred in the 18th century [5]. Furthermore, the rulers do not create efficient Environmental policy. Other point, environmental policy and economic growth are often described as existence in conflict with one another. In other words, an increase in economic activity is understood as being inevitably bad for the environment, while environmental policy is considered as imposing a drag on growth [6].

In this context, the main goal of the present paper is to show the development of an experimental apparatus that simulates the greenhouse effect and global warming. This device can be used by the teacher in the classroom. Thus, students will be able to understand better the greenhouse effect and the importance of preserving the environment. In short, this article focused on the design, construction and instrumentation of an experimental test apparatus and evaluate its performance.

2. Experimental

Arduino is a well-established experimental technique base on the measurement of the many signals resulting from the several sensors. In this work, we used temperature and pressure sensors [7,8,9]. These sensors were installed in two different inert environments. While the radiation inside on the sample surface the signals are detected by sensors and, Arduino was used to monitor and store the signal profile of the sensors. An experimental apparatus with two inert environments is shown in figure 1.
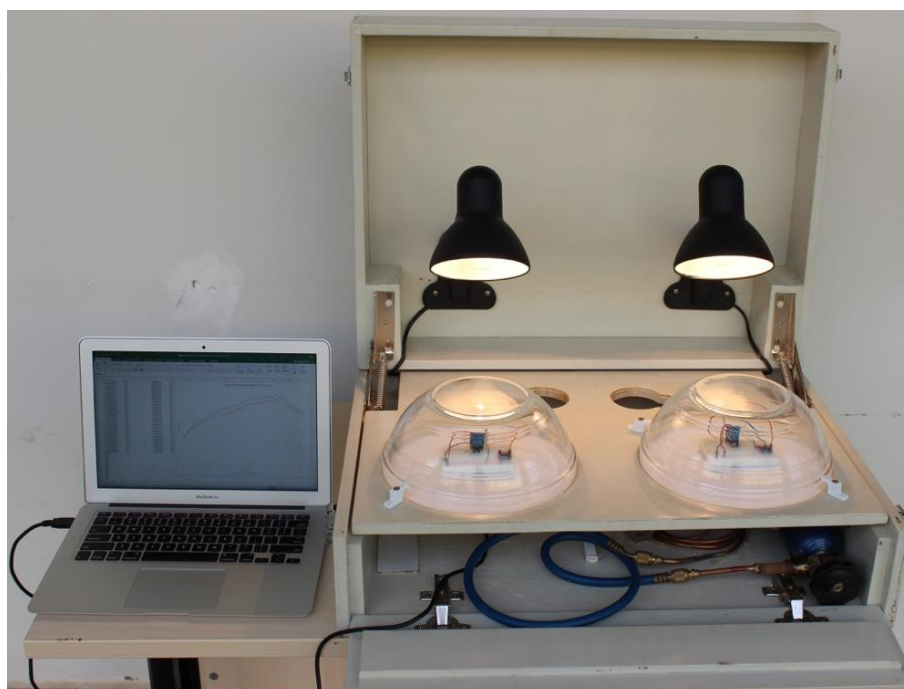
Figure 1. Experimental apparatus linked to the computer, experimental data are collected in two different inert environments simultaneously. SOUCE: Own author, 2020.

These environments are delimited by semi glass ball and sensors are installed inside them. The radiations from the lamps, focuses with the same intensity in both superficies. One of them is linked to a gas cylinder with carbon dioxide (CO_2). In this atmosphere, the concentration of CO_2 can be increase. Finally, this device can recall temperature curves as a function of time.

3. Result and discussion

The first configuration, we used one environment with semi glass ball for simulate the Earth's atmosphere and other without this protection. The result of that measure is shown in figure 2.
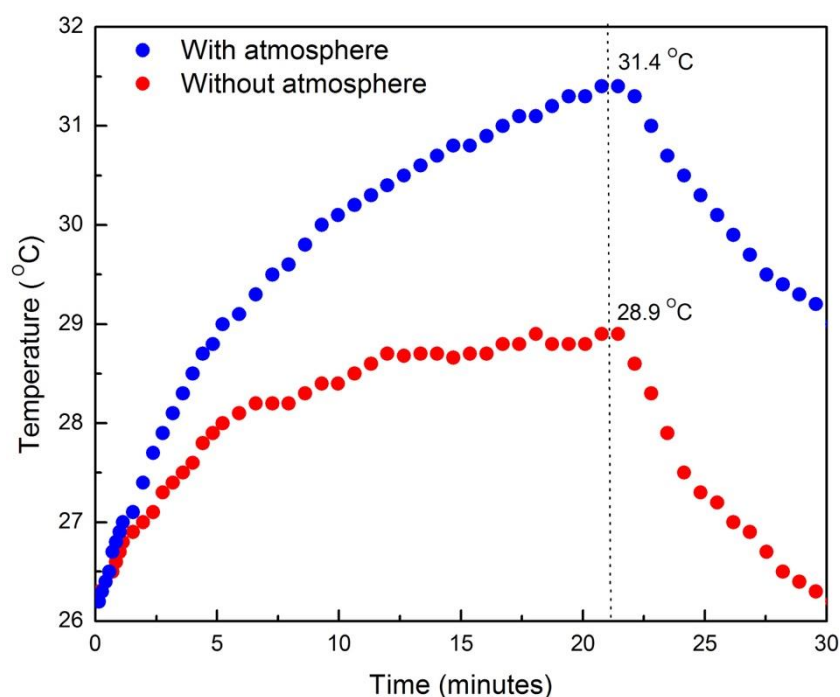
Figure 2. Temperature curves for the two environments, one with and one without semi glass ball, represented by blue and red curves respectively.

The temperature curve for the atmospheric environment exhibited a greater warming than the environment without atmospheric. This result highlights the importance of the atmospheric for life on Earth.

Atmosphere with carbon dioxide and without this gas, as can be seen in figure 3, the obtained curves confirms the temperature increase of two degrees Celsius due the injection of a CO_2.
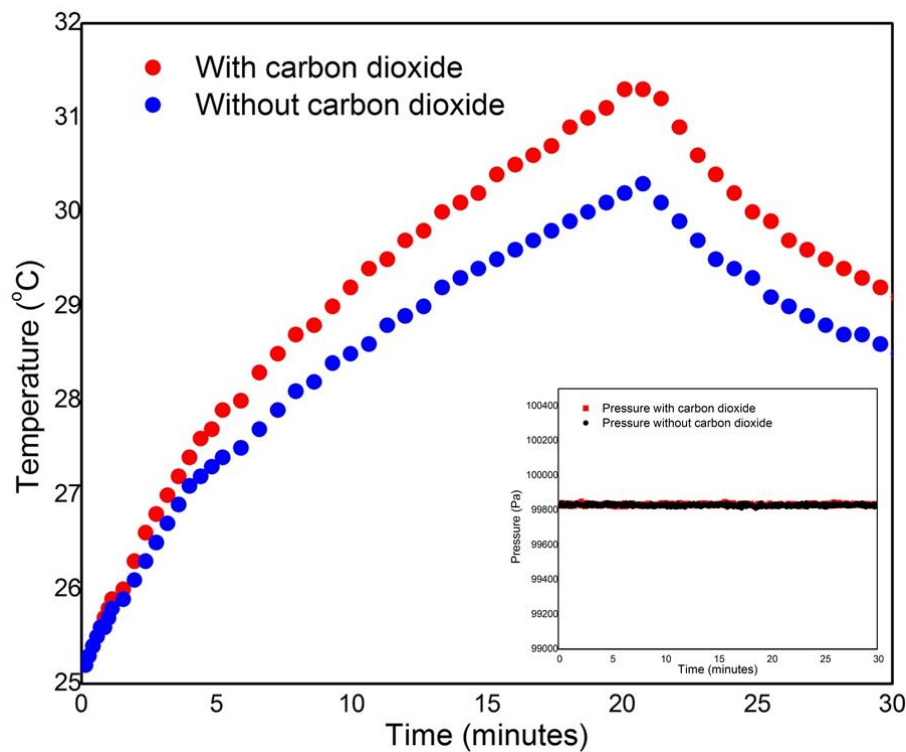
Figure 3. Temperature curves for the two inert environments, one with and one without carbon dioxide, represented by red and blue curves respectively. The insert shows internal pressure of the two enveronments during the measurement.

The insertion of figure 3 shows the internal pressure in both environments during measurement are same. According to these results, the increasing carbon dioxide affects the average system temperature. The inserte of figure 3 shows the internal pressure in both environments during mesurement are same, these results showed that the pressure did not change due to carbon dioxide, And, that the temperature increase was due to the carbon dioxide increase.

All collected data in this experiment with this configuration exhibit a characteristic signal by the contribution of the carbon dioxide. Here, with results that reflect a consensus, the increased concentration of CO_2 and other greenhouse gases in the atmosphere form a serious threat to the average temperature of the Earth. In other words, climate change is caused by global warming, and it is produced by human activity. In this context, our experimental apparatus is an important didactic tool that allows the diffusion of these phenomena and teachers can use it in the classroom to demonstrate who climate change happen.

4. Conclusion

In this paper a low cost greenhouse and global warming simulation experimental apparatus for educational purposes was successfully fabricated. One Arduino UNO, temperature and pressure sensors were used to collect the experimental data. The measurements of the temperature curves of the two inert environments, one with and one without carbon dioxide, showed the impact of this gas in the environment's mean temperature.

At the end of the development of the experimental apparatus and based on the results obtained, it can be concluded that this device is a didactic tool and suitable for teachers use in classroom to demonstration of

greenhouse effect and global warming.

5. Acknowledgement

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Analysis of Influence of Family Ownership Towards Performance of The Company

Yudastio[1] , Fajar Gustiawaty Dewi[2], Usep Syaippudin[3]

[1]Faculty of Economics and Business, University of Lampung, Indonesia,
+6285279852007.yudastio@gmail.com

[2]Faculty of Economics and Business, University of Lampung, Indonesia

[3]Faculty of Economics and Business, University of Lampung, Indonesia

Accounting Department, Faculty of Economics and Business, Lampung University.

ABSTRACT

This study aims to examine the effect of family ownership on company performance. The independent variable in this study is family ownership. The dependent variable in this study is company performance which is reflected by return on assets (ROA). This study uses control variables where the control variables are leverage and company size (size). The sample selected in this study amounted to 39 property, real estate, and building construction companies with the observation year 2011-2013, so the total sample observed was 117. The data were analyzed using Statistical Package for Social Science (SPSS) with linear regression analysis method multiple. Hypothesis testing results indicate that family ownership has a positive effect on company performance.

Keywords: *family ownership,* company performance, a performance company the property, real estate, and building construction

INTRODUCTION

In the face of competitive business competition, the company tries to improve performance and develop the business to develop the company. The company was founded to increase the value of the company by increasing the prosperity of the owners or shareholders. The composition of ownership in a family-owned company is a common form that is now often found in many countries. As many as 68% of the total companies *going public* in the world are *family-owned companies*. In Indonesia alone, the average family ownership is 26%, where this ownership is enough to give the family authority to regulate the performance of the company.

It can be seen that family ownership is closely related to the performance of the company itself. Family ownership can bring a positive influence on company performance because the dominance of ownership by the family causes a reduction in *agency problems* that occur in the company. But with family ownership, there is a tendency that companies will employ relationships within families that do not have enough competence so that it can also negatively affect the performance of the company.

This research was conducted because it was motivated by the diversity of the results of the research on the ownership structure of the company conducted by previous researchers. Not many studies have focused on *family ownership*. Even though there are very many companies in Indonesia adopting system *family ownership* in their company.

This study focuses on the Market Ratio with *Return On Assets* (ROA) as an indicator, ROA can show the benefits of the company, because this ratio describes the return on assets owned by the company (Hernitra, 2011). By using the Market Ratio, the company can provide an indication for management regarding investors' assessments of the company's past performance and prospects.

Based on the background of the problems outlined earlier, the formulation of the problem to be examined in this study is whether *family ownership* affects company performance.

THEORETICAL AND DEVELOPMENT HYPOTHESIS

Agency theory

A perspective agency relationship is a basis used to understand *corporate* governance.Managers must maximize the welfare of shareholders. But on the other hand, managers also have an interest in maximizing their welfare. Such a pooling of interests often leads to conflicts called agency conflicts (Jensen and Meckling, 1976).

The existence of a shift in the business environment resulted in companies that used to have only one person, namely(*owner-manager owner-manager) is* now a company whose ownership is spread with shareholders owned by various groups. This transition resulted in a separation between ownership and management, where ownership was in the hands of the shareholders while management was in the hands of the management team. This agency relationship as a contract in which one or more parties (*principal*) gives the task to other parties (*agents*) to carry out services and delegation of authority in decision making (Jensen and Meckling, 1976). This relationship is called agency theory, with the performance of management itself.

Ownership Structure

Theory of Management The company is increasingly separated from company ownership is one of the characteristics of the modern economy, this is in accordance with *agency theory* that wants company owners (*principals*) to submit management of the company to professionals (*agents*) who understand more in running a business. The purpose of separating the management and ownership of the company is so that the owner gets the maximum profit with efficient costs.

Family ownership is the ownership of individuals and owners of private companies (above 5%) that are not public, state, or financial institutions. Based on this definition, companies with family ownership are not limited to companies that place their family members in CEO, commissioner, or other management positions. Companies with family ownership constitute the majority of types of companies in Indonesia.

This company is generally owned in the majority by certain families or the ownership of its shares is concentrated in certain families (Job, 2008).

A company can be said to be *family-owned* if the family is *controlling shareholders,* or has a share of at least 20% of *voting rights* and is the highest compared to *shareholder shareholders* other(Kamaliah, 2013). Public companies in Indonesia have characteristics that are no different from companies in Asia in general. Companies in Asia are historically and sociologically money companies owned or controlled by families (Claessens*,* 1999). Even though these companies grew and became public companies, the family still held significant control.

Company Performance

Performance measurements are broadly grouped into two, namely non-financial and financial measurements. Non-financial performance is a measurement of performance using non-financial information that is more emphasized in terms of service quality to customers. While financial performance measurement is the use of financial information in measuring a company's performance. Financial information that is commonly used is the income statement and balance sheet (Sari, 2012).

Performance is a reflection of a company's ability to manage and allocate its resources. The purpose of performance appraisal is to motivate employees in achieving organizational goals and in meeting predetermined standards of behavior in order to different desired outcomes and actions. Standards of behavior can be in the form of management policies or formal plans as outlined in the budget.

This study uses *Return on Assets* (ROA) as a basis for measuring financial performance. The reason researchers use ROA as a *proxy* for company performance is that ROA is more comprehensive in measuring the overall rate of return both from debt and capital.

Return on Assets

The profitability of a company can be measured by linking the profits or profits derived from the company's main activities with the wealth or assets owned to produce company profits (*operating assets*). *Operating Assets* are all assets except long-term investments and other assets that are not used in activities or businesses to obtain regular income or the main business of the company.

Measurement of the company's financial performance with ROA shows the ability of capital invested in overall assets held to generate profits. *Return On Assets (ROA),* which is the ratio between *Net Income After Tax* to assets as a whole shows the size of asset productivity in providing returns on investment (Sawir, 2001).

Framework

Based on the description presented earlier, the variables involved in this study can be formulated through a framework as follows:
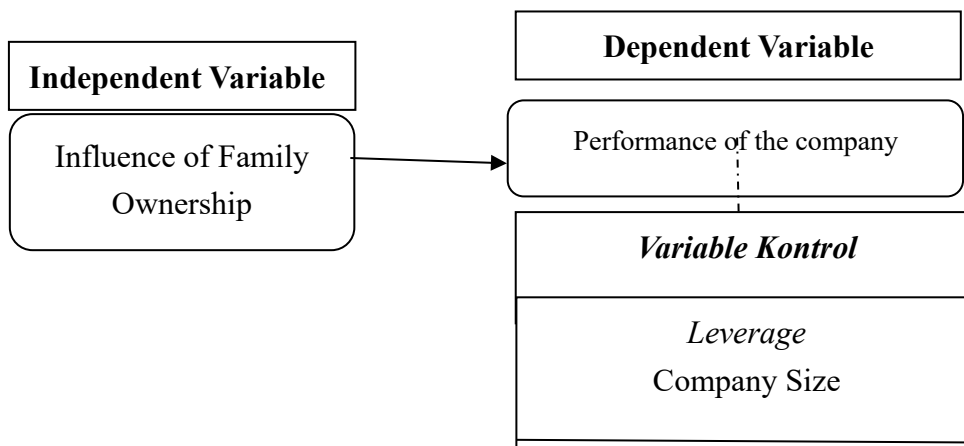
Hypothesis Development Research

Based on the above framework, the hypothesis of this study consisted of:

Influence of Family Ownership *(family ownership)* on the Company's Performance Against

According to agency theory, the ownership structure of a company can influence agency problems in a company. Companies whose shares are mostly controlled by families show a tendency to have management that is a member of the family so that it will reduce agency conflicts that will occur. But when the management is not controlled by the family by the family, there will tend to be agency problems that can interfere with the company's performance. According to Cucculelli (2006) states that large family stock ownership has a negative influence on company performance.

But the authors assume the risk of negative influences will not significantly influence the company's performance due to a high sense of ownership to the company. Because the facts prove that many family companies have become business giants, let alone companies in Indonesia. Family-owned companies generally tend to have a long-term perspective on their business. With a high sense of belonging to the company, the family placed on the board of directors and managerial structure of the company will have a high sense of responsibility and dedication to do the best for the company. This is what the authors consider can have a positive impact that can affect company performance. Therefore the writer can give a hypothesis is as follows:

H: Family ownership has a positive effect on company performance.

METHODS

Population and Sample

The population in this study are all property, real estate, and building construction companies listed on the Indonesia Stock Exchange (IDX) in 2011-2013. In this study, the sample company was selected based on *Purposive Sampling* (desired criteria). The sample criteria in this study are as follows:

1. The property, real estate, and building construction companies listed on the Indonesia Stock Exchange in 2011-2013.

2. The company is a company that experienced a profit in the 2011-2013 period. And provide information about the structure of the company's directors.
3. The company published an annual report for the period 2011-2013.
4. Having complete data related to the variables used.

Table 1. Sample Selection Procedure

DESCRIPTION OF	AMOUNT
Number of property, real estate, and building construction companies listed on the IDX in 2011-2013	54
Number of property, real estate, and building construction companies that did not publish an annual report during the period 2011-2013	(15)
Total samples according to criteria	39

Source: Processed data (2019)

The Data Test

Descriptive this study is used to provide descriptive or research variables. Descriptive statistics will provide a general description or description of the research variable regarding the mean (mean), standard deviation, maximum, minimum, sum. This test is done to make it easier to understand the variables used in research.

The regression method was performed on the model proposed by the researcher using the SPSS program to predict the relationship between the independent variable and the dependent variable. Based on the problem formulation and theoretical framework that has been described previously, the research model formed is as follows:

ROA = α   + β $_1$FO + β $_2$ SIZE + β $_3$ LEV + e$_t$

Description:

ROA: *Return On Assets* as a measure of company performance

FO: Family ownership structure,

   family ownership = 1, no family ownership = 0

SIZE: Size of the company measured by total assets

LEV: The ratio between debt and equity

e$_t$: *Error term*

α: Constants of the regression equation

β: Coefficient of the regression equation

DISCUSSION AND ANALYSIS

Data used in this study are secondary data, namely the company's annual report for the period 2011-2013. This study uses the property sector, real estate, and building construction as objects to be studied. Sampling

uses *purposive sampling,* with a total of 39 companies.

Variable Description

Table 2. Descriptive Statistics

Variable	Minimum	Maximum	Mean	Std. Deviation
ROA	0.00	1.73	0.0876	0.18481
Family ownership	0	1	0.46	0.501
SIZE	25.49	30.84	28.5748	1.19840
LEVERAGE	0.07	5.67	1.1080	1.03369

Source: Processed Data, 2019.Source

Independent Variable

Independent Variable is the variables that affect or are the cause of the change or the occurrence of dependent or dependent variables (Suwito, 2005).

Family ownership

Family ownership is a company whose ownership is owned by the family. The company is said to have family ownership if the leader or family has more than 20% of the voting rights (Anderson and Reeb, 2003). According to Perdana (2011) to find out the family-owned the first step taken is to trace the ownership structure of the IDX (*Indonesian Stock Exchanges*) of the Indonesia Stock Exchange in 2011-2013 and also the company structure data can be obtained from information in the *annual report* company'sand *company profile*. Then the ownership structure verification process is carried out to determine which companies are family or non-family.

One way is seen from the name of the board of commissioners and the board of directors of the company. Because the tendency of family ownership will place the family on the board of commissioners of the company and the board of directors, as well as structural positions in the subsidiary. In order to properly monitor the business of his family's company and can have an important position in determining the direction of company policy. If the name of the board of directors and the board of commissioners tend to be the same in a few years and has a stake in the ownership of the company, the company could be included in the ownership by the family.

If the owner is the name of the company, then the company is traced to its ownership, in several ways, namely by pyramid ownership, ownership without a mechanism, and cross-ownership structure. This can be seen and equated with the company's share ownership information. After tracing, it can be analyzed if the controlling shareholder of the company is there is an individual or a person's name, it can be categorized as family ownership.

It can also be traced from the company's website and the *annual report* in the notes section of the financial report will be shown regarding the shareholders of the company. Family ownership is measured using available *dummy*, namely by using scale 1 for companies that have family ownership in the *annual report*, and scale 0 for companies that do not have family ownership in the *annual report* that can be seen in the corporate ownership structure section.

Dependent Variable

Return On Assets

The dependent variable in this study is the variable that is explained or influenced by the independent variable. The dependent variable in this study is the growth of company performance (*profitability)* as measured by *Return On Assets.*

ROA =   **Net Profit**
                    Total Assets

Dependent Variable

Company Size

Research firm size can use asset benchmarks. Because the total assets of the company are large, this can be simplified by transforming into natural logarithms (Ghozali, 2013) so that they can be calculated by:

Company Size = (Ln) Total Asset

Leverage

In this study, *leverage is* measured from the ratio of debt to equity where *Debt to Equity Ratio* (DER) is a comparison of the total debt held by a company with its own capital (equity) (Ghozali, 2013). The formula often used in the measurement of DER (*Debt to Equity Ratio*) is as follows:

Debt to Equity Ratio = Total Liabilities
                        Equity

Analysis of data

Classical Assumption Test

The requirement to be able to use multiple regression equations is the fulfillment of classical assumptions. To get an efficient and unbiased value or *Best Linear Unbias Estimator* (BLUE) from one multiple regression equation, it is necessary to test to determine the resulting regression model meets the classical assumption requirements (Ghozali, 2013)**.**

Normality Test

Table 3.Normality Test Results

Kolmogorov-Smirnov One-Sample

		Unstandardized Residual
N		112
Normal Parameters	Mean	.0000000

	Std. Deviation	.36773286
Most Extreme Differences	Absolute	.070
	Positive	.070
	Negative	-.055
Kolmogorov-Smirnov Z		.740
Asymp. Sig. (2-tailed)		.644

Source: SPSS output, 2019

Multicollinearity Test

Test Results Table 4Multicollinearity

Model		collinearity Statistics	
		Tolerance	VIP
1	Family Ownership	0889	1124
	SIZE	0894	1118
	DER.	0863	1159

a Dependent Variable: ROA

Source: SPSS Output Results, 2019

Autocorrelation Test

Table 5 Autocorrelation

Runs Test

	Unstandardized Residual
Test Value	-.01816
Cases <Test Value	58
Cases> = Test Value	59
Total Cases	117
Number of Runs	54
Z	-1,021
Asymp. Sig. (2-tailed)	.307

a. Median

Source: Secondary data processed (2019)

Multiple Linear Regression Analysis Multiple

Regression methods are performed on the model proposed by researchers using *software* SPSS to predict the relationship between the independent variable and the dependent variable

Determination Coefficient Test

Results Table 6 Coefficient Determination Test (Test R2)

Model	*R*	*R²*
1	0.26135	0.0435

The test results indicate that the value Adj R² of 0.0435 or 4.35%. These results indicate that the independent variables in research *family ownership* and the control variables are the *size* and *leverage*able to explain the variability of the dependent variable *Return On Asset* by 4.35%. Meanwhile, the remaining 95.65% is explained by other variables outside this research model.

Feasibility Test Model

Results Table 7 Test Statistics F

$F_{arithmetic}$	F_{table}	Sig
2.761	2.25	0.045

From the results of this test, the value of F calculated is 2.761 with a significance level of 0.045. Because the significance is less than 0.05, it can be said that in the regression model all independent variables and control variables (LEVERAGE, and SIZE) jointly influence the dependent variable (ROA).

Hypothesis Testing

Hypothesis testing in this study uses the t statistical test, the t statistical test basically shows how far the influence of one independent variable individually in explaining the variation of the dependent variable. Hypothesis test results using the t statistical test as follows:

Table 8 Hypothesis Test Results

variable	Coefficients	t-count	sig
(Constant)	1.0236	2.4664	0.015
Family ownership	0.0721	2.0295	0.044
SIZE	-0.034	-2.304	0.023
LEVERAGE	0.0051	0.2942	0.769

Based on the results of these calculations we get the following regression equation:

ROA = 1.0236 + 0.0721 Familyownership + 0.0051Leverage - 0.034Size + e

From the results of the formed regression equation, the constant value of 1.0236 means that the value of the company's *Cumulative Abnormal Return* will be worth 1.0236 if all independent variables and control variables are worth 0.

Research

Hypothesis	Beta	ResultsTest Results Significance of	Decision
H: Family Ownership positive effect on company performance (ROA)	0.0721	0.044> 0.05	Supported

The hypothesis in this study is to test that there is a positive influence between *family ownership* on *return on assets* (ROA)*.* The second hypothesis testing uses two control variables namely *firm size* and *leverage*. The results of tests using multiple regression analysis showed that the coefficient of *family ownership* was positive and significant with a significance level of 0.0447 (sig> 0.05). Thus, it can be concluded that there is an influence between *family ownership* on *return on assets* (ROA) so that the hypothesis (Positive influence of *family ownership* on company performance) is ***accepted***.

Discussion

Based on the results of this study it was found that the regression model is in accordance with the observational results of the study. Where this shows that the dependent variable used in research is related to the independent variable. Furthermore, the influence of each of these variables can be seen in the table discussion can be made as follows:

The hypothesis in this study is to test that there is a positive influence between *family ownership* on *return on assets* (ROA)*.* The second hypothesis testing uses two control variables namely *firm size* and *leverage*. The results of tests using multiple regression analysis showed that the coefficient of *family ownership* was positive and significant with a significance level of 0.0447 (sig> 0.05). Thus, it can be concluded that there is an influence between *family ownership* on *return on assets* (ROA) so that the hypothesis (Positive influence of *family ownership* on company performance) is ***accepted***.

The Influence of *Family Ownership on* Company Performance (ROA)
Based on the results of multiple linear regression testing on the hypothesis with independent variables namely *family ownership*, and control variables *size,* and *leverage* shows a significant positive effect of the dependent variable.

From the results of this study, it can be concluded that family ownership shows a positive influence on the company. In addition, companies with family ownership place families in the ranks of managerial directors

who have good company profits. Sense of responsibility and sense of ownership owned by the family. So the family-owned company has a long-term perspective on its business so that the company can be more advanced and bigger. And with a high sense of belonging to the company, the family placed on the board of directors and managerial structure of the company will have a high sense of responsibility and dedication to do the best for the company. The hybridization of family values is able to improve the company's performance from year to year.

The results support the resultsDwipoyono (2012) which showed that the positive relationship between *family ownership* against *firm* performance. The results of this study are also consistent with Wahidahwati's research (2002) which shows that ownership structure has a positive and significant effect on the performance of manufacturing companies. Positive influence means more family ownership (family-owned shares) in a company, it will affect the company's performance which in this case is the company's profit.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

This study was conducted to examine the effect of family ownership on the performance of the company *(Returnon*Assets). *Family Ownership is* measured using available *dummy*, namely using a scale of 1 for companies that have family ownership in the *annual report*, and a scale of 0 for companies that do not have family ownership in the *annual report* that can be seen in the ownership structure section of the company. And the company's performance is proxied through *Return On Assets* (ROA).

This study uses multiple regression as a hypothesis analysis tool because to see and calculate ROA for independent variables must be the company's annual financial statement. Based on the results of hypothesis testing, it can be concluded that the ownership of the family proved to have a positive significant effect on the financial performance of the company. This can be caused because in companies with family ownership arises *agency problem* another, namely between majority shareholders and minority shareholders. Information risk becomes greater when the majority of shareholders have control of the company. Therefore, the *return* desired by investors is higher and increases the cost of company performance.

So that the positive influence of family ownership on company performance *(return on* assets) means more ownership of the family (family-owned shares) in a company, it will be significantly associated with the company's performance in this regard is the company's profit.

ADVICE

1.   Subsequent research can expand the test to examine the influence of
      family ownership to other variables within the *company.* Researchers suggest using independent variables other than *Return On Assets* (ROE), such as *Price Earning Ratio* (PER) or *Return On Equity* (ROE) to represent the proxy of company performance to be more precise and accurate in measuring performance, because it involves the company's ownership structure.

2.   Conduct future research with a wider and representative sample and extend the observation period so that the number of research samples also increases. This can improve data distribution and increase the level of information accuracy. And to make it more visible the consistency of the variables used.

3.   Further Research can examine the company sector on other BEI and has not been studied from previous research, so as to enrich the results of research on family ownership in companies in Indonesia. Such as the agricultural company sector, the mining sector, or the transportation and infrastructure sector which have never done research on family ownership.

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The Effect of Company Growth on Firm Value with Debt Policy as Moderation in Service Sector Industries

Muhammad Syahrial[1]; Yuliansyah[2]; Sudrajat[3]

[1]Faculty of Economics and Business, University of Lampung, Indonesia,
msyahrial1313@gmail.com

[2]Faculty of Economics and Business, University of Lampung, Indonesia

[3]Faculty of Economics and Business, University of Lampung, Indonesia

Accounting Department, Faculty of Economics and Business, Lampung University.

ABSTRACT

This research aims to analyze the effect of asset growth, revenue growth on Firm value, and moderated by leverage. The population in this study is non-banking service companies listed on the Indonesia Stock Exchange in the period 2014 - 2018. Sampling in this study uses a purposive sampling method which consists of 55 research samples. The data used in this study are secondary data. The analysis technique uses multiple linear regression analysis and moderated regression analysis using the classic assumption test. Test result shows (i) assets growth has a positive significant effect on firm value, (ii) revenue growth does not affect firm value, (iii) As for moderation, leverage strengthens the effect of the relationship between asset growth and firm value, (iv) However, leverage weakens the relationship between revenue growth and firm value.

Keywords: Asset Growth, Revenue Growth, Leverage, Firm Value.

INTRODUCTION

Company growth is the most important part of a business. The company needs good growth that useful for the company's survival following going concern principle. Good company growth will produce a good performance and company value. Every company business is not only determined by external factors, but also internal factors.

The competition in the business world is getting tougher and requires a lot of effort to improve in developing the company, this can be seen from the company's growth. Company growth can be measured by two indicators, revenue growth, which is higher sales growth compared to cost increases, will result increasing company profits and asset growth, which shows the level of asset development from the previous period.

Every company growth has an important meaning to continue in business activities, it is because when the company has difficulties to grow and develop, it will have an impact on the company's operational activities and can affect all aspects of the company. The growth of company assets appears as an economically significant predictor and statistic of stock returns (Cooper et al., 2008). Li et al. (2012) had a predictions of

Return for steps related to asset growth. The effect of asset growth also exists in the capital market and also the effect of asset growth also exists among the largest stocks (Gray, 2011). This makes asset growth is an important indicator in the company's activities to see developments within the company. Some previous research makes the growth of the company have the effect on firm value.

It is important to see the extent assets growth and company revenues in increasing firm value, because the assets and revenues growth make to assess the company well and keep running in accordance with the going concern principle. In addition to earning profits, the company also aims to develop and grow to increasing its value. If a company has good growth, it will get good value and can increase and attract investor. The previous research about the existence of the effect of asset growth on the equity market and the effect of significant asset growth is when using returns (Bettman et al., 2011). Good asset and revenue growth will keep the company innovated and have confidence in capital market. It also always need additional funds such as a loan from creditors or investors in addition to its own capital.

The company's growth occurs along with the company's business activities, the higher the company's growth the more valuable the company in the capital market. Capital is needed in running a business, sometimes the company must be in debt. The debt policy is a policy taken by management to obtain sources of funding from outside the company so that it can be used to finance the company's operational activities.

THEORETICAL AND DEVELOPMENT HYPOTHESES

Pecking Order Theory

Management knows more about company value than potential investors. Investors interpret the company's actions rationally. Several aspects of company financing behavior, including the tendency to rely on internal funding sources, and debt over capital if external financing is needed (Myers and Majluf, 1984). Pecking Order Theory adopted policy by a company to seek additional funds by selling its assets (Fahmi, 2014).

This theory illustrates a hierarchy of company fund planning where the level of financing starts from the company's retained earnings, followed by financing with debt and finally equity from external parties. This theory is important in this study because this theory underlies in the research that is financing the company's growth planning with debt makes the company get additional funds for additional company assets or in carrying out the company's operational activities, so the company can continue business and grow.

Signaling Theory

The market gives responding to positive and negative signals is very influential in market conditions, it will react in various ways in responding signals from managers (Spence, 1973). This theory discusses the up and down of prices in the market such as the prices of shares, bonds, and so that will influence investor's decisions (Fahmi, 2014). However, seen from the reaction of investor's signals reacting to avoid risks that will arise from market conditions that have not been profitable for investors. Managers can use more debt

as a signal to investors. If debt increases, the possibility of companies going to increase bankrupt, therefore companies that increase debt are considered quite confident in managing the company, it gives a signal to investors.

Asset Growth

Growth is inseparable from going concern and profitability of a company. The growth that measures the company's ability to maintain its position within the industry and in the general economic development. The companies's development can be seen by the development of its assets and revenue, the greater the assets expected by management, the greater the operational results obtained by the company. Parta and Sedana (2018) examined the effect of company growth on firm value and the results is company growth had a positive and significant effect on firm value. So that the higher rate growth company, the greater firm value, based on these descriptions then formulated the following hypotheses:

H1: The company assets growth has a significant positive effect on firm value

Revenue Growth

Company growth is not only measured by asset growth but also revenue growth. Company growth can be measured by two indicators, revenue growth and asset growth. Sales are often used in manufacturing companies while service companies are called revenue, because service companies carry out service activities to generate income. Previous research has examined sales growth on firm value. Ermanda and Purnamawati (2017) sales growth have a significant positive effect on company profitability. Hendratmoko and Muid (2017) examine that sales growth is proven have a significant effect on Islamic Corporate Social Responsibility. Thus, the higher revenue growth level in company, the greater firm value, so that the growth rate of the company has an effect on firm value. Based on these descriptions then formulated the following hypotheses:

H2: Revenue growth has a significant positive effect on firm value

The Moderating Between Asset Growth and Firm Value

An effective debt can increase company value. However, debt that continues to grow without control will only cause a decrease its value. The debt makes control between the ability to pay or cannot pay. The higher company growth, which also means that the opportunity to grow the company is higher, the greater funds needed. For this reason, it is necessary to increase capital in form of debt. Leverage is a description of debt using by a company. Debt are more effective in reducing bankrupt risk because of management's planning responsibilities. For this reason, debt can influence to weaken or strengthen the relationship of growth and value company. so that the hypothesis can be formulated as follows:

H3: Leverage moderates the effect of asset growth on firm value

The Moderating Between Revenue Growth and Firm Value

The effect of the relationship of company revenue growth on firm value is expected to be other factors that effect debt to revenue growth. Previous research has tried to examine the effect of revenue growth on firm value by moderation or intervening, as conducted by Zuhair and Nurdiniah (2018) evidence revenue growth

as a moderation and has results strengthen the effect of leverage on earnings management. Andriani (2018) examine the growth company on firm value with dividend policy as intervening and the result was sales growth having a positive effect on firm value. The higher operational needs require big capital, to get big capital can be done with leverage. To increase the higher growth rate of the revenue company, the higher value company level, and moderation with leverage is needed. Then revenue growth can get higher, or it can also be vice versa. For this reason leverage can effect to weaken or strengthen the relationship of revenue growth to firm value. Based on these descriptions then formulated the following hypotheses:

H4: Leverage moderates the effect of revenue growth on firm value.

Framework

The effect of independent variables on the dependent variable using moderating that has been described above, it can be described the framework of theoretical thought as follows:

Figure 1 Framework
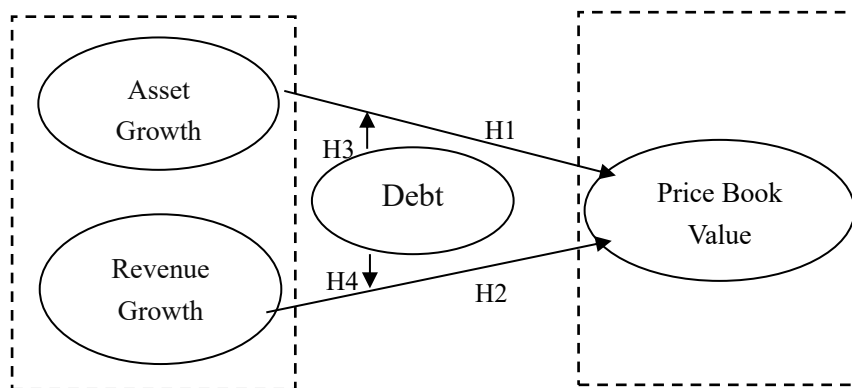
METHODS RESEARCH

Sampling in this study were the service companies listed on the Indonesia Stock Exchange from 2014 to 2018. This research analyzed the effect of company growth on firm value with debt policy as a moderating on the service company by observing the financial statements form financial position reports, profit/loss statements, cash flow statements, note of financial statements, also the number of shares outstanding and prices stock.

Table Sample Research Period 2014-2018

Criteria	Number
Service companie listed on the Stock Exchange in 2014 - 2018	172
Companies that have negative assets growth	(47)
Companies that have negative revenue growth	(32)
Companies that have loss statements	(28)
Companies that do not provide complete data	(54)
Total sample of companies	11
The number of observations sample study	55

Source: Data Processed in years (2020)

Testing Data

This study using multiple linear regression with the help of software SPSS 25 application program assistance. Linear Regression equation:

PBV = α + β1 AG + β2 RG + β3 Lev + e .... (1)

PBV = α + β1 AG + β3 Lev + β4 AG*Lev + e .... (2)

PBV = α + β2 RG + β3 Lev + β5 RG*Lev + e .... (3)

Description :

    PBV = Price Book Value

    AG = Asset Growth

    RG = Revenue Gowth

    Lev = Leverage

    α = Constanta

    β = Regression coefficient

    e = *Error*

Measurement of Variable

Variable	Measurement variable
Asset Growth	$\dfrac{\text{Total Asset – Total Asset t-1}}{\text{Total Asset t-1}}$
Revenue Growth	$\dfrac{\text{Total Revenue –Total Revenue t-1}}{\text{Total Revenue t-1}}$
Leverage	$\dfrac{\text{Total Debt}}{\text{Total Asset}}$
Price Book Value	$\dfrac{\text{Stock Price}}{\text{Book Value}}$

DISCUSSION AND ANALYSIS

Descriptive Statistics

Analyzing descriptive statistics to explain the average value of statistics and standard deviations that compare between Assets Growth, Revenue Growth, Leverage, and Prive Book Value variables. More specifically, a further explanation regarding statistics can be seen in the following table.

Descriptive Statistics

Variable	N	Range	Min	Max	Sum	Mean	Standart Deviation
Asset Growth	55	0.6946	0.0975	0.7921	23.5098	0.427451	0.5097468
Revenue Growth	55	0.6589	0.0938	0.7527	23.3548	0.424632	0.1639457

| Leverage | 55 | 1.1918 | 0.4109 | 1.6027 | 55.8451 | 1.015365 | 0.1466048 |
| PBV | 55 | 1.8902 | 0.6306 | 2.5208 | 75.7091 | 1.376528 | 0.3208222 |

Source: Data Processed Results (2020)

The result show the maximum and minimum values of each variable in 11 companies multiplied by 5 years of observation. There is a minimum value of asset growth at a value of 0.0975 and maximum of 0.7921 with a total of 23,508 with an average of 0.427451 and a standard deviation of 0.50974 during the research period of 2014 - 2018.

The minimum value on revenue growth is at 0.938, the maximum at 0.7527 with a total of 23.3548, an average of 0.424632 and a standard deviation of 0.16394 during the research period of 2014 - 2018 on service companies listed on the Indonesia Stock Exchange. The minimum value on Leverage is at 0.4109, the maximum at 1.6027, the total of research data 55.8451, an average research data of 1.015365, and a standard deviation of 0.1466048 during the research period of 2014 - 2018 In service companies listed on the Indonesia Stock Exchange. The minimum value on the Prive Book Value (PBV) is at the value of 0.6306, the maximum value is 2.5208, a total of 75.7091, an average research data of 1.376528, and a standard deviation of 0.3208222.

Test Results Coefficient of Determination

Table Test Results Coefficient of Determination

Model	R	R^2	Adjusted R Square	F	Sig
1	0.486	0.237	0.192	5.268	0.003
2	0.518	0.268	0.225	6.219	0.001
3	0.402	0.162	0.113	3.286	0.028

Source: Data Processed Results (2020)

The results regression of the model 1 testing explained that the R square value of 0.237 or 23.7%. While Adjusted R Square of 0.192 or of 19.2%, and the remaining 80.2% is explained by causes outside the model. After moderation in model 2, there was an increase that obtained R square value of 0.268 or 26.8%, which was previously 0.237 or 23.7% an increase of 3.1%. Adjusted R Square of 0.225 or 22.5% also increased from 0.192 or 19.2%, up 3.3% from the previous, while the remaining 77.5% was explained by causes outside the model. In Model 3 After moderation, there was a decrease after moderation, it was found that the value of R square decreased to 0.162 or 16.2% which was previously 0.237 or 23.7% an or decreased by 7.5% from before with the indicated weakening of the model. Adjusted R Square of 0.113 or 11.3% also decreased from 0.192 or 19.2%, down 7.9 % from the previous, while the remaining 88.7% was explained by causes outside the model.

The results show that the level of significance for Asset Growth, Income Growth, Leverage and Prive Book Value variables. The result in model 1 F-value of 5,268 with a significance value of 0.003 indicates that the P-value is less than 0.05, the dependent variable is PBV statistically acceptable because it is significant

at 0.05. This shows that there is significance between the independent variable has a significant effect on the dependent variable.

The Results Statistics

Hypothesis testing determine the significance effect of the independent variables and dependent variable after testing the classical assumptions. This test is carried out using multiple linear regression at 95% confidence level and an error in the analysis of 5%. Following are the results of hypothesis testing:

Table The Results Statistics test

Model		Unstandardized		Standardized	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.134	0.299		3.787	0.000
	AssetGrowth	1.055	0.453	0.339	2.327	0.024
	RevenueGrowth	0.378	0.507	0.109	0.745	0.460
	Leverage	-0.363	0.195	-0.228	-1.857	0.069

Source: Data Processed SPSS Results (2020)

Effect of asset growth on firm value

Hypothesis testing shows that the regression coefficient (β) is 1.055, while in the column significance shows that the value of asset growth has 0.024 less than 0.050, the results can be stated that the asset growth variable effect to Price Book Value. Thus, it can be concluded that Hypothesis 1 can be accepted. Based on data analysis, it is proven that asset growth has a significant positive effect on firm value**.**

Effect of Revenue growth on firm value

The result shows that the value of the regression coefficient (β) is 0.378, while in the column sig (significance) shows that the value of income growth has 0.460 more than 0.05, the results can be stated that the income growth variable does not effect to Price Book Value.

The Moderating Between Asset Growth and Firm Value

Table The Results Statistics Test (Moderation)

Model		Unstandardized		Standardized	t	Sig.
		B	Std. Error	Beta		
2	(Constant)	1.996	0.538		3.712	0.001
	AssetGrowth	-0.594	1.164	-0.191	-0.510	0.612
	Leverage	-1.207	0.540	-0.760	-2.237	0.030
	Mod_GAssetLeverage	2.002	1.206	0.782	1.661	0.103

Source: Data Processed SPSS Results (2020)

Testing Results in the table explains that the value of asset growth of 0.612 is higher than 0.05, which means it is not significant, while the leverage variable with a value of 0.030 is smaller than 0.05, which means significant and the moderation value of assets and leverage of 0.103 is higher than 0.05, which means it is not significant.

The Moderating Between Revenue Growth and Firm Value

Table The Results Statistics Test (Moderation)
Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
3	(Constant)	1.757	0.736		2.387	0.021
	RevenueGrowth	0.005	1.673	0.001	0.003	0.998
	Leverage	-0.823	0.730	-0.518	-1.128	0.264
	Mod_GRevenueLeverage	1.059	1.692	0.391	0.626	0.534

Source: Data Processed SPSS Results (2020)

The result explain that revenue growth value is 0.998 higher than 0.05 which is not significant, while the leverage variable with a value of 0.264 is higher than 0.05 and the moderation value of revenue growth and leverage is 0.534 higher than 0.05. This means that those variables have not a significance value, moderating regression test weaken the relationship between revenue growth and firm value.

CONCLUSION AND RECOMMENDATIONS

Conclusion

The research aims to determine the Asset Growth, Revenue Growth, and Firm Value With Leverage as a Moderating in service company in 2014 to 2018 on the Indonesia Stock Exchange. From the results, it can be concluded that:

1. Asset growth has positive effect firm value, which mean that higher asset growth make higher firm value.
2. There is a strength relationship between asset growth and firm value when moderated by leverage.
3. Revenue growth has no effect firm value.
4. The relationship between revenue growth and firm value statistically when moderated by leverage weaken the relationship between revenue growth and firm value.

Suggestion

For further research to enhance the study were as follows:
1. The study further recommended adding other variables such as business risk in debt and strengthen the investment decision making for investor.

2. The study further recommended used larger sampling company on future studies to enhance the reseach.

3. This study only uses financial statement by projecting each ratio to one variable used, it can be expanded by using other variables, such as intervening variables or moderation variables based on research analysis.

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Satisfaction of Individuals with Physical Disabilities Regarding the Use of Assistive Technologies

Daiane de Cesaro; ORCID ID: orcid.org/0000-0003-4521-4558
Mateus Francisco Vanesio;ORCID ID: orcid.org 0000-0002-0807-9636
Fabiola Hermes Chesani-PHD; ORCID ID: orcid.org/0000-0002-4518-470X
Carina Nunes Bossardi-PHD; ORCID: http://orcid.org/ 0000-0003-0734-3463

Correspondent Author:
Fabiola Hermes Chesani Professor- Physiotherapy and Master degree in Health- University of Vale of Itajaí. Uruguai, 458Itajaí / SC CEP 88302-202
Telephone: +55(47)3341-7932
Email: fabiola.chesani@univali.br

Abstract

Background: *The individual's personality and social factors influence a person's desire or ability to use assistive technology devices. Therefore, these components contribute to a positive or negative influence on the use of assistive technology and on the degree of satisfaction with the use.* ***Objective****: The aim of the study was to evaluate levels of satisfaction of individuals with physical disabilities with their prescribed assistive technology device.* ***Methods:*** *A quantitative questionnaire survey using The Quebec User Evaluation of Satisfaction with Assistive Technology 2.0 and questionnaire on sociodemographic and health data. Data collect took place from August 2018 to April 2019, in the Physiotherapy Clinic of a Community University, in the Specialized Center for Physical and Intellectual Rehabilitation II and in the support networks for individuals with disabilities, such as: Roda Solta, Association for Supporting Families of Impaired People, Association of Disabled People and athletes of the women's Paralympic Handball Championship.* ***Results:*** *Fifty-six individuals with physical disabilities between 20 and 80 years old participated in the research, 27 women (48.2%) and 29 men (51.8%).The results suggested that individuals are quite satisfied with their assistive technology device M=3.56(SD=1.09) and more or less satisfied with the professional services provided M=3.28 (SD=1.34). Among the 12 items considered most important by the participants, durability of device (54%) prevailed, followed by comfort (28%) and safety (24%).* ***Conclusions****: The patients are satisfied with the assistive technology device but not with the professional's services provided. Assistive technical devices need to be adapted to the user's needs, always aiming to improve health condition and quality of life.*

Keywords: *Health promotion, Patient Satisfaction, People with Disabilities, Physiotherapy Specialty, Rehabilitation.*

1. Background

According to the World Health Organization (WHO) statistics (1) about 1 billion people worldwide have some form of disability. In 2013, the Brazilian Institute of Geography and Statistics released the results of the 2013 National Health Survey (NHS) (2)in Brazil 1.3% of the population declared that they had physical disabilities, with the men having a higher level (1.6%) than women (1.0%).

Only 5 to 15% of the individuals who need care products in low- and middle-income countries have access to one assistive technology (orthosis, prosthesis and wheelchairs) However, the aging of the population can lead to motor injuries, which consequently increase the chances of using auxiliary devices (3). Thus, the demand for better rehabilitation services and efficient assistive technologies will be necessary to serve this population with motor injuries,

The International Classification of Functioning, Disability and Health (CFDH) has broadened the understanding and measuring of disability. It includes aspects of functionality, disability and health of people. In the International Classification of Functioning (ICF), deficiency arises from the interaction between health problems and contextual factors such as environmental and personal factors. The environmental factors include the following: products and technologies (4).

Technology, which may seem perfect for a need, may be misused or even not used when personal criteria, social characteristics or environmental needs are not considered, thus leading to personal frustration, and to waste of devices(5).

The individual's personality and social factors influence a person's desire or ability to use assistive technology devices. Therefore, these components contribute to a positive or negative influence on the use of assistive technology and on the degree of satisfaction with the use (6). Therefore, what is the satisfaction of people with physical disabilities regarding the use of assistive technologies? The aim of the study was to evaluate levels of satisfaction of individuals with physical disabilities with their prescribed assistive technology device.

Methods

The research was quantitative and exploratory and involved the use of Quebec User Evaluation of Satisfaction with Assistive Technology (2.0)(QUEST2.0) Give a ref to the tool. The participants were residents in the Itajaí Valley region and were invited to participate by personal contact or by telephone. Telephone numbers were provided by the leaders of the disability support networks. These include people with disabilities who used assistive technologies such as wheelchairs, Canadian crutches, axillary crutches, walkers, walking sticks, prosthetics, and orthotics, among others. Inclusion criteria were individuals with physical disabilities who use some device, aid or any other help in the field of assistive technology. Exclusion criteria were individuals with disabilities other than physical disabilities and impaired underage individuals.

Data collect took place from August 2018 to April 2019, in the Physiotherapy Clinic of a Community University, in the Specialized Center for Physical and Intellectual Rehabilitation II and in the support networks for individuals with disabilities, such as: Roda Solta, Association for Supporting Families of   Impaired People,   Association   of   Disabled People   and   athletes   of   the   women's

Paralympic Handball Championship. After contacting those responsible for the support networks, a data collection schedule was organized according to the dates and times that people with disabilities performed their rehabilitation or sports activities. Data collect took place in the aforementioned places, in a private room and only the researcher and the participants were present. The collect was scheduled on the dates and times available by the participants so that it did not interfere with their activities. The average time for applying the questionnaire was 20 minutes for each participant.

The data collect instrument was the test called Quebec User Evaluation of Satisfaction with Assistive Technology (2.0), which was developed with the objective of assessing user satisfaction with the assistive technology device in several aspects, justifying the need for the effective use of these devices. The reliability or internal consistency of the instrument items was tested by Cronbach's alpha coefficient for each factor and for each item removed, and for the total score. Cronbach's alpha coefficients for the B-Quest's "device", "services" and "total score" items were 0.862, 0.717 and 0.826, respectively (7).

Quebec User Evaluation of Satisfaction with Assistive Technology (2.0) was validated in Brazil in 2014 by Carvalho; Gois Júnior (7) and consists of 12 items related to satisfaction regarding two dimensions: assistive technology device and service. For each item, the participant assessed their satisfaction using a scale from 1 to 5, where 1 (Dissatisfied), 2 (Not Satisfied), 3 (More or Less Satisfied), 4 (Very Satisfied) and 5 (Fully Satisfied) with the assistive technology being used. The questions about device satisfaction are 8 in total and point to items such as dimensions, weight, fit, safety, durability, ease of use, comfort and effectiveness. However, the service dimension is made up of 4 issues that address the delivery process, technical assistance, professional services - information, guidance received to use the device, support services. After the 12 questions, the participant chose 3 items that they considered most important for complete satisfaction in the use of the assistive technology, among 12 words such as: dimensions, weight, adjustments, safety, durability, ease of use, repairs/technical support, comfort, effectiveness, follow-up services, professional services, delivery.

From the results of the Quest2.0 application, the data referring to the measurement instrument were tabulated and processed in a spreadsheet using the Statistical Package for Social Sciences (18.0) statistical program. Descriptive analyses for mean and standard deviation were performed.

The research related to human use has complied with all the relevant national regulations and institutional policies, has followed the tenets of the Declaration of Helsinki, and has been approved by the Ethics Committee on Researches with Human Beings of the University of Vale do Itajaí (number 2.577.51). The legal participants signed the Informed Consent Form.

Results

The study included 56 people aged between 20 and over 60 years old. Regarding gender in the sample, the percentage was higher in males and lower in females. Table 1 summarizes the main sociodemographic characteristics of the individuals evaluated.

Table 1 – Sociodemographic and health characterization of the physically disabled participants.

Variable	N	%
Age group (years old)		
20 - 30	14	24.9
31 – 60	33	59.0
Above 60	9	16.1
Gender		
Male	29	51.78
Female	27	48.22
Marital Status		
Single	26	46.4
Married	21	37.5
Divorced	6	10.7
Widower/Widow	3	5.4

Among the causes for the physical disabilities of the research participants were diseases that affect the nervous system, n=31 (55.3%), followed by traumatic accidents, n=25 (44.6). Still regarding the disabilities, the time of each motor impairment was evaluated, especially the time from 0 to 5 years of disability, n=21 (37.4%), being more recent injuries and which may influence the use or not use of assistive technology devices.

It was decided to use the terms plegias and paresis in order to define whether the impairment resulting from the motor system was total or partial. The term lower limb discrepancy was considered from 4cm onwards with impaired community gait. Predominance was identified in relation to mobility aids, especially wheelchairs. This may be explained, in part, by the fact that the sample had a higher prevalence of individuals with some neurological pathology and nervous system impairment, and this etiology stood out in the research, n=31 (55.3%), as the major cause of the physical disabilities in the study. Table 2 presents the health characterization of the physically disabled participants.

Table 2 – Health characterization of the physically disabled participants.

Variable	n	%
Physical Disability Etiology		
Nervous System Impairment	31	55.3
Traumatism	25	44.6
Time of Physical Disability (years)		
0 |- 5	21	37.4
5 |-10	9	16.1
10 |- 20	17	30.3
Over 20 years |-	8	16.2
Type of Physical Disability		
Paraplegia	16	28.6
Amputation	20	35.7
Paraparesis	4	7.1
Hemiparesis	8	14.3
Tetraparesis	2	3.6
Hemiplegia	2	3.6
Assistive Technology being used		
Wheelchair	26	46.4
Canadian Crutch	12	21.4
Axillary Crutches	2	3.6
Prosthesis	8	14.3
Walking Stick	3	5.4
Powered Wheelchair	1	1.8

The overall satisfaction result of the 56 survey participants showed M=3.56; SD=1.09 in the device dimension and M=3.28; SD=1.34 in the service dimension. These results show that individuals are more

satisfied with the assistive technology device and less satisfied with the professional services provided. Classified by the Quest 2.0 instrument as Fairly Satisfied in the device dimension and More or Less Satisfied in the service dimension.

The results of the instrument that asked the participant to choose three items out of twelve options, which the participant considered most important to obtain satisfaction with an assistive technology, were the durability of the device, being cited most frequently (54%) among the 56 study members, followed by comfort (50%) and safety (43%). Table 3 shows the relationship between satisfaction and the type of assistive technology.

Table 3-Relationship of user satisfaction with the type of Assistive Technology.

Type of Assistive Technology	Mean (SD) of device	Mean (SD) of service
Wheelchair	3.22 (±1.12)	2.62 (±1.31)
Canadian Crutches	4.21 (±0.77)	4.41 (±0.82)
Axillary Crutches	2.81 (±1.14)	2.12 (±0.53)
Prosthesis	3.33 (±1.20)	3.50 (±0.84)
Walking Stick	4.04 (±1.12)	4.00 (±1.52)
Powered Wheelchair	4.87	5.00

Table 4 shows which physical disabilities the participants have who are most satisfied with the assistive technology device and professional services provided, as well as those who are most dissatisfied. It may be related to the impairment level on each physical disability displayed by the participants. Pearson's chi-square test revealed no statistically significant differences between levels of satisfaction (device and service) by type of disability and type of assistive technology.

Table 4- Relationship between Assistive Technology user satisfaction and the type of physical disability.

Type of Disability	Mean (SD) of device	Mean (SD) of services
Paraplegia	2.85 (±1.13)	2.32 (±1.21)
Amputation	3.55 (±0.97)	3.33 (±1.13)
Hemiparesis	4.40 (±0.77)	4.50 (±0.65)
Hemiplegia	4.56 (±0.44)	4.50 (±0.70)
Paraparesis	3.96 (±1.19)	3.87 (±1.93)
Tetraparesis	4.62 (±0.35)	3.25 (±2.47)

Discussion

This study evaluated the satisfaction of individuals with physical disabilities regarding the use of assistive technologies. In relation to gender, the overall percentage was n=29 (51.8%) men and n=27 (48.2%) women with physical disabilities, in contrast to another study,[8] which investigated the prevalence and factors related to disability, with 53.1% being female. the epidemiological profile of individuals with physical disabilities in this study is similar to other published studies (9).

Similarly the age range of, individuals using some kind of assistive technology who were 31 – 60 years which is also similar to other published works (10,11). The most prevalent cause of physical disabilities in the study were the neurological disorders n=31 (55.3%). In the above research, neurological problems also appeared as the main etiology of physical disabilities (43.3%)(11).One of the main neurological diseases in this study was Stroke, and in Brazil it is the leading cause for death in the adult population, as well as one of the main reasons for disability, since 70% of the patients do not resume a productive life. Advances in technologies and treatments have increased the survival of people who have suffered a stroke, increasing the number of people with sensorial and/or motor disabilities. In addition to the stroke that appeared frequently in the research, diseases like Myelomeningocele, Poliomyelitis, Meningitis, Transverse Myelitis and Congenital Diseases were the reason for the developed physical disabilities.

The second most cited etiology in the study was trauma, n=25 (44.6%), which can cause spinal cord injuries, which are also related to the high incidence of traffic accidents. According to the latest WHO update, in February 2019, road traffic injuries cause significant economic losses for individuals, their families and countries as a whole. Traffic accidents cost most countries 3% of their gross domestic product (12). Poor road traffic education often leads to negligence in the attitudes of drivers, cyclists and pedestrians resulting in an acquired physical disability. Firearm trauma was also cited by participants as a cause of their physical disability within the research etiology category.

In 2014 A study in Brazil aimed to analyze the care of people injured by firearms in Brazilian emergency services, in 24 capitals indicated that 1.5% for self-caused injuries, 15.9% for aggression and 65.1% for legal intervention were caused by firearm. There was predominance of assistance to male patients, young adults (20 to 39 years old), brown skin color and low schooling (13).

The time of physical disability of the participants that prevailed in the study was 0 to 5 years, n=21 (37.4%), being more recent lesions, in the sequence the time between 10-20 years, n=17 (30.3%), was persistent what about those who had an impairment between 5 and 10 years.

Impairment time can be influenced by satisfaction with assistive technology, since adaptation to using an assistive technology in recent injuries is necessary. Early motor physiotherapy improves the patient's potential for the recovery of functionality and the greater chance for recovery from lost functions during this period, and may act to guide the use of the assistive device which will become easier to use (14).

In this study, the time of physical disability of the participants with hemiplegia and hemiparesis was from 0 to 5 years, most of them attending Physical Rehabilitation Centers with professionals such as the Physiotherapist helping in the adaptation and rehabilitation process within the physical disability. There are patterns in the mobility needs of subjects with stroke, which may change over time due to the functional evolution of the condition (15).This so reinforces the importance of specialized services and of professionals properly trained to follow up the process of assessment, prescription, training and reassessment in the context of assistive technologies, since in this study the participants were more or less satisfied (Quest 2.0) regarding the professional services provided. The difference between the levels of functional independence among the participants may relate to using different types of mobility aids, as well as to the high levels of dependence on preponderant wheelchair use among the subjects (16).

The Quebec User Satisfaction Rating with Assistive Technology (2.0) contains 12 questions divided into two dimensions: device and service. The questions of both device and service dimensions enable answers in which participants select items between 1 and 5. The answers from the professional services provided obtained M = 3.28; SD = 1.34 being rated More or Less Satisfied. The average proportion of device responses M = 3.5; SD = 1.09, then rated very satisfied with QUEST 2.0.

The study by Joseph *et al* (17) in Florida, aimed to determine the level of customer satisfaction on the orthotic assistive device and the professional guidance services with QUEST 2.0, obtained a participants' average score for the device section of 4.53 and the services mean was 4.71, resulting in a satisfaction rating of Fully Satisfied with the assistive technology device and with the follow-up services. The difference in technology satisfaction of the study participants in Brazil with what occurred in Florida (USA) may be related to the North American socioeconomic situation that allows people to access professional support from the moment they purchase the assistive device.

In the QUEST 2.0 stage on the 3 main categories for the device characteristics that would lead to total satisfaction, the most frequently selected items stood out: Durability n=30 (54%), Comfort n=28 (50%) and Safety n=24 (43%). The study by Chen *et al* (18) that assessed the satisfaction of 280 assistive technology users, corroborated two T-QUEST items that were most often cited as the most important: 'Comfort' n=149 (53.2%) and Safety n=120 (42.9%); durability was not one of the three items chosen by the survey participants.

Regarding satisfaction with the types of assistive technologies, the most satisfied individual in the survey is the motorized wheelchair user, both in the device dimension (M=3.22; SD=1.12) and in the service dimension (M=2.62; SD= 1.31). The reduction in efforts when using the motorized wheelchair is a consequence of technological innovations following wheelchair motorization, including sharing levels of autonomy between the user and the wheelchair navigation system (19). But some disadvantages may come to occur when using a motorized wheelchair such as weight gain, physical de-conditioning and high acquisition cost.

The individuals using axillary crutches (n=2) were the most dissatisfied in the research's device and service dimensions. Such devices, like axillary crutches, allow for an increased autonomous mobility of the user; however, they require load transfer from lower to upper limbs, which may have some negative effect on these limbs (19). Canadian crutches users are satisfied both with the device and with the service provided. In Australia, Polese *et al* (20) evaluated the perception of chronic hemiplegics on using Canadian crutches and walking sticks as walking aids. The results showed an improvement in the mobility of hemiplegic individuals when these devices are prescribed during rehabilitation, indicating greater confidence when walking.

However, prosthesis wearers are dissatisfied with the device and the service. It was identified through other research that the user drop-out rate for lower limb prostheses is 33.87%, mainly due to negative factors such as size and difficulties in fitting inadequate prostheses. This may be related to problems with assessment and prescribing, and may still prevent functional gains from the rehabilitation treatment[3].

Manual wheelchair users had greater dissatisfaction both in device and in service. T   ual wheelchair is a device that requires adjustments such as seat size, depth, arm and foot rest, an   ers, to be adequate. But with proper ergonomics, mobility is provided and complications like falls, contractures and pressure ulcers are prevented [21].

Mandy et al [23] explored the experiences of 11 hemiplegic users with their manual wheelchairs. The results identified four main themes: heteronomy, wheelchair design inadequacy / inadequacy, poor sidewalk and road conditions that prohibit wheelchair use, and lack of adequate wheelchair provision. The results confirm that the current manual arrangement of new and used wheelchairs for this group of users is inadequate and highlighted the problems and problems arising from the current layout.

Walking stick and walker users had a fairly high level of satisfaction with the device, whereas in relation to service satisfaction, walker users are less satisfied. In its turn, the use of walking sticks and walkers can be related to the group with better physical conditions. Corroborating such idea, a study found that subjects using walking sticks have better levels of mobility as well as lower levels of physical disability[16].The participant using the insole is more or less satisfied both with the device and with the service. Users should be involved in the decisions about the device they receive to make it easier for them to gain functional results and to be satisfied with the assistive technology [5].

Table 4 shows the relationship between the assessed satisfaction based on the QUEST 2.0 questions and the type of physical disability. The participants with paraplegia were the most dissatisfied within the mean of 1 to 5, both with the assistive technology device (M=2.85; SD=1.13) that they use and with the professional services (M=2.32; SD=1.21) provided, rated as More or Less Satisfied and Not Satisfied

according to QUEST 2.0. In contrast, physically handicapped individuals with tetraparesis displayed the highest satisfaction with the device (M=4.62; SD=0.35) and the hemiplegic and hemiparetic patients displayed the highest satisfaction in the research regarding the professional services (M=4.50; SD=0.65), being classified as Very Satisfied and Totally Satisfied.

Regarding satisfaction with the type of physical disability, the most dissatisfied members both in the device and in the service dimensions were mostly women, paraplegics, single women, manual wheelchair users, and athletes from a Paralympic Sports Support Club where the research took place, and this may be linked by the fact that the athletes use the assistive technology device for their sport as well as for daily life activities, thus demanding a better quality. The most satisfied in the research both in device and in service were mostly men, married, hemiplegic, Canadian crutches' users, and who attended the rehabilitation centers where the research took place, conducting rehabilitation physiotherapy sessions.

In Brazil, in 2011, the National Plan for the Rights of Individuals with Disabilities - Living Without Limits was presented, aiming to ensure and strengthen the Rights of Individuals with Disabilities. This political and social movement implemented by the government sought to support and favor the lives of people with disabilities in general, with access to education, social inclusion, health care and accessibility [22]. In this prerogative, the rehabilitation services received an investment in specialized rehabilitation centers and orthopedic workshops to expand the supply of orthoses, prostheses and mobility aids throughout Brazil.

User satisfaction with the use of assistive technology promotes a need for assistance reduced by users and an improved quality of life, independence and freedom. Mandy et al [23] examined the experiences of users of a power device and found that in the thematic analysis gave rise to five themes: independence and positivity, emotions, impact on family and social life, equipment functionality and motivation. Users reported that the need for assistance was reduced and that their quality of life, independence, and freedom improved.

The limitations of the study are pointed out as difficulties in the face of data and location of people with physical problems in health centers and in illnesses, often due to lack of support from the teams, the estimated sample number calculated is not possible.

The satisfaction of individuals with physical disabilities regarding the use of assistive technologies was more evident in the questions related to using the assistive technology, whereas they showed dissatisfaction with the dimension related to professional services. In this context, it is emphasized that for a better satisfaction regarding the professional services, greater professional support is needed from the time the device is acquired. It is also suggested to future physiotherapists that, when assessing and recommending an assistive technology, the patient's needs, personality, skills and socioeconomic situation should be observed, since there is no point in prescribing a device that the individual cannot afford. It needs to be adapted to the user's needs, always aiming to improve health condition and quality of life.

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Mental health, spirituality and alternative practices for coping with health professionals in the face of the COVID-19 pandemic

Luana Araújo Macedo Scalia1; Omar Pereira de Almeida Neto1; Poliana Rodrigues Alves Duarte2; Kamila Miranda3; Cecília Soares Ferreira Carilli3

1 PhD. Nurse. Professor at Federal University of Uberlandia, City of Uberlandia – Brazil
2 PhD. Nurse. Professor at Federal University of Catalao, City of Catalao – Brazil
3 Nurse Student. Federal University of Uberlandia, City of Uberlandia – Brazil

ABSTRACT

The new pneumonia caused by coronavirus 2 of severe acute respiratory syndrome (COVID-19) has the potential to develop biopsychosocial instability in the population and is responsible for much of the increase in mental disorders that occur after the beginning of the pandemic, especially among health professionals working on the front line. Physical exhaustion and mental distress lead them to search alternative therapies for harm reduction, such as therapeutic communication therapies, active listening, meditation, mindfulness and yoga. Such actions can decrease stress and have potential harm reduction in relation to the development of posttraumatic stress disorder. In addition, religiosity and/or spirituality reduced the psychological suffering of health workers, not only in moments of pandemic, but in the daily work routines.

Keywords: Coronavirus Infections, Crisis Intervention, Complementary Therapies, Spirituality

INTRODUCTION

Since December 2019, the Chinese city of Wuhan has reported a new kind of pneumonia caused by coronavirus disease 2019 (COVID-19). The virus was called coronavirus 2 of severe acute respiratory syndrome (SARS-CoV-2) [1]. On January 30, 2020, the World Health Organization (WHO) has held an emergency meeting and declared the global outbreak of COVID-19 a public health emergency of international interest [2].

According to the interactive map of the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University, there are already 11,691,068 confirmed cases, 540,062 deaths in 188 countries. United States and Brazil are perceived in delicate situations lead the ranking of confirmed cases [3].

Previous research has showed a deep and wide range of psychosocial impacts on people at the individual, community and international levels during infection outbreaks. At the individual level, people are likely to experience fear of falling ill or dying, feelings of helplessness and stigma [4].

A study conducted in China, two weeks after the COVID-19 outbreak, with 1210 respondents, more than half (53.8%) classified as moderate or severe the psychological impact of the COVID-19 outbreak [5].

The risks of contamination, social isolation and uncertainties caused by virus can aggravate or generate mental problems such as anxiety and depression[5]. Social isolation/distancing changes the family, personal and professional routine of the population, besides causing increased rates of unemployment, domestic violence, family conflicts, among others [6].

In view of this critical situation, health professionals who are directly involved in the diagnosis, treatment and care of patients with COVID-19 are at risk of developing psychological distress, posttraumatic stress disorder (PTSD) and other somatic symptoms, as already reported at other pandemic moments [7,8]. The increasing number of confirmed and suspected cases, overwhelming workload, exhaustion of personal protective equipment, wide media coverage, lack of specific medications and inadequate feelings of support can contribute to the mental burden of these health professionals [9, 10].

According to Lai et al[9]. out of 1,257 professionals working in Wuhan hospitals, 50% reported symptoms of depression, 44% anxiety, 34% insomnia and 71% anguish. Female nurses, frontline health professionals, reported more severe degrees of all mental health symptom measurements than other health professionals[9].

Kang et al.[12] surveyed the mental health of 994 physicians and nurses who worked in Wuhan, and 34.4% had mild disorders, 22.4% had moderate disorders (PHQ-9: 9.0) and 6.2% had severe disorder at the immediate moment of viral epidemic. The most serious cases were in young women[12]. The interesting thing in this work is that they asked how these professionals dealt with the psychological stress they went through and 36.3% had accessed psychological materials (such as books on mental health), 50.4% had accessed psychological resources available through the media (such as online messages about self-help in mental health and coping methods), and 17.5% participated in counseling or psychotherapy. Although access to mental health services was limited, distressed professionals saw these services as important resources to relieve acute mental health stresses and improve perceptions of physical health.

These findings emphasize the importance of being prepared to support frontline workers through mental health interventions in times of widespread crisis[12].

In Latin America, COVID-19 arrived later than in other continents. In Brazil, the first case recorded was on February 25, 2020, but it is currently the country with the highest number of cases and deaths on the continent and these data are probably underestimated because the country does not have enough tests[3]. Something also worrisome is the lack of protection equipment for health professionals, few hospital beds available in cities and insecurity in relation to the economy. Furthermore, the country is still going through a serious political crisis[13].

If health professional is already so subjected to severe stressors in pandemic times, all these factors mentioned above contribute even more to make them insecure and in psychological distress, which increases the number of cases of posttraumatic stress disorder (PTSD) [11].

PTSD is characterized by the development of specific symptoms after the occurrence of an intense traumatic event, involving the direct or non-participation of the patient/victim [14]. Health professionals who participated in an outbreak of acute respiratory syndrome in 2003 had a prevalence of 10-20% of PTSD [8,15]. In addition, PTSD can lead to increased use of psychoactive substances as a way of relieving symptoms resulting from the disorder [16].

Therefore, in the presence of the pandemic the control of stress and anxiety is important because

emotional exhaustion will reflect on the physical and mental condition of people causing them to be seriously psychological disorders and the difficulties of complying with the COVID-19 coping plan. In particular, if health workers don't receive mental health care, will reduce their potential for care, increase the chances of sick leave, dissemination, deaths and consequences after the pandemic crisis[1].

Regardless of the manifestations that may occur, the intervention should be based on the reception of the subject and his emotions, in a sensitive, empathic way, through active and qualified listening that is the basis of therapeutic communication. Interventions should focus on effective coping, problem solving, hope and positive thoughts in order to provoke adaptive and healthy psych emotional responses[2].

Besides therapeutic communication tools other strategies to reduce stress and are necessary, such as the constructs religiosity, spirituality and the use of alternative and complementary therapies (yoga, meditation, mindfulness, for instance). Such constructs resize the meaning of life and in people who are sensitive to self-awareness about their spirituality; the processes of meaning and resignification of the facts of life are favored[17].

Spirituality can lead to good relationships between professional and client besides indispensable component for the administration of feelings of loss, lack of hope and stressful situations. The spirituality dimension in care aims to promote and well-being of the person and family in care and community environments and among the professionals involved in care as one of the main resources to understand suffering and strengthen humanity for new challenges in currently moment[17].

A recent study shows experiences in the fight against the coronavirus pandemic in Italy. Approximately 60 priests who worked tirelessly and without personal protective equipment lost their lives to provide spiritual assistance to infected patients, family members, and health professionals. They also report the importance of health professionals especially physicians and nurses to have skills in providing some kind of religious/spiritual assistance, this ability has already been recognized as essential in some specialties such as palliative care, but they are even more important in health or climatic disaster scenarios to alleviate psychic suffering[18].

In Spain 3.480 people were diagnosed with depression, anxiety and posttraumatic stress disorder statistically related to the presence of the pandemic. Results has revealed a prevalence of 18.7% of depression, 21.6% of anxiety and 15.8% of PTSD symptoms. Being older age group, having economic stability and believing that adequate information had been provided about the pandemic was negatively related to depression, anxiety and PTSD. However, female gender, previous diagnosis of mental health problems or neurological disorders, with symptoms associated with the virus or with infected close relative were associated with greater symptomatology in the three variables. Predictive models revealed that the greatest protector of symptomatology was spiritual well-being, while loneliness was the strongest predictor of depression, anxiety and PTSD [19].

With regard to alternative and complementary therapies for the reduction of mental health damage in the face of the pandemic, it is important to note that they act in different ways in each individual. One practitioner may find yoga and mindfulness reassuring, while others prefer to walk, run or practice some kind of physical activity. Some will have more time to explore their spirituality while others lack feeling with the subject. Physician Herbert Benson researched the so-called "Relaxation Response" in yogis and spiritual exercisers, observing how the organism itself responded to the stimulus of the mind. The author

describes what he called the "Faith Factor", which would be the great influence of a deep religious or philosophical faith, but not necessarily devout, to evoke the Relaxation Response, which can be shown as a possible instrument to work spirituality in health professionals[20].

Final Considerations

In view of all the data surveys used to compose reflections in this study, most showed that the new pneumonia caused by coronavirus 2 of severe acute respiratory syndrome has the potential to trigger biopsychosocial instability among the population and that its impacts, classified as moderate and severe, are responsible for much of the increase in mental disorders that occurred after the onset of the pandemic [1, 6].

It is still unclear what the consequences will be in the field of mental health and worker health after the end of the pandemic, however, experts warn of the increase in mental disorders such as anxiety, depression and PTSD [19, 20th].

Health professionals working on the front line have demonstrated physical exhaustion and mental suffering, which leads them to seek alternative therapies for harm reduction, such as psychotherapies online therapies, therapeutic communication, active listening, meditation, mindfulness, yoga, among others[6, 12, 17].Such actions have potential harm reduction with regard to the development of posttraumatic stress disorder[16].

Moreover, access to the constructs religiosity and spirituality have reduced the psychic suffering of professionals, not only in pandemic moments, but in the daily life of their work routines. The spiritual field has also been shown to considerably improve the interpersonal relationship of professionals with patients undergoing treatment of COVID-19[18].

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Etiological Factors of Autism Spectrum Disorder

Manuel Ojea Rúa, Nuria Diéguez García, María D. Dapía Conde

(*University of Vigo*)

ABSTRACT

People with autism spectrum disorder (ASD) have multifactorial etiology, combined by different factors, both genetic, psychological and environmental; however, it´s necessary sharply discriminate those significant factors or components, regarding elaborate an early action protocol for diagnostic processes and subsequent intervention guidelines, which co A total of 192 participants with ASD of three intensity levels (American Psychiatric Association -APA-, 2013) have collaborated in this study. ASD diagnostic shape the discrimination´ aim to 18 independent variables, considered, a priori, potentially influential over diagnostic intrinsic process.

Results of discriminant analysis include two axes it delimits the two main functions, represented by two variables: "karyotype" (Wilks´ Lambda statistic= .88) and "diagnosis" (Wilks´ Lambda statistic= .83). Both variables are complemented along structure matrix of discriminant analysis with variable "gene" for first function ("karyotype") and variable "age" to second function ("diagnosis" + "karyotype").

These allow defining the general characteristics to establish an effective action protocol for the specific diagnosis, which constitutes the general aim of this empirical research.

KEY WORDS: Autism spectrum disorder. Diagnosis. Genetic.

INTRODUCTION

People with autism spectrum disorders (ASD) present a particular shape of perceptual-cognitive processing that affects global development regarding criteria of interaction and social communication and over manifestation of restrictive and repetitive behaviors that cause specific needs in the scope personal and social at different levels or degrees of intensity of disorder, which are issued by International Classification of Disabilities (American Psychiatric Association –APA-, 2013). Therefore, the highly specificity of this disorder demand an intervention process rightly adjusted to processing way of perceiving, coding and recovering information along feedback between the incoming information (*input*) and consequent personal response action (*output*). This intervention is possible when there´s a specific clearly differential diagnosis that allows conclude with effective development program. In this sense, a specific diagnosis is essential process to assure an adapted vital development, hence it´s fundamental investigate the basic etiology of this disorder regarding delimit an action protocol to early specific diagnosis effectiveness that eases the corresponding specific action program.

Just to investigate this issue, Ojea (2018) performs a synthetic study that concludes the causes of this disorder are based over wide genetic and neurological basis. The support of these conclusions is founded on research that show, firstly, the disorder concurs with specific biological and neural conditions, related,

especially to psychiatric comorbidity processes (Freitag et al., 2008; Kohane et al., 2012; Levy et al., 2010; Rutherford & Troje, 2012) and, secondly, results found from clinical studies supported over specific genetic basis of ASD diagnosis, are characterized by disabilities founded in relationships and interneuronal synaptic fluency (Doshi-Velez, Ge & Kohane, 2014; Tuchman & Mamounas, 2013). Genetic analyzes are numerous and are supported over concurrence of mutations of different genes, among which the fragile X chromosome syndrome, whose relationship with the presence of ASD disorder is estimated around 30%, the tuberous sclerosis with a 1-4% prevalence within ASD disorder and highly correlation related with Rett syndrome (Acosta y Pearl, 2006). Also, Oviedo, Manuel- Apolinar, Chesnaye & Guerra- Araiza (2015) find a synopsis of interaction percentage between different syndromes of genetic etiology, among which, especially, the Prader-Willi syndrome (SPV), with 25.3% interaction percentage with criteria of ASD disorder, Angelman syndrome with 42%, Investment-Duplication syndrome (15q11-q13), of 2-4% interaction, the Fragile X syndrome with 25-33%, Permutation syndrome (SXF), with 10-60%, Deletion syndrome 2q37.3 with the presence of several reported cases and Mutation syndrome of the ARX gene. These studies are complemented by other research related to analysis of dysfunction over GABA way (Solís- Añez, Delgado- Luengo & Hernández, 2007), basically, concerning to gene-interval 15q11-q13, that codify the units β3, α5 y 3 of receptor GABA$_A$, which show highly correlations in monozygotic twins by 60%. Druand et al. (2006) conclude with strong association of this disorder regarding deficits over interneuronal synaptic processes, related to deletion or mutation of SHANK3 gene, which performs a fundamental role along development of synaptic functions affecting in way sensitive to performance of information cognitive processing. James, Shpyleva, Melnyk, Pavliv & Pogribny (2013) detect the presence of methyl CpG gene mutations, protein 2 (gen MeCp2).

Epidemiological studies also indicate evidence of multiple recurring genetic factors between 4-8% among brothers and sisters of children with ASD and the studies with twins, that report a prevalence of 60% concordance in monozygotic twins versus 0 in dizygotic twins, hence the wide phenotypic variety attributed to ASD diagnosis disorder is conclusive (Andres, 2002; Muhle, Trentacoste & Rapin, 2004; Veenstra-Van der Weele & Cook, 2004).   Likewise, it´s estimated, at least, 10 genes highlight specially as explicative responsible to etiology of ASD diagnosis, which 7q31- q33 gene be specifically highlighted, with descriptions of duplicity on chromosome 15. Others genes of lower incidence are indicated, FOXP2 gene, Ray1/ ST7 gene, IMMP2L gene, RELN en 7q22- q33, GABA (A) and UBE3A genes, located on chromosome 15q11- q13, as well as, 5-HTT serotonin transporter gene variants en el cromosoma 17q11- q12 and interactions found at oxytocin receptor on chromosome 3p25-p26, that Bayés et al. (2014) extends to consistency of 2q, 3q, 16p y 17q chromosomes.

Calahorro (2011) shows the significant association of ASD disorder with the 5HTTLPR-S allele of SLC6A4 gene promoter, which gets a reduction over serotonin transporter expression. Also, investigate the patterns of single and double mutant behaviors by deletion in nrx-1 and nlg-1 genes, which codify neuronal adhesion proteins, which affects the synapse and found alterations along defecation cycle, mechanosesorial response, exploration capacity, movement speed and the response capacity to an osmotic shock.

Camacho (2013) realice studies about neurexina-1ß (NRXN1ß) gen and finds the identification of heterozygous variants not described, located in two regions of gene, one atbeginning of translation, other in protein juxtamembrane region.

In summary, there´s wide research based on multifunctional etiology studies, where genetic etiology is an essential component. Various authors (Gilissen et al. 2014; Helsmoortel et al. 2014; Deciphering Developmental Disorders 2015; Wright et al. 2015), conclude with basic presence of 217 candidate genes, among which 13 genes specially harmonized to X chromosome stand out: *ATRX*, *CUL4B*, *DMD*, *FMR1*, *HCFC1*, *IL1RAPL1*, *IQSEC2*, *KDM5C*, *MAOA*, *MECP2*, *SLC9A6*, *SLC16A2* y *PHF8* and 10 de novo mutations in 8 autosomal dominant genes: *DYRK1A*, *GRIN1*, *MED13L*, *TCF4*, *RAI1*, *SHANK3*, *SLC2A1* y *SYNGAP1,* as well as, the presence of 10 rich genes in variants with potential loss of functionality: *ADNP*, *DYRK1A*, *NRXN1*, *NRG3*, *SETBP1*, *ZMYND11*, *DNM3*, *CYFIP1*, *FOXP1* y *SCN2A*.

Upon, this research attempts corroborate of autism causes are supported this studies lines, based on multi-factoriality with specific dominance of genetic etiology.

METHOD

Research aims

This study aims: 1) define main components of autism spectrum disorder etiology, and 2) deduce, hence, an action protocol to facilitate specific diagnostic processes.

Design

This research is supported for experimental study, based over application of an ad hoc designed questionnaire. Questionnaire is formed set of questions with structured response alternatives designed online through the Drive application (see Annex 1). Likewise, the quality levels of this questionnaire has been previously supervised by statistical experts, whose recommendations have been included over final design.

Participants

A total of 192 participants have participated in this study. Samples correspond to educational (153 participants), clinical (27 participants) or social (12 participants) ambit, related to individual diagnostic analyzes of 192 people with ASD of 3 levels or degrees of intensitr, of which, 111 correspond to ASD level 1, 31 to ASD level 2 and 50 are ASD level 3. Likewise, 150 men and 42 women.

Variables

For this study analysis, the following variables have been operationalized. Firstly, variable related to group of levels (1-2-3) of ASD participants: "ASD", which constitutes the aim of explanatory-causal analysis of this diagnosis, which configures the dependent variable (DV); and, secondly, a set of factors or independent variables (IV) are described, that are hypothetically explanatory factors of the variance found along DV: "ASD", that involves the disorder diagnosis, whose names are following:

1. The age of diagnosed participants: "age".
2. The age of diagnostic process was carried out: "diagnosis".
3. The sex of diagnosed participants: "sex".
4. The place of origin of participants with ASD: "location".

5. The center of diagnosis: "center".

6. The performance of genetic karyotype within diagnostic process: "karyotype".

7. The detection of gene/s type or combination of genes: "gene".

8.Other possible psychological, environmental, psychological, educational causes indicated through diagnostic process report: "multi".

9. Level of ancestry of "multis" causes (father-mother, brother, grandfather, uncle, cousin, others...): "Family-multi".

10. The Indication of family history related to autistim disorders: "autism-type".

11. Level of ancestry of causes related to "autism-type": "family- autism".

12. The presence of family history related to disorders of organic type: "organic-type".

13. Level of ancestry of organic causes: "Family-organic".

14. The family history concourse related to schizoid disorders: "schizoid-type".

15. Level of ancestry of causes chizoid symptoms: "Family-schizoid".

16. The detection of family history related to depressive type alterations: "Family-type-depressive".

17. The presence of family history related to anxiety, lability or others emotional factors: "anxiety-type".

18. Level of ancestry of causes related to anxiety...: "Family-anxiety".

Processure

Once questionnaire has been constructed with, it was sent to educational services, to orientation departments of the educational centers, likewise, to clinical, social services and different associations and federations that labor with people with ASD within Autonomous Community of Galicia (Spain).

Data analysis

Corresponding responses were received, statistical analyzes resulting from sample were carried out according SPSS statistical package, whose fundamental test is configured by discriminant analysis, throughout stepwise selective method.

RESULTS

General analysis

From global viewpoint, observed in Table 1, critical *p* levels associated with the *F* of statistical *Wilk´s Lambda* test are significant for 4 study variables, which seem show highest level of specificity for explain discriminant functionality with respect to group formed by DV: "ASD". The 4 significant variables are: "diagnosis" (*Wilk´s Lambda*= .94, *F*= 6.01, *p*= .00), "karyotype" variable (*Wilk´s Lambda*= .88, *F*= 12.70, *p*= .00), "gene" variable (*Wilk´s Lambda*= .91, *F*= 8.98, *p*= .00) and "autism-type" variable (*Wilk´s Lambda*= .96, *F*= 3.31, *p*= .03). Within these four variables, higher level of initial specificity is observed in "karyotype" variable, hence, a priori, it´d be the variable best defines the discriminant function explaining of variability found in "ASD". Other study variables don´t show related significant level.

Table 1: Test de Wilk´s Lambda (N= 192).

	Wilks' Lambda	F	df1	df2	p
1. Age	.97	2.52	2	189	.08
2. Diagnosis	**.94**	**6,01**	**2**	**189**	**.00**
3. Sex	.98	1.14	2	189	.32
4. Location	.99	.70	2	189	.49
5. Center	.97	2.00	2	189	.13
6. Karyotype	**.88**	**12.70**	**2**	**189**	**.00**
7. Gene	**.91**	**8.98**	**2**	**189**	**.00**
8. Multi	.99	.98	2	189	.37
9. Family- multi	.99	.60	2	189	.54
10. Autism-type	**.96**	**3.31**	**2**	**189**	**.03**
11. Family-autism	.98	1.63	2	189	.19
12. Organic-type	.99	.92	2	189	.39
13. Family-organic	.97	1.98	2	189	.14
14. schizoid-type	.97	2.06	2	189	.13
15. Family- shizoid	.99	.24	2	189	.78
16. Family- type-depressive	.99	.26	2	189	.76
17. Anxiety-type	.99	.30	2	189	.73
18. Family-anxiety	.99	.27	2	189	.75

VD: TEA.

Discriminant analysis

In fact, to implement an analysis of specific discriminant functions, a discriminant analysis of step selection method is carried out. In Table 2 are observe that discriminant analysis select 2 steps, represented by 2 axes corresponding to: 1) the "karyotype" variable; and 2) it adds "diagnosis" variable (diagnosis age).

Table 2:   Step discriminant analysis.

Step		Tolerance	F to Remove	Wilks' Lambda
1	Karyotype	1.00	12.70	
2	Karyotype +	.99	12.15	.94
	Diagnosis	.99	5.53	.88

Wilk´s Lambda values related two previous steps can be seen in Table 3. Both values aren´t very small, that´s, it aren´t next to zero level ("karyotype": *Wilks´Lambda* statistic= .88; and "diagnosis": *Wilks´Lambda* statistic = .83), which indicates that groups may be bit differentiated for discriminant analysis. However, *Wilks´Lambda p*-values and related exact *F* statistic indicate a right explicative capacity

for two variables collected by discriminant analysis: "karyotype": exact *F* statistic: 12.70, *Sig*= .00; and "diagnosis": Exact *F* statistic: 9.02, *Sig*= .00.

Table 3: Variables Entered- removed (a, b, c, d).

Steps	Variables	Wilks' Lambda								
		Statistic	Df1	Exact F					Df2	Df3
				Df2	Df3	Statistic	Df1			
1	Karyotype	.88	1	2	189.000	12.70	2		189,00	,00
2	Diagnosis	.83	2	2	189.000	9.02	4		376,00	,00

Explicative variance

Variables selected determine discriminant functions of analysis. First discriminant function (1), represented by "karyotype" variable, explains the higher of explanatory variance found over variability of "ASD" variable: variance = 80.5%, while secong function (2), corresponding to "diagnosis" variable explain the 19.5% of variance (see Table 4).

Also, it´s observed the 1 function indicate a canonical correlation = .36 (Chi-square = 34.55), which is almost double the canonical correlation of 2 function = .19 (Chi-square = 7.05). Therefore, 1 function ("karyotype") (development of previous genetic diagnosis study) are decisive to conform the main explanatory component of diagnosis variable "ASD".

Table 4: Eigenvalues.

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation	Chi-square	Wilks' Lambda	Sig.
1	.15(a)	80.5	80.5	.36	34.55	.83	.00
2	.03(a)	19.5	100.0	.19	7.05	.96	.00

Particular analysis of frequencies corresponding to both explanatory variables allows conclude that, in effect, with respect "karyotype" variable, it was realized on 112 occasions (58.3%), while was not on 80 reports (41.7%), constituting most important variable of this discriminant process. Accumulated "diagnosis" variable concludes that explanatory incidence of variability in "ASD" variable is greater when age range of diagnosis is lower, thus, over 0-5 age range it´s detected one or several genes of diagnostic processes reports in 23 situations; in 6-11 age range it´s detected 18 times; in 12-17 interval 8 times; in 18-25 interval years and more than 26 years were found in 0 reports. Moreover, developing of corresponding karyotype is more explanatory when age range is smaller, so in 0-5 age range it´s performed 61 times; in 6-11 interval 36 times; in 12-17 interval in 14; in interval of 18-25 years in 1 and in more 26 years was never not realized.

Structure matrix

La matriz de la estructura discriminante muestra que las dos variables "cariotipo" y "gen" tienen la mayor correlación con la primera función (1), representada por la variable "cariotipo": .90 y .28, seguido de otras variables con menores puntuaciones correlativas; mientras que la segunda función (2), representada por la variable "diagnosis": "cariotipo+diagnosis" está conformada por las variables "diagnosis" y "edad" con mayores correlaciones: .88 y .44, seguido de otras variables (ver Tabla 5).

Table 5: Structure matrix.

	Function	
	1	2
Karyotype	.90(*)	-.43
Gene(a)	.28(*)	-.12
Multi-type(a)	-.11(*)	-.08
Schizoid-type(a)	-.10(*)	-.07
Family-multi(a)	.10(*)	-.06
Family- autism(a)	-.08(*)	.00
Family-organic(a)	.04(*)	.00
Organic-type(a)	.02(*)	-.00
Diagnosis	.46	.88(*)
Age(a)	.24	.44(*)
Center(a)	.10	.17(*)
Sex(a)	-.06	.13(*)
Family-schizoid(a)	-.09	-.10(*)
Family-multi(a)	-.08	-.09(*)
Location(a)	-.06	.09(*)
Family-type-depressive(a)	.00	-.08(*)
Autism-type(a)	-.05	-.06(*)
Anxidety-type(a)	.00	-.04(*)

The variable "gene" is incorporated in structure matrix within 1 function: "karyotype". Indeed, this variable stand out by presence of following genes over diagnosis reports: 1) the 15q-11.2 gene (13 situations, 6.8%), 2) the q13 gene (3 times, 1.6%), 3) the fragile X gene (3 times, 1.6%), 4) gene/s combined (3 times, 1.6%), and 5) others genes: 45XY, P16, TCF3, ETV6 (27 times, 14.1%).

Also, the "age" variable correlates with high score with 2 function: "diagnosis" ("diagnosis" + "karyotype"), that conforms, then, an essential element of diagnostic process. In this sense, diagnosis process is more effective if earlier the diagnosis age.

Comparative analysis

Finally, centroids analysis conclude that clearly differentiated statistic means are observed for 1-2 functions, which allows delimit evident differences for the three ASD levels. Thereby, 1-2 functions are clearly differentiated to group ASD, thus, ASD1 level: 1 function= .32; 2 function= .05 in relation to ASD2:

1 function= -.20; 2 function= -.43 and, also, in relation to ASD3 variable level (1 function= -.58; 2 function= .15) (see Table 6).

Tabla 6: Canonical Discriminant Function Coefficients.

	Function	
	1	2
diagnosis	.52	1.08
karyotype	1.90	-.99
(constant)	-1.13	-.29

ASD	Function	
	1	2
ASD1	.32	.05
ASD2	-.20	-.43
ASD3	-.58	.15

CONCLUSIONS

Although, factors collected for discriminant analysis initially contribute to explaining the explanatory variance of the disorder diagnosis: "ASD", all variables accumulated along two axes selected by discriminant analysis contribute to forming the explicative components of VD variance: "ASD".

Thus, effectiveness of action protocol for ASD diagnosis and, therefore, the prognosis to effective and efficient intervention proposal is directly related, firstly, to the development of corresponding genetic karyotype and specification of possible existence of responsible genes: "gene" variable (see Table 5), which must carried out early possible, especially, if there´re high-risk family factors related to presence of significant symptomatic alterations, related with "type-autism" variable (see Table 1). Secondly, also, participants age when this diagnostic process is carried out: "diagnosis" constitutes basic axis of the 2 function of discriminant analysis, which allows deduce that effectiveness of this protocol correlates with the age at diagnostic process is carried out and, also, extent, also, with age of diagnosed people: "age" (see Table 5).

Likewise, early detection of diagnostic process makes possible establish the intervention measures more adjusted to particular perceptual-cognitive processes of people with ASD, who, in situations of absence of specific diagnosis and, mainly, of a misdiagnosis, may lead to measures of support or reinforcement contradictory with shape of information processing of people with ASD. Particular procedural functioning of coding and memory system of these people require a specific adaptation of differential socio-educational and clinical action method regarding others diagnoses, e.g., related to lexical difficulties, emotional disturbances, attention deficits and hyperactivity or other symptoms, which initially can be confused if there´s no clearly specific diagnosis of ASD disorder.

DISCUSSION

According this research results, the US Department of Health and Human Services, Interagency Autism Coordinating Committee; National Institute of Mental Health (NIMH) (DHHS/NIH), Office of Autism Research Coordination (OARC)- (2017) confirm, throughout different studies, that fundamental causes of ASD are genetic type, however, the presence of single genetic variations doesn´t seem sufficient to cause ASD disorder, therefore, posterior researchs refer to variations over gene/s and its modifications associated as responsables of ASD highest risk. Studies conclude that genetic variations can lead to alteration of DNA methylation, which constitutes a type of genetic modification that can change the gene expression without altering the DNA sequence. These variations, called methylation, can indirectly affect the expression of one or more highest risk genes regarding this disorder.

For this reason, the researchers scope that, along different studies, show empirical conclusions regarding karyotype analysis that provide clarification on specific etiology is essential.

Napoli et al. (2018), likewise, conduct a study with 133 children with ASD phenotype by means of comparative genomic hybridization analysis, whose results show that 12 children have variants of causal genetic copies number associated with the disorder susceptibility, 29 children had non-causal variants and 92 didn´t present. This data indicate the analysis documented that none participant was affected by Fragile X, 41 tested positive for genetic copy variations, 33 showed only 1 variation, 7 showed 2 and only one participant showed 3 or more; in one participant 50 desequilibrium were detected with 19 deletions and 31 duplications, hence for 26 desequilibrium was possible verify the parents inherited origin, 11 by maternal and 8 by paternal via, while 7 new emerged. Two duplications involved chromosomes 4 and 15, regarding 4p16.3p15.1 gene and 15q11.2q13.1 gene, which emerged new and were classified as pathogenic in 4%, ten showed 6 duplications and 4 deletions, were potentially causal and 38 presented 23 duplicacoines and 15 deletions, that were considered potential in 76%.

Rubenstein et al. (2019) replicate these studies through analysis of sample of 707 people with ASD and conclude the infant phenotype in autism is related to broader phenotypic forms derived from multiple developmental measures. In this investigation find that phenotype existing, at least, regarding one of their parents and seems associated with greater probability the child present a symptomatology related this disorder.

Demily et al. (2018) find that duplication of 22q11.2 gene is variant of penetrating copy number associated with a broad spectrum of clinical manifestations that include ASD and epilepsy and report over presence of pathogenic genetic mutations "HUWE1" and "KIF1A" in two ASD participants with duplication of the 22q11.2 gene, which leads conclude to recommend an urgent action protocol in families that carry this pathogenic mutation.

Artemios et al. (2019) associate the ASD clinical characteristics with presence of Myhre syndrome, which constitutes a connective tissue disorder with multisitemic involvement, which decisively influences over information transmission, requiring greater deepening this research pathway.

STUDY LIMITATIONS

Indeed, a greater depth is needed to investigate the relationship of responsibles genes of ASD diagnosis, as well as increasae the surveys number obtained, which was slightly lower to purposes of this study.

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ANNEX 1

ETIOLOGICAL STUDY OF AUTISTIC SPECTRUM DISORDER (ASD)

1. DIAGNOSIS TYPE *

( ) ASD 1

( ) ASD 2

( ) ASD 3

( ) Anothers:

2. CURRENT AGE OF DIAGNOSED PEOPLE *

3. AGE WHEN DIAGNOSTIC PROCESS HAS BEEN CARRIED OUT SEXO DE LA PERSONA CON DIAGNÓSTICO DEL TEA *

4. SEX

( ) MAN

( ) WOMAN

5. LOCATION (indicate location):

6. DIAGNOSTIC CENTER *

( ) EDUCATIONAL SERVICE

( ) MEDICAL SERVICE

( ) SOCIAL SERVICE

( ) ASSOCIATION/ FEDERARATION SERVICE

( ) Another:

7. WAS A GENETIC ANALYSIS REALIZED DURING THE DIAGNOSIS PROCESS: KARYOTYPE ANALYSIS?*

( ) YES

( ) NO

( ) Another:

- **IF AFFIRMATIVE, KARYOTYPE STUDY INDICATES THE PRESENCE OF GENE?**

( ) YES

( ) NO

( ) Another:

- **IF AFFIRMATIVE, WRITE NAME OF RESPONSIBLE GEN / GENES:**

- **OTHERS CONSIDERATIONS INDICATED IN KARYOTYPE ANALYSIS:**

8. IN DIAGNOSTIC PROCESS, ARE VARIOUS CAUSES INDICATED?

( ) ENVIRONMENTAL CAUSES ( ) PSYCHOLOGICAL CAUSES ( ) EDUCATIONAL CAUSES
( ) OTHER CAUSES ( ) NO INDICATED

- **IF AFFIRMATIVE, WRITE BRIEFLY:**

9. FAMILY BACKGROUND: PRESENCE OF AUTISTIC DISORDER:
( ) FATHER/ MATHER ( ) BROTHER ( ) GRANDFATHER/ GRANDMOTHER
( ) UNCLE/COUSIN ( ) OTHERS ( ) NO INDICATED

- **IF AFFIRMATIVE, INDICATE AUTISM TYPE:**

10. FAMILY BACKGROUND: PRESENCE OF NEUROLOGICAL-ORGANIC DISORDER
( ) FATHER/ MATHER ( ) BROTHER ( ) GRANDFATHER/ GRANDMOTHER
( ) UNCLE/COUSIN ( ) OTHERS ( ) NO INDICATED

- **IF AFFIRMATIVE, INDICATE DISORDER TYPE:**

11. FAMILY BACKGROUND: PRESENCE OF SCHIZOID DISORDER
( ) FATHER/ MATHER ( ) BROTHER ( ) GRANDFATHER/ GRANDMOTHER
 ( ) UNCLE/COUSIN ( )OTHERS ( )NO INDICATED

- **IF AFFIRMATIVE, INDICATE SCHIZOID TYPE:**

12. FAMILY BACKGROUND: PRESENCE OF DEPRESSIVE TYPE:
( ) FATHER/ MATHER ( ) BROTHER ( ) GRANDFATHER/ GRANDMOTHER
 ( ) UNCLE/COUSIN ( ) OTHERS ( ) NO INDICATED

13. FAMILY BACKGROUND: PRESENCE OF ANXIETY- EMOTIONAL DISTURBANCE:

( ) FATHER/ MATHER ( ) BROTHER ( ) GRANDFATHER/ GRANDMOTHER
( ) UNCLE/COUSIN ( ) OTHERS ( ) NO INDICATED

- **IF AFFIRMATIVE, INDICATE EMOTIONAL DISTRUBANCE TYPE:**

*Answer is obligatory.

THANK YOU FOR YOUR COOPERATION

University Solidarity Management: Weaving Possibilities on Decolonial Terrain

Fabiana Pinto de Almeida Bizarria

e-mail – bianapsq@hotmail.com

Doutora em Administração

Faculdade Luciano Feijão

Universidade da Integração Internacional da Lusfonia Afro-Brasileira

Mônica Mota Tassigny

e-mail - monica.tass@gmail.com

Doutora em Educação

Universidade de Fortaleza

Flávia Lorenne Barbosa

e-mail - flsbarbosa@hotmail.com

Doutora em Administração

Universidade Federal do Piauí

Abstract

In the perspective of discussing a university management proposal that places an alternative epistemological conception and understands the multidimensionality of human beings and social systems (as a critique of economic instrumentality) and the multidimensionality of the educational phenomenon, this article presents a theoretical synthesis, an essay of idea, in the sense of proposing a model of solidarity management, in the perspective of its dimensions (Cosmopolitan Rationality; Multidimensional Model of Administration Management; Intercultural Translation). The solidary management of the university centralizes the debate on interculturalityfrom the perspective of emancipation, while activating the reflective process on how to strategically operationalize actions that are guided by an integrative rationality and coordinate the dimensions of the educational phenomenon, in this case: culture, politics, pedagogy and economics. It is in the scope of a democratization of knowledge that this management advances from the "societal" management, as it comprehends a perspective on participation that qualifies the knowledge and practices of social agents in building proposals as credible, and the social organization should focus its efforts and trigger the experiences of the subjects so that the intercultural translation process incorporates comprehensive and purposeful practices within symbolic interactions.

Keywords: Societal Management. Epistemologies of the South. Substantive Rationality. Academic Dependency.

Introduction

In the Brazilian context, as well as in the other countries considered peripheral, the models disseminated in the European and Yankee realities entered the constitution of universities (Duarte et al., 2012), perpetuating the logic of migration from the countries of the North to the nations of the South (Ghilherme & Santamaria, 2015). This export diffuses specific conceptions of these models in the way of thinking about higher education in peripheral countries, which is reflected in the policies adopted (Sander, 2007a, Sander, 2007b). In addition, it reflects natural contradictions in adherence to imported models, distant from the contextual reality of the recipient countries, which also deepens a type of dependency, the academic one (Beigel, 2014a, Beigel, 2014b, Beigel, 2016).

It is understood that, the new moment expands the attention of peripheral cultures, seeks to expand the history of the world and calls for intercultural and symmetrical dialogue between thinkers from the south (Dussel, 2016), given that there are other options to make sense of history (society, economy, political organization, international relations, etc.) when projects that assume the decoloniality of knowledge are assumed (Mignolo, 2014), a more complex ethnography that makes emerging epistemic options tangible (Meneses, 2008). With the post-colonialist panorama, it is argued in favor of a transition paradigm, in the proposal of an epistemic "decolonization" (Mignolo, 2017).

With regard to university management, alternative discourses take into account the fact that organizational studies still resonate with colonialist elaborations, thus requiring their reinvention supported by new bases (Justen, 2013). Certainly, in the defense that university management represents a specific field of study and intervention in organizational theory (Sander, 2007b), it is argued that universities have typical characteristics that differentiate them from other social organizations (Solino, 1996). As a result, it is vulnerable to sustain itself in performance standards of the competitive-market context, which makes it closer to the business model, supported by the profit perspective (Amarante, Crubellate & Meyer Jr., 2017) and to distance itself from its social relevance (Spatti, Serafim & Dias, 2016), impairing the observance of criteria of historical, political and sociocultural relevance of the knowledge produced (Miranda & Costa, 2014, Weber, 2015).

In contrast, Santos (1989a, 2010) debates on crises of legitimacy, institutionality and hegemony, contextualized by virtue of the competitive logic that underpins the corporate and market models. In addition to these crises, social and political challenges are added, reflecting in the discussion of the need for new management models, aligned to resistance, to overcoming the liberal idea (SANDER, 2007b). Reading Almeida Filho (2007, p. 191), it appears that discussing corporate logic within the scope of university management is the main dilemma to be faced by the university system in the 21st century. At the same time, the author gives clues in relation to overcoming proposals , by assuming the idea "[...] Habermasian communities ideas of dialogue [...] resulting from sharing and true Exchange" (Almeida Filho, 2007, p. 191).

Thus, the crisis-changes have gained even more momentum when university management expresses itself as "[...] an integral part of a broader process of growth and organizational development, whose direction seeks to find or find, continuously, its point of view. stability" (Colossi, 2015, p. 81). And, on the change side, university management, in adherence to its social relevance, has as its horizon the idea of

renewal, expressed by Almeida Filho (2007, p. 192), when he expresses that the academy needs to advance beyond moral development, cultural and economic, to achieve true sustainable social development "[...] through realistic proposals and concrete actions firmly committed to peace, equity and social justice".

Under the conception of modern science and, due to its instrumental aspect regarding the rationality that operates in the sense of social organization (Ramos, 1989), the reading of innovation in the educational field "[...] follows the logic between cost and the benefit [...] as its correlate of carelessness and destruction" (Messina, 2001, p. 227). With that, Messina (2001, p. 227) contrasts what idea you can have with innovation, as it can "[…] make it possible for subjects and institutions to be more self-owned, but full and autonomous in their way of being, doing, think or, on the contrary, submits them to a unique logic, accepted as natural". Part of this opposition is in the defense that the educational field should not be regulated by the market logic and that the management of this system should be inspired by other administrative readings .

In this aspect, even if innovation in its conceptualization in the context of an instrumental rationality, its conduct must be relativized when it incorporates another logic of rationality, particularly that which focuses on thinking and acting within the scope of ethics and cultural diversity. It is argued, then, in favor of a university management that places an alternative epistemological conception and understands the multidimensionality of human beings and social systems (as a critique of economic instrumentality) and the multidimensionality of the educational phenomenon.

In this context, the article aims to discuss the model of solidarity management, from the perspective of its dimensions (Cosmopolitan Rationality; Multidimensional Model of Administration Management; Intercultural Translation). Considering that the defense that this management can assume elements of coping with the three crises of the university (hegemony, legitimacy and institutionality) and, specifically, it aims to define alternative discourses (southern epistemologies, society and multidimensional management) as insights for the conception of three dimensions to the exercise of solidarity management: Cosmopolitan Substantial Rationality, which recognizes the person in his multidimensional (Ramos, 1989) and plural (Almeida Filho, 2007, Santos, 2002, Santos 2007b) condition, the Multidimensional Model of Education Administration and Intercultural Translation, which guide the search for quality of collective life, through intercultural relevance, political effectiveness, educational effectiveness and economic efficiency, as performance criteria in line with the mediation to be developed through intercultural translation .

2 From university crises to necessary changes

As a reflection of social movements around the world in 1968 and, the manifest questions about the hierarchies of knowledge and power expressed within university life (Wainwright, 1998), Santos (1989a, 2010) theorizes about the existence of crises in the university (hegemony, legitimacy and institutionality), associating them with challenges to modern science in the context of the expansion of society that is affirmed under economic regulation .

The hegemony crisis has as its genesis what inspired the 1968 revolt, in this case, the formation for high culture, supported by theories, in tension with the demands for popular culture, attentive to the instrumental practices necessary to work in the capital system. The 1968 movement also illustrates the

crisis of legitimacy, while the explosion of the academic population brought up the discussion about the role of the university in society, in the face of a formation that no longer met social concerns (Santos, 1989a, Santos, 1989b, 2010). The expansion of access, in these terms, responds to the idea of massification, required by the capital production itself (Pina, 2017), which illustrates the statement that the academy when not performing its social function (meeting social demands - market), it is no longer legitimated as the only higher education social institution (Ésther, 2011).

The institutional crisis, in turn, reflects the erosion of hegemony and university legitimacy, becoming more visible in the last 20 years (Santos Filho, 2015). In this crisis, institutional responses are no longer able to manage the conflicts of contradictory social demands, evidenced both in the appeal to the university's social responsibility - in attention to social problems aggravated as a result of environmental, social and economic degradation - as well as in the role of the institution in production scientific and technological capable of facing the progressive deterioration of social policies under the welfare state crisis and providing economic and social development.

With the prerogative of the participation of companies in higher education, there is the conformation of performance criteria increasingly closer to the competitive logic, (effectiveness, performance and productivity) (Santos, 1989a; 2010), obscuring academic autonomy due to neoliberal pressures (Wanderley, 2002). The institutional crisis, therefore, returns to address the problem of economic centrality, then from the perspective of university management, within the scope of institutional responses and their consequences for society.

With the crises of hegemony, legitimacy and institutionality, it becomes ambiguous "to whom" and "what" higher education is for. Responding to these inquiries under the understanding of the market, Santos Filho (2015, p. 225) understands that "[...] the university allowed itself to be functionalized by the demands of capitalist development and defrauded the expectations of social promotion of the working classes through means of false democratization". In this way, crises are aligned as problems of a society from a competitive perspective, including social responses that aim to minimize conflicts over access to higher education, but that result in a democratization not extended to concrete social changes.

The reading of Santos (1989a, 2010) stems from the fact that contradictory functions, demands and responses reveal the list of challenges facing universities for the 21st century. In the context of crises, the economic / instrumental and social / symbolic duality is critical based on a model of society that demands employability and, at the same time, calls on the academy to reflect social values to be fundamental in the conduction of alternative projects. In this horizon, Santos (1989a, 2010) considers it urgent to face crises and options that show weight on the social role of university knowledge, when different knowledge and practices are aligned with demands to solve social problems.

The coping strategies, in the idea of Santos (1989a, 2010), meet a counter-hegemonic attitude, in adherence to the proposal of "pluriversity", when the university space is revised through respect for the plurality of the human being. With this, it defends the democratization not only of access to higher education, but also of the knowledge produced, emphasizing the diversity of knowledge, the narrowing between theory and practice and the contextualization of investigations. Ecology, then, reinforces the idea that the relationship between diverse knowledge and its agents must be constructive, riddled with sustainable and dynamic interactions, without compromising the autonomy of each one of them (Santos,

2007a). It is understood, therefore, the harmony of the ecology of knowledge with the valorization of plurality (difference and diversity), the incentive for distinction (the creative potency of each subject) and the reduction of inequality (greater promotion of equity).

3 Methodology

A synthetic proposal, in this research, concerns the idea of an outline to be deepened by experience, dialogue, criticism, refutation. Therefore, an outline is proposed, as the way of "[...] if not the outline of a theory, at least some intuitions that give it originality and creativity" (Bertero, 2011, p. 342), as says Freire (1996, p. 25), the result of an "[...] epistemological curiosity". A new approach is required, an essay of ideas, conceptions and theories (Meneghetti; 2011), driven by uneasiness and desire to overcome theoretical-empirical problems insoluble by the theories given, institutionalized conceptions. A synthesis proposal, too, represents an "[...] invitation to go ahead in the production of knowledge, a stimulus to the reading of other works and to the expanded observation of concrete phenomena" (Cattani, 2003, p. 14).

Three theoretical sets make up the referential framework of the research (Figure 1). Each of them is discussed in the perspective of the crisis of hegemony, legitimacy and institutionality. Although theories are complex, Becker's recommendation (1997, p. 127) follows, regarding the fact that the "[...] model provides answers to the theoretical questions of the study and demonstrates the contribution of each part of the structure analyzed to explain the phenomenon".

Figure 1 - Theoretical design of the research
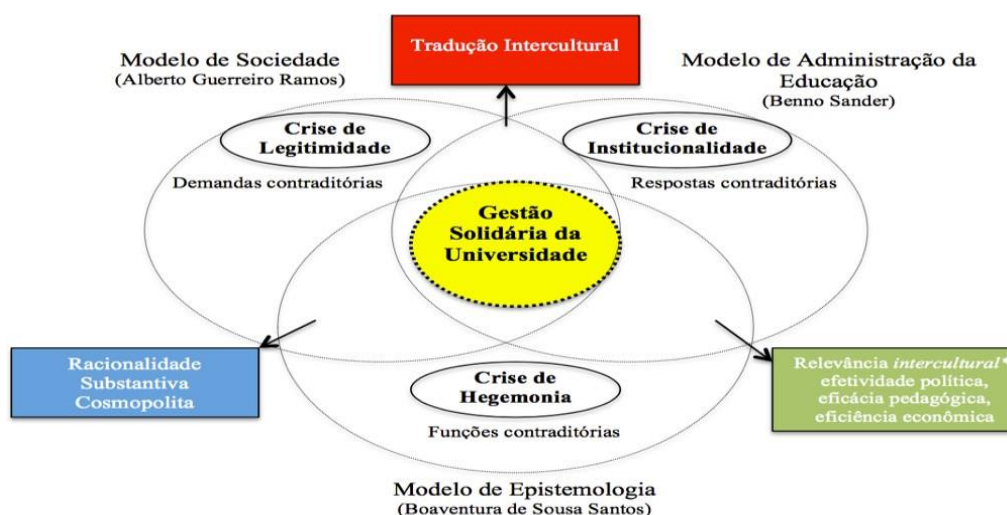
Source: Prepared by the authors (2017).
Note: * "Intercultural relevance" is spelled in place of the diction "cultural relevance", which appears in the multidimensional model of education administration .

Three readings are derived from these discussions and support the elaboration of a theoretical synthesis (solidary management), in this case, the cosmopolitan substantive reason, the intercultural translation and the education management harment model (intercultural relevance, political effectiveness, pedagogical effectiveness and economic efficiency). Therefore, the assumptions of this research are the

statement that: 1- solidary management constitutes the administration model capable of facing the crises of hegemony, legitimacy and institutionality of the university; 2- in the face of the crisis of legitimacy, solidary management considers the multidimensionality of the person and social systems (multidimensional society); and 3- in the face of the crisis of hegemony, solidarity management considers the plurality of the human person (Epistemologies of the South).

5 Solidary management: outline of a synthesis

In order to enter into this discussion as the intention of synthesizing a university management project, it is necessary to understand the Southern Epistemologies project and the multidimensional model of education administration.

5.1 Overcoming hegemony in the perspective of the southern epistemologies Project

The university's hegemony crisis shows that the epistemological conception, the mainstay of modern science, leads to problematic results in relation to the quality of life of people and social groups. Considering it as an ideation of knowledge structured around a capitalist production system, epistemology in terms of modern science neglects human plurality (Santos, 2010). With that, this topic deepens the discussion, by outlining the Southern Epistemologies Project as an alternative proposal, this being a reference to support a new idea of knowledge in consideration of differences, diversity, and social practices. Such a project, therefore, suggests insights into the hegemony crisis and offers elements for overcoming it.

Initially, the emerging discourse on the epistemological field in the social sciences inserts cultural disputes and counter-hegemonic battles with a focus on emancipation, independence, autonomy and liberation (Giurleo, 2014). Boaventura de Sousa Santos is a reference in this field, as he demarcates a critical-emancipatory proposal from the perspective of reinventing social emancipation (Bonet, 2010). The Epistemologies of the South Project is the result of the author's trajectory who, since 1960, has made academically transgressive efforts, when many of his theoretical proposals take on modalities of action strategies (Bonet, 2010), in the possibility of unraveling the domination frames of Western modernity (Salatino, 2014).

With regard to the historicity of epistemology, it is understood that the epistemological reflection around the issue of the coloniality of power, knowledge and being emerges (Dussel, 2016, Lander, 2005, Mignolo, 2017, QUIJANO, 2009), in perspective incontesting the epistemic patterns raised under a selective rationality to the orbit of knowledge that implies the negation of what does not converge to the values of western modernity (Mignolo, 2017). Colonialism, in this case, naturalized differences between north and south, modern science of non-science (invalid knowledge) and justified domination, which implied the deliberate destruction of the knowledge and culture of peoples, others, non-civilized people. These are responsible for clarification, knowledge of the First World. At this point, Santos (2016) highlights what constituted itself as an " epistemicide ": the destruction of knowledge, subjectivities, cultures of subjects subject to domination; a universal project, to homogenize the world, opposing and reducing the epistemological diversity of the world (Santos & Meneses, 2009).

In any case, the concept of "Epistemologies of the South" questions Eurocentrism , not only from a geographical perspective (from a "knowledge" that is done outside Europe). Post- coloniality , in turn, centralizes criticisms of modern rationality and its implications for the denial of the diversity of knowledge (Meneses, 2008). The new moment expands the attention of peripheral cultures, seeks to expand the history of the world and calls for intercultural and symmetrical dialogue between thinkers from the south (Dussel, 2016), given that there are other options to make sense of history (society, economy, political organization, international relations, etc.) when projects that assume the decoloniality of knowledge are assumed (Mignolo, 2017), a more complex ethnography that makes emerging epistemic options tangible (MENESES, 2008). Underlining this challenge is the recognition of the exhaustion of the intellectual and political model that has sought to impose itself as global in recent centuries (Márquez-Fernández, 2012, Meneses, 2013).

With the post-colonialist panorama, it is argued in favor of a transition paradigm, in the proposal of an epistemic "decolonization " (Mignolo, 2017). In announcing the idea of paradigmatic transition, Santos (1989b, 1999a) distinguishes two types of knowledge crisis experienced at the end of the 20th century: those of growth, alluding to Thomas Kuhn and Jean Piaget, who dramatize the autonomy of scientific knowledge in in relation to other knowledge modalities and practices; and the degeneracy crisis, spread after the Second World War, which implies a paradigm crisis, considering scientific knowledge as a practice of knowledge, among others and, not necessarily, the best. Within the scope of social systems and, still, as a reflection of the crisis of degeneration, the paradigmatic transition announced by Santos (1999a, 2007b) places two paths in the social sciences: social regulation (structural-functionalist) and emancipation. The first, based on a totalizing idea, foresees the knowledge of order about chaos (knowledge-regulation). The second incorporates knowledge based on an ecology, when knowledge, considered in its multiplicity, shares for solidarity (knowledge-emancipation).

As a path to emancipation, Santos (2002) defines the recognition of the other as an agent of relevant social practices based on solidary reason, in the perspective of overcoming the colonial logic based on hegemonic knowledge. Knowledge-emancipation, in this case, assumes the ecology of knowledge as an epistemological change, considering modern scientific knowledge as necessary and important, but calls for other knowledge for a dialogue that enhances sustainable and dynamic interactions of social agents (Santos, 2007a, 2007b).

Because it originates from the principle that the world is epistemologically diverse, defined by the search for a horizontal dialogue, the ecology of knowledge brings unintelligible (by modern discourse) social experiences and practices into intelligible (by ecological discourse) (Santos, 2007a, 2007b). With this, it becomes possible to establish futures through a political act, which converges scientific analysis with utopian thinking, considering that alternatives are considered based on people's creativity in overcoming their social problems (Santos, 1999a, 1999b).

In line with the idea that a new epistemology must be pragmatic and realistic, supported by hermeneutics, the ecology of knowledge is configured as an essential dialogic exercise for the Epistemologies of the South project. Thus, this idea is faced with the following demand:) how to promote dialogue between social agents that have different cultural, social and political bases? The idea of intercultural translation seeks to answer this question.

The innovative step in intercultural translation comes from the need to establish emancipation with a mainstay in a new relationship between respect for equality and the principle of the recognition of difference, and, through modern thinking, the principle of equality is discussed, not that of difference. (Santos, 2007b). In this sense, intercultural translation acts as "[...] epistemological support for emancipatory practices" (Santos, 2002, p. 206). In this sense, through intercultural translation, it is possible to make understandable knowledge and practices silenced by modern logic. Thus, there is talk of transposing the abyssal logic, in the idea that the knowledge and practices of the north (in the perspective of modern science) and those of the south can dialogue and produce other knowledge, which are closer to the concrete demands of the people involved in this production (Santos, Araújo & Baumgarten, 2016).

Indeed, the Epistemologies of the South project represents a set of propositions articulated to confront coloniality, in the proposal of a method, transgressive sociologies (absences and emergencies), which symbolically expand knowledge and practices and constitute futures supported by real options (Escobar, 2016). The project reflects a post-colonialist thinking and, therefore, its conduct needs to cultivate a "decolonial" sociological imagination (Savransky, 2017), in the perspective of recognizing that there is no cognitive justice without existential justice and this is marked by the constitution of possible futures with preservation of the intellectual heritage of the peoples of the "Global South" (Tilley, 2017).

5.2 Overcoming legitimacy from the perspective of the multidimensional model of society

With this topic, a theoretical possibility of addressing the university's legitimacy crisis is expressed, with discussion that instigates not only its overcoming, but also advances to an idea about university management capable of providing new horizons for academic training and society. Thus, the multicentric (or multidimensional) project of society calls for the meaning of biological existence and survival in adherence to the idea of the future, which, perceptible by ethical action, focuses on sustainable efforts, based on solidarity and participation (Ramos, 1989; Santos, 2002, Santos 2007a, Santos 2007b).

The project is formulated based on the delimitation of social systems, whose idea invokes the need for the existence of multiple types of systems, transforming the formal economic organization into a restricted and incidental enclave in the human living space (Ramos, 1989). The limits of each system and its internal requirements (law of adequate requirements) , in the sense of Ramos (1989), must reinforce the objectives of each system, respecting the diversity of its activities, the needs of its entities and the delimitation of each social space .

The requirements for resource allocation and the optimization of transactions between these systems are defined in terms of the regulation of social systems, supported by the paraeconomic paradigm (Azevedo & Albernaz, 2015). In this way, Ramos (1989) defends a "[...] substantive political theory of allocation and relationships between social enclaves, necessary for the qualitative stimulation of social life." (FARIA, 2009, p. 432). With the paradigm, Ramos (1989) reports on the creation and distribution of wealth, paying attention to the enjoyment of coexistence between human beings, to the adequate requirements of each social system, and to social and ecological externalities. For this reason, it thinks in terms of economic efficiency, without sacrificing the requirements of equality and equity, and, in this case, it is in line with the concept that "the social and economical healthy coexistence of the principles of competition and cooperation is" (Lisboa, 2003, p. 249).

The paradigm under analysis reveals the new science's commitment to social and environmental problems, placing them as a problem of the capitalist social system, but seeks, through the creative-pragmatic way, to formulate a set of concepts-prescriptions in order to enable the social scientist and the social agent in the exercise of overcoming such issues. Thus, the multidimensional model of society, based on the paraeconomic paradigm, is based on the premise that people are multidimensional and, therefore, need social systems capable of giving way to updating human beings in symbolic social interactions. Within these relationships, Ramos (1989) conceives of the possibility of the human being acting according to a substantive rationality, when he raises consideration about the plurality of the human being and his political exercise in the face of engagement with social transformation in the course of what defines as good society. In relation to organizations, this idea of reason is still obscured, whereas the mainstream of rationality and organizational intelligibility still shows the economic parameter (Justen, 2013), admitted as inherent to instrumental rationality, to the economic man, to the marketing logic (Ramos, 1989).

In the same way, Santos (2002, 2007a) undertakes an alternative conception of rationality. Cosmopolitan reason, being raised on criticism of indolent reason, is expressed as the possibility of symbolic expansion underlying new modalities of understanding and transformation of the world. In this reading, the idea of a reason emerges from a "decolonial" project , in the face of the recognition of historical violence directed at subjects inserted in the historical plot of the colonial world. With the idea of cosmopolitanism, therefore, substantive reason, adhering to the political consideration of a critical-reflective agent of social transformation, is directed to changes in the context of confronting coloniality . In line with substantive rationality (Ramos, 1989), cosmopolitan rationality (Santos, 2002, 2007a) places the importance of symbolic interaction at the same time that it resorts to the idea that it is in the dialog that the flow of experiences is possible before the intercultural translation that, in addition to referring to "decolonial" projects, highlights the establishment of social actions conducive to the realization of man and his multidimensional nature, his material and symbolic condition. In these terms, the constitution of social spaces conducive to symbolic interaction is emphasized , which, in the organizational panorama, is evident in the search to provide mediation, participation, consensus and adhesion in interculturally relevant strategies , as dimensioned by Sander (2007b).

Thus, it must be recognized that symbolic interaction is an argument to bring substantive Reason closer to cosmopolitan Reason. From this, the sense of substantive cosmopolitan reason derives, which situates the multidimensional being, endowed with rationality, which enables him to act ethically as a social agent engaged with social transformation; and the plural being, which characterizes its uniqueness and the diversity of its social group. For him, symbolic interactions are essential for the free expression of his potentialities and, in favorable social spaces, encouragement for the expression of experiences for the constitution of social and administrative actions relevant to solidarity, to emancipation. Thus, "[...] it is possible to create a transformative rationality [...] a new thinking based on the emancipation of man". (Mozzato & Grzybovski, 2013, p. 512-513).

5.3 Overcoming institutionality from the perspective of the multidimensional model of education administration

The multidimensionality in education imposes a new theoretical and methodological treatment for management, starting from non-reductionist and fragmented conceptions of reality. Thus, as a synthesis, there is a simultaneous vision of the multiple dimensions in the search for actions that guarantee attention to relevance, effectiveness, efficiency and effectiveness, with emphasis on the idea that the substantive dimension (political and cultural) needs to regulate the instrumental dimension (economic and pedagogical) (Sander, 2007b) .

In relation to instrumental issues, the economic dimension of the educational institution involves aspects "[...] financial and material, structural, bureaucratic norms and coordination and communication mechanisms" (Sander, 2007b, p. 96). Thus, the dimension is related to an external instrumental performance, under the economic logic, before the ability to manage financial resources to obtain maximum productivity. The pedagogical content involves the principles, panoramas and educational techniques related to the achievement of educational objectives, which range from the teaching visions to the methodologies adopted, thus being what guarantees the specificity of educational management (Sander, 1995, Sander, 2007b). With an emphasis on this dimension, an internal instrumental performance is carried out, based on the coordination, creation and use of criteria, methods and spaces to meet the objectives of education, guided by parameters of effectiveness, to achieve objectives of a pedagogical nature (Sander, 2007b).

The political dimension, in turn, places strategic actions in the political context, with an emphasis on social responsibility that they must emphasize (Sander, 1995, Sander, 2007b). Within this scope, the educational institution is called upon to consider the internal demands of an economic and pedagogical nature, with those of the external order. The dimension, therefore, is characterized by the search for effectiveness, based on a substantive external performance, given that it seeks to achieve objectives demanded by members external to the institution (Sander, 1995, Sander, 2007b). The cultural dimension, finally, relates values, beliefs and attitudes of various orders (philosophical, anthropological, biopsychic and social) of the participants of the educational system, as well as of the community (Sander, 1995, 2007b). It is considered an intrinsic dimension, because its emphasis is on relevance for all those considering the ethical values they aspire to in the socio-cultural context.

In the convergence of the four dimensions of the multidimensional paradigm of education administration, two aspects highlighted by Sander (1984, 1995) place it within the scope of democratic management, in this case, mediation (political and administrative) and collective participation. The first expresses the fulfillment of the role of the administration, in view of the function of equating the demands and the dimensions, between the confluences and contradictions that characterize the educational phenomena within the society; the second involves the necessary basis for politically meaningful and culturally relevant management. It is in this sense that it is recognized the importance of the academic community (including its internal and external members) to convey the meaning of educational actions to improve their concrete realities (Sander, 1995).

In Sander's understanding (1984, 1995, 2007b), mediation and participation are the main functions of educational management, considering it inserted in global realities, constituted by dialectically articulated dimensions, with sometimes opposite, sometimes complementary emphases. In the exercise of mediating and participatory management, the ordering of the criteria for administrative performance within

the scope of the four dimensions is effective in view of the commitment to the consequences of administrative actions for human and social development, qualitatively. It is, therefore, in the managerial sphere, combined mediation and participation, that a new status can be instituted to the institutionality of the University. In this course, however, it is necessary to analyze in which perspective this mediation and this participation, given the complexity of organizational phenomena in the university context, can carry out plural dialogues, based on the commitment to the human being in his multidimensional condition .

With the proposal of multidimensional management of education, by Sander (1984, 1990, 1995, 2007b), it is argued that the university can manage its dimensions in order to equate the economic, pedagogical, political and cultural criteria in a way that the substantive aspects may prevail over instruments, based on the concept of collective human quality of life, based on the ethical values of freedom and equity. With this, this management can provide answers to the institutional crisis supported by the search for overcoming conflicts through a holistic approach to organizational phenomena. Regarding the idea Sander (1984, 1990, 1995, 2007b) also being attentive to the interculturality in the university (Cortés, Dietz & Zuany, 2016, Romero et al, 2016), debates on a university "decolonial" (Reyes, 2013), in response to the promises of progress propagated as necessary for development (Mignolo, 2017). In this regard, it is believed that the approach to university management based on the multidimensional model needs to consider the intercultural dimension, even in the context of expanding the internationalization of higher education in recent years (Santos & Almeida Filho, 2012).

Within the university, interculturality places the plurality of human beings, in relation to their differences and to the social diversity in which they participate (Almeida Filho, 2007). The recognition of the other that Santos (2002, 2007b) proposes, when affirming the idea of knowledge-solidarity, makes attention to interculturality central in an alternative project, when management prioritizes the exercise of intercultural translation. Indeed, it is understood that living with diversity represents an important challenge in view of the prospect of building a more just world (Lisboa, 2003).

5.5 Solidary management of the university

Preliminarily, accused by the reading that Bizarria and Tassigny (2017) make of Ramos (1983), through their analytical model of administrative strategy (purpose, active agent, strategic factors, objective possibilities, consensus), university management, now proposed, it requires instruments of an administrative model aligned with its function of social organization reflected by the solidarity bias, as an innovative model synthesized in this research.

First, it can be inferred that the "purpose" of solidary management reflects the notion that its relationship with society makes it seek quality of life for its members. With this, knowledge-solidarity influences the type of knowledge elaboration that should emphasize, or at least enhance, as, for example, the formation of expertise in the scope of solidarity economy and social technologies. With the idea of solidary management, this would not be knowledge peripheral to the main currents of academic science, but it would be the axis for which the university's political-pedagogical projects would be organized .

The "active agent (s)" of this process, when deliberating (on) actions capable of realizing knowledge-solidarity, assume (m) commitment to the Social Responsibility of University Knowledge (RSCU), as it defends Santos (2010), and not only with University Social Responsibility (RSU), while the

center of the subject is not in the social action that this institution does, but in the academic training it develops, it enables the subjects to reflect on various possibilities of income production, for example. These competences that lead to lasting social relevance, as they institutionalize, via knowledge, through the curricula, an alternative of " worldview", as stated by Alarcão (2001).

These actions also assume performance criteria, in this case, intercultural relevance, political effectiveness, pedagogical effectiveness and academic efficiency. These dimensions of the educational reality are both revealed as "strategic factors", when management manages to favor the prevalence of substantive issues over instrumental ones, as they derive from them "objective possibilities", when the manager considers, analyzes and seeks resolution to limits and challenges that the integrative approach of these dimensions produces.

Finally, the "consensus" that is sought strategically is based on the importance of adhering to the purpose, which is a reflection of the knowledge, understanding and identification that one has with the institutional mission. With the idea of consensus, intercultural translation is added, in the sense of providing symbolic interactions to the process of democratic participation. With these, the members of the organization are activated to the circumstance of strategic agents, at the same time that their knowledge and experiences are activated through dialogue and, with this, the resulting knowledge-solidarity is incorporated into the organizational practices. These points lead to referring to solidarity management as a strategic administration, assuming the RSCU as an assumption, as defends Santos (2010).

Given the strategic consistency of the innovative model and, from the perspectives of coping with crises, three dimensions of solidarity management are derived, in this case, the substantive cosmopolitan reason, intercultural translation and the education management model (intercultural relevance, political effectiveness, pedagogical effectiveness and economic efficiency) (Figure 2)

Figure 2 - The university's solidary management model

Source: Elaborated by the authors (2017), based on Santos (2002), Sander (2007b) and Ramos (1989).
Note: * "Intercultural relevance" is expressed by replacing the diction "cultural relevance" in the multidimensional model of education administration.

The first, substantive cosmopolitan reason, highlights the concept of human being in this project, in this case, multidimensional and plural, when social and cultural differences and diversity are recognized and considered in the strategic scope. This reason makes solidarity management raise the centrality of the consequences of the university's actions in relation to society. It is with this idea of reason that the importance of symbolic social interactions and human development in them is discussed, a point that is increasingly problematic due to the intensification of technologies of interaction and communication in daily life in social relations .

Regarding the dimensions of the educational reality, as described by Sander (1984, 1990, 1995, 2007b), solidarity management is carried out in line with the global and integrative conception of these dimensions. However, the second dimension, intercultural, is defined, replacing the cultural one, given that, due to the advancement of the democratization of higher education in the last decade, and also by the creation of institutions dedicated to internationalization (Santos & Almeida Filho, 2012). Intercultural translation settles the debate on mediation, participation, consensus and adherence in this context.

As a third dimension, it brings to the management the debate about the university's hegemony crisis and its confrontation through the epistemological path. Intercultural translation calls for the knowledge-solidarity that Santos (2016) sustains when exhibiting the Southern Epistemology project, at the same time that it argues that the coloniality of knowledge must be a concern that management must stick to.

For this purpose, the solidarity management approach still attaches particular importance to the active participation of the subjects involved, both in the university and in the community where it operates. It is in the sense of symbolic spaces and understanding strategies that Solidarity Management focuses on taking Ramos (1989) the understanding of symbolic interactions and Santos (2002) the intercultural translation in the sense of an ecology of knowledge. However, such participation is also emblematic of "Societal" Management, which prioritizes questioning about centralization and authoritarianism in the exercise of power in the public sphere (Paes de Paula, 2005).

In line with Solidarity Management, the "Societal" nature calls the active agent to the constitution of social life, but solidary knowledge informs that the activation of this human capacity is enhanced when there are spaces for intercultural translation, when in the interactions of social agents the dialogue between knowledge and practices is built up in search of solutions to the problems expressed in the particular context of citizens' lives in their material and symbolic existences. Thus, if, within the scope of "Societal" Management, "[...] it seeks to feed from different channels of participation and model new institutional designs to connect municipal, state and feral hopes" (Paes de Paula, 2005, p. 159), Solidarity Management focuses its efforts on understanding what Wainwright (1998) places as knowledge democratization, a policy of affirmative knowledge of an alternative vision that, invoking its social character, emphasizes that solutions to social problems can emerge before greater understanding of their actions through mutual understanding, thereby opening up "[...] possibilities for forms of social regulation and control that use practical knowledge and recognize their fallibility" (Wainwritht, 1998, p. 55).

It is in the sense that Wainwright (1998) grants democracy that Solidary Management is understood to be, intrinsically, democratic, considering the epistemological sense that it incorporates in the construction of knowledge that generates social transformation, validating the plurality of knowledge. It is in the way knowledge is approached that solidary management advances from " societal " management,

considering that participation is guaranteed when one understands a "[...] radical and participatory approach to democracy" (Wainwright, 1998 , p. 125), comprises the formulation of policies before the democratization of knowledge through the empowerment of agents with strategies capable of triggering their experiences described in social knowledge and practices.

Final considerations

As a synthetic proposal, the university's solidarity management approaches the way Justen (2013, p. 75) positions itself in relation to education, in this case, "[...] to be built on and by the interaction of man with his fellow men, the community and the environment, linking to a purpose [...] constituting a true instrument of emancipatory power". Therefore, it is clear that the solidary management of the university centralizes the debate on interculturality in the perspective of emancipation, while activating the reflective process on how to strategically operationalize actions that are guided by an integrative rationality and coordinate the dimensions of the educational phenomenon, case: culture, politics, pedagogy and economics. It is in the scope of a democratization of knowledge that this management advances from the "societal" management , as it comprehends a perspective on participation that qualifies the knowledge and practices of social agents in building proposals as credible, and the social organization must focus efforts and trigger the subjects' experiences so that the intercultural translation process incorporates comprehensive and purposeful practices within symbolic interactions.

In theoretical terms, it is not envisaged that solidary management, as designed in this research, can be conducted in analyzes in contexts foreign to higher education, particularly in the public context. This reading results from the theoretical background that, in an articulated way, derives from the raised proposal, being contextualized for the university field. Such limit/ possibility of research can favor with that the solidarity management, as it is taken in this research, is element of subsidy to other proposals of the management that have as horizon the solidarity, also for the same field. For what was raised, a given perspective is assumed, social emancipation, which makes it situate itself as a theory of critical management.

In the same way, this research does not have an instrumental perspective of integrated, reflected knowledge. There is a pragmatic epistemological reading that "[...] should give preference to forms of knowledge that guarantee the greater participation of the social groups involved in the conception, execution, control and enjoyment of the intervention" (Santos, 2007a, p. 29). It is in this sense that some possibilities for action are raised, suggestions that are shown only in the horizon of a solidary knowledge assumed as a purpose.

Finally, the clash between models, policies and theoretical conceptions involved reinforces the affirmation of the need to advance in the understanding of how to establish a university under a logic different from that which organizes current knowledge and practice. With this, it is understood that the few managers, not inculcating, are faced with the difficult task of organizing the new, but, in proposal, triggering that there is an individual and collective dimension of accountability that can expand the building of a university from a new perspective epistemological, when the university management, made by many, plays a key role.

Thinking about and producing a new university from this perspective comprises a broad involvement of action, with an important social influence, as it collaborates with a corporate organization guided by knowledge that generates different ways of being in the world, sociability arising from various ways of producing material and symbolic existence. Whether this amplitude will be experienced, derived, estimated, or even asleep by the cognitive political current that prevails before the capitalist logic, referenced in the academy by modern science, only history will confirm. The engagement in the present and the commitment to the future, however, can lead to ruptures, when human action is recognized as capable of giving new contours to this story in the face of the bet, the rebellion, the search for better living conditions in society .

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Socioeconomic Data Mining and Student Dropout: Analyzing a Higher Education Course in Brazil

Oldair Luiz Gonçalves

Dept. of Education, Federal Institute of Espírito Santo (IFES)

Espírito Santo, Brazil

Walber Antonio Ramos Beltrame

Dept. of Education, Federal Institute of Espírito Santo (IFES)

Espírito Santo, Brazil

Abstract

This paper aims to analyze the student dropout from a higher education course, in the city of Guarapari, Espírito Santo, Brazil, through the use of the computational tool known as data mining. The objective was to investigate the possible scenarios for the early identification of students with higher risk of dropping out by analyzing socioeconomic data from business school graduates between 2014 and 2018 with the use of information extracted from the academic system. The methodology used was the experimental research, from a quantitative approach through a comparative analysis of data resulting from the processing of computational algorithms. After the analysis, it was concluded that computational techniques can be used to help administrators to plan pedagogical and administrative actions and that the combination of socioeconomic data with school performance information, using the tool, can yield advantageous results, allowing the fight against evasion to be seen as an early and continuous practice.

Keywords: Academic System; Data Mining; Student Dropout.

1. Introduction

The topic of students' dropout in higher education has great relevance in the educational context, as it has a meaningful impact over the educational institutions and systems, being of extreme importance in the life path of students who choose to conclude or not an undergrad course. It is a phenomenon of complex nature, where many variables and factors interact. Due to its wide scope, this topic can be presented and interpreted through many different perspectives, allowing for a great variety of analysis. For this reason, it has been present in many different forms.

The research conducted over the topic of student dropout is relevant in the discussion of an educational institution's commitment to current and future issues which pertain to students' formation. It is observed that, in the period between the students' admission and graduation many interactions happen with the purpose of encouraging students to finish their course. On the other hand, the will to drop out of a course can also be cultivated in many ways.

The Brazilian Ministry of Education [6], through the Secretariat of Higher Education, created the

Special Commission of Studies on the Student Dropout in Brazilian Public Universities and identified three groups of factors of great relevance in higher education dropout rates. These are the external factors, with no relation to the educational institution, the internal factors, with direct relation to the educational institution and the individual factors, which are inherent to the students' life and background.

Some of the external factors observed are the job market related to the course, social recognition and depreciation of the chosen career, the economic situation, governmental policies and difficulties to keep updated with technological, economic and social contemporary changes. Meanwhile, some of the internal factors related to the educational institutions are academia inherent issues, such as lack of clarity in the chosen course's pedagogical project, low didactic and pedagogical levels, possible institutionalized culture of faculty under appreciation and a lacking support structure to higher education courses. Lastly, the individual factors, inherent to the students' life and background, can be related to personality, lack of developed study skills, previous schooling, early choice of profession, lack of information about the chosen course, difficulties due to multiple failings or poor attendance.

Therefore, studies on students' dropout comprehend a series of analysis, which regard economic, emotional, administrative and pedagogical activities [8], related to the academic community and based on institutional competences and evaluations. As a result, the definition of analytical parameters for scientific research are complex. Another factor that should be considered when analyzing dropout rates is the concept which is being used, since each institution and researcher has its favored approaches. Therefore, dropout rates can be analyzed based on the student leaving the course, the campus, the institution or the educational system altogether [8].

Aside from the previous definitions, it is also essential to note that the students' drop out can cause poorer productive efficiency in companies, motivate loss of national competitiveness and the lack of specialized workforce [22]. Furthermore, it impedes social change and the improvement of the individuals' quality of life [18], since the dropouts consider dropping out as the failure to reach previously set professional goals [5].

This research analyses the application of data mining techniques in the undergrad Business Administration major at Federal Institute of Espírito Santo (IFES), Guarapari campus. The analysis was conducted using data provided by the Academic Registry Coordination, taking into account students enrolled between 2014 and 2018, and aiming at the early identification of students with a tendency of dropping out.

Differently from what was observed on other similar papers, where the analyzed data related to scholarly performance through grades, this paper assumes the existence of other evaluation criteria, which can be used in computational techniques, such as the analysis of socioeconomic indicators. Therefore, it is estimated that the risk of a student dropping out could be calculated even before the beginning and in the early months of the school year, previously to teacher's first evaluations, increasing the preventative measures the Institute could take.

This paper is composed by the following sections: Chapter 2 presents the literature review on the subject of dropout rates, while Chapter 3 encompasses the contextualization of the study and a description of the collected data. Next, Chapter 4 brings the description of the algorithms applied in the data analysis, Chapter 5 brings forth the results obtained in the analysis and the subsequent discussion and, lastly, Chapter

6 presents the conclusion of the study and possible paths for future papers.

2. Literature Review

This chapter is divided in two main subsections. The first one presents the concepts of dropout rates in higher education, building the foundation for the paper's proposal and applied measuring criteria. Meanwhile, the second subsection contextualizes the computational tools used in the mining of educational data, which will be exemplified in the following chapters.

2.1 The student dropout

The study of student dropout rates in Brazilian public higher education is part of a discussion that takes into account the institutional commitment of a University with issues and problems of its time and the future perspective of its reality. In the time between a students' enrollment and graduation, an interaction takes place, which must be reconstructed if there is an intention of learning something about the university, the difficulties faced by its students and the questions posed to them.

The term student dropout has been object of different investigations and scientific research, with the purpose of deepening the knowledge about the motivations and impacts of the topic in the educational context. To characterize the many aspects related to the topic appropriately, this paper defines in a consolidated form the interpretation of the topic, presents selected theories that support the given concepts and, lastly, demonstrates the model used for this analysis.

In addition, student dropout in higher education can be considered as a complex educational phenomenon, defined as the interruption of the educational process and becoming, with time, a disturbing problem to public as well as private educational institutions' administrators. It can also be understood as the loss of students in many levels of education, causing, amongst other, social, academic and economic consequences [18]. Therefore, the interest in statistical methods capable of the early identification of likely candidates do drop out is constantly on the rise.

Complementing the definitions shown above, [7] classifies student dropout in three new types, which are: (1) Final dropout, when students abandon the institution in definitive, regardless of motivation; (2) Temporary dropout, when the voluntary interruption of the course occurs, for a period which can vary from one to ten semesters and; (3) Course dropout, when an internal transfer occurs and the student is relocated in a different course within the same institution.

According to these prerogatives, [22] separates student dropouts in two. The first is the annual average dropout, represented by the percentage of students enrolled in the educational system, institution or different courses who, even not having concluded their studies, have not registered in the following semester. The second is the total student dropout, which takes into account the number of students who, having enrolled in a specific course in the past, have not graduated in a set period of time, which is called graduation index.

2.1.1 Presenting some theories

The learning processes a student goes through after enrolling in a higher education course can and

must be analyzed in different ways. This occurs because, while there are those who complete theirs studies in the regularly set period of time, some need more time to complete their studies and others abandon their studies, dropping out of the course.

Those who study the subject present different analytical aspects, such as: (1) The presentation of theoretical models and the development of theories, which aim at explaining the process of dropping out of a course [25], [14], [4]; (2) The development of models which take into consideration the characteristics of the students, of the institutions and of the relationship between them, searching for indicators which allow the student dropout to be anticipated [9], [2] and; (3) Aspects that allow for a greater intervention in the educational system, aiming at the articulation of proper institutional actions which aid in the retention of the students [24], [29], [3].

The students' dropout and retention processes in higher education, which have been studied since the 1950's, are based in different perspectives. Even though the priority consistently lies in the relationship between the student and the institution and in the circumstances that occasion for the rupture of this relationship, before taking into account the school's curriculum.

Through the presentation of different theories, this literature review demonstrates that the phenomenon has accumulated a growing amount of attention by researchers, allowing for a better understanding of the different research focal points. These theories arise from different approaches, with the most noteworthy being, according to [18]: (1) The sociological approach, which follows the ideas of [28], [25], [26], [2], [13], [1]; (2) The psychological approach, which follows the ideas of authors such as [14], [9], [27], [15], [10]; (3) The study of organizational, interaction and economic factors [11], [18], [26] and; (4) The pedagogical approach [4].

2.1.2 Measuring the student dropout rate

There are different ways to measure the student dropout, all of which are based on three fundamental pillars: the concept of student dropout adopted according to the phenomenon being studied; the nature of the data available for analysis and; the calculation procedure. According to [23], these three aspects are intertwined, since the conceptual definition impacts on data collection and processing.

For this paper, the concept of student dropout taken into consideration is the same used by IFES, which considers as a dropout a student who hasn't yet conclude his or her course but has failed to register for subsequent curricular components without officially interrupting his or her course or requesting a transference. It has also been established that a student is not considered a dropout if he or she has transferred courses or campuses, as long as he or she continues to study in the Institute.

2.2 Educational Data Mining

The expression data mining refers to the use of technologies supported by computational learning algorithms, which automatize the creation of analytical models through structured data, extracting or indicating patterns, which will then be used for information grouping (descriptive modeling), classification (prescriptive modeling) or prediction (predictive modeling) [12].

In regards to the descriptive modeling, it's possible to highlight the methods for grouping of similar entries (clustering); detection of anomalies for the discovery of discrepant values; association rules to

determine the relationship between entries; statistical component analysis which point out relationships between variables and groups of data affinities [12]. In that which pertains to prescriptive modeling, it's possible to enumerate the techniques for analyzing, filtering and transforming non-structured data (such as files, tests, images and videos) for prepossessing (data preparation and exploration) and post processing (model validation, foundation and monitoring) though rules classifiers and identifiers [12]. Lastly, in regards to predictive modeling, it is important to highlight the approaches that accomplish data regression as a metric for the relationship between dependent and independent variables; neural networks to identify patters; decision trees for probable occurrences; and vector machines for prediction through machine learning [12].

In the educational field, according to [20], [21], Data Mining is applied in academic systems with the purpose of discovering potential groups of students with similar characteristics, identifying behaviors after pedagogical strategies have been employed, detecting errors or incorrect use in virtual learning environments, proposing new studies or didactic resources based on automatic evaluations and finding demotivated students with a tendency towards dropping out [16], [17].

3. Case Study

The foundation of the School for Craftsmen Apprentices of Espírito Santo through the Decree number 7,566 from September 23rd 1909 by then President Nilo Peçanha started the official offer of vocational courses on a Federal level. With initial focus on free primary and professional education, it had as its main goal to train youths who could and wanted to learn a trade through practical education and the transfer of practical knowledge needed to act as factory workers and foremen [19].

After its establishment, it went through many changes, and the names of Vocational School of Vitória (ETV), Vocational Federal School of Espírito Santo (ETFES), Federal Center of Vocational Education of Espírito Santo (CEFET-ES), when it also becomes a higher education institution. In 2008, through the Law number 11,892, the Federal Institute of Espírito Santo (IFES) was established by the unification of CEFET-ES and local agrotechnical schools.

Following policies of expansion away from the metropolitan areas, so as to reach poorer communities where access to education is limited, which started in 2002, the IFES currently caters to around 22 thousand students enrolled in over 90 vocational courses, 50 undergrad courses, 20 specialization courses and 10 master programs. IFES is present in all regions of state, working out of 22 campuses and 35 hubs for distance learning.

Inaugurated in April 19th 2010, as part of the government policy for vocational schools expansion, the Guarapari campus, located South of the metropolitan area of Vitória, Espírito Santo, began activities offering a Business Vocational High School Course, with the enrollment of 42 students happening every 6 months through an open entrance exam. In 2014, following the proposal for vertical education, the undergrad Business course was founded, accessible by both students from IFES vocational high school courses and students who graduated high school in other private and public institutions.

4. Data Mining Tools and Algorithms

Data Mining is being frequently employed with both scientific and commercial purposes, due to its capability of analyzing a great amount of data in a fast and trustworthy manner, extracting relevant information through software-consolidated tools, which possess academically accepted algorithms, enhancing visualization resources and data analysis in a facilitated way with a low learning curve [12].

The aim of this paper is to use Mining Data techniques to identify the existing relationships between socioeconomic data extracted from the academic system and student dropout. With this purpose, the software Orange Mining was chosen as it is an accessible tool of open use with many versions of the main algorithms described by [12], simple a drag and drop interface and the availability of statistical resources for data analysis and performance comparison.

Eleven classification algorithms available in the software were selected: A_1 (*CN2 rule inducer*), A_2 (*kNN*), A_3 (*Tree*), A_4 (*Random Forest*), A_5 (*SVM*), A_6 (*Logistic Regression*), A_7 (*Naive Bayes*), A_8 (*AdaBoost*), A_9 (*Neural Network*), A_{10} (*SGD*) and A_{11} (*Stacking*). These algorithms have the purpose of finding mathematical models that define classes, which, in this article, relate to student dropout and no student dropout (or student retention). The obtained model identifies new examples of unknown classes based on training routines that use data labeled in the initially described classes, which can be denominated as supervised learning. This learning is verified by a set of tests applied to the model [12].

The tool also provides the identification of classes (as seen in the columns of Tables 1 and 2, in the following section) that have greater statistical influence over the predictive class (student dropout and no student dropout), regardless of the learning algorithm. The classes here identified are: Info Gain (Information gain) - expected amount of information (entropy decrease); Gain ratio - relation between Info Gain and the intrinsic information of the attribute, which decreases the tendency to multiple value characteristics; Gini - disparity between the values and frequency attribution; X^2 (*Chi2*) - dependency between the resource and the class as a quadratic statistical measure; ReliefF - an attribute's capability to distinguish classes in similar data conditions. In this manner, it is possible to establish an order of the most important classes and adopt measures to improve the algorithms, such as disposal of attributes [12].

To evaluate the test results, it is possible to adopt statistical metrics common to the computational area. Some of them are: Accuracy - proportion of correctly classified examples, not taking into account what is positive or negative; Sensibility (or Recall) - proportion of true positive results between all positive instances; Precision - proportion of true positives in all instances classified as positive; F1 - harmonic weighted average of precision and recall; and ROC - diagnostics capabilities as the discrimination threshold varies [12].

5. Data Mining Algorithm Experimentation

As a way to evaluate the training basis and the relation between the classes and the data discrimination, an evaluating resource in the order of importance of the attributes was executed and the results were presented in Table 1 (below), ordered according to the degree of importance in a decreasing manner. It is possible to see that frequency (attendance rates) is a prevalent indicator in this perspective even though the data is more closely related to academic performance (attendance and absences) than to the social economic

descriptive, thus, it is deductively associated as a predictor of student dropout. However, in situations where there is a desire to predict the likelihood of a student dropping out even before the beginning of the school year, or during the first school semester, it is not possible to evaluate this information given the fact that attendance and absences are fed into the system later on into the semester. Therefore, the experiments were divided in two data basis for training and tests. The first one considers attendance information (frequency and frequency band) while the other one does not.

The third class in this order, C_6 - City, is an important social economic data, which can be related to difficulties of transportation for students who reside in locations that are not near the Institute, a possible cause for students' dropout. In Table 7 it is possible to observe that this attribute has a high influence in dropout rates, corroborating the previous statement. However, an aspect that must be considered in this analysis is the fact that data is not always properly updated or registered in the system. A student might move to a different address after the initial enrollment period and not inform the academic registry, which partially invalidates this conclusion.

Table 1. Class evaluation through training basis

		Info Gain	Gain ratio	Gini	X²	ReliefF
C_8	Band (frequency)	0.25	0.28	0.14	12.62	0.06
C_7	Frequency (attendance)	0.18	0.09	0.10	27.90	0.08
C_6	City	0.12	0.07	0.00	4.85	0.02
C_4	Previous Educational Institution	0.06	0.04	0.00	0.92	0.01
C_9	Color/Race	0.05	0.03	0.03	0.16	0.11
C_3	Family Income	0.04	0.02	0.03	3.36	0.00
C_{10}	Age	0.04	0.02	0.02	5.18	0.02
C_{11}	Age range	0.03	0.02	0.02	2.79	0.08
C_5	Type of Previous Educational Institution	0.00	0.03	0.00	0.00	0.00
C_1	Gender	0.00	0.00	0.00	0.50	0.04
C_2	Type of Enrollment	0.00	0.00	0.00	0.04	0.00

Source: the author

Other attributes have also suffered from lacking data, reducing the assertion in validating or not given attributes as meaningful, such as can be observe in class C_5 - Type of Previous Educational Institution. Another important point is that data such as Gender and School age, which are largely homogeneous due to the tendency of the course in attracting women of average adult age, are attributed low relevance in the prediction modeling learning algorithms.

5.1 Cross Validation Experiment

The first experiment on the database used a technique where it is divided into ten sets of cross validation and, after ten consecutive algorithm interactions, with their own optimal setting values, a result is achieved where the mean of these results for each statistical index. The results were described in the

Tables 2 and 3, in which R, A, F, P and S are the respective values for ROC, Accuracy, F1, Precision and Sensibility (Recall), in that which pertains exclusively to student dropout, exclusively to no student dropout and the mean, in a decreasing order according to ROC.

For the database that takes into consideration school attendance, the results showed Accuracy of up to 78.7% with the SVM algorithm, similar to the results of experiments that took coursework grades into consideration [17]. For the other database, without the school attendance classes, performance was inferior, with the best Accuracy reaching 66.7%. This values can still be considered satisfactory to the point where they can be used to direct pedagogical intervention initiatives aiming towards the prevention of students' dropout in initial years.

Table 2. Algorithms' results taking into consideration database with school attendance attributes

	Mean (%)					Dropout (%)					No Dropout (%)				
	R	A	F	P	S	R	A	F	P	S	R	A	F	P	S
Stacking	84.4	75.9	74.8	75.5	75.9	84.4	75.9	61.4	73.0	52.9	84.4	75.9	82.5	76.9	88.9
Random Forest	81.5	78.0	75.8	80.3	78.0	81.5	78.0	59.7	88.5	45.1	81.5	78.0	84.9	75.7	96.7
Tree	81.3	76.6	76.2	76.2	76.6	81.3	76.6	65.3	70.5	60.8	81.3	76.6	82.4	79.4	85.6
Naive Bayes	80.8	71.6	72.1	74.1	71.6	80.8	71.6	65.5	58.5	74.5	80.8	71.6	75.9	82.9	70.0
SVM	80.7	78.7	76.1	82.7	78.7	80.7	78.7	59.5	95.7	43.1	80.7	78.7	85.6	75.4	98.9
Neural Network	80.0	73.0	71.9	72.3	73.0	80.0	73.0	56.8	67.6	49.0	80.0	78.8	80.4	75.0	86.7
Logistic Regression	76.7	75.2	73.0	75.9	75.2	76.7	75.2	55.7	78.6	43.1	76.7	78.9	82.8	74.3	93.3
kNN	76.6	73.0	72.3	72.3	73.0	76.6	73.0	58.7	65.9	52.9	76.6	79.0	80.0	76.0	84.4
CN2 rule inducer	71.9	65.2	65.9	72.4	65.2	71.9	65.2	58.8	51.5	68.6	71.9	79.1	69.9	78.1	63.3
SGD	69.9	75.9	74.2	72.5	75.9	69.9	75.9	58.5	77.4	47.1	69.9	79.2	83.0	75.5	92.2
AdaBoost	63.4	66.0	66.1	72.6	66.0	63.4	66.0	53.8	52.8	54.9	63.4	79.3	73.0	73.9	72.2

Source: the author

Table 3. Algorithms' results taking into consideration database without school attendance attributes

	Mean (%)					Dropout (%)					No Dropout (%)				
	R	A	F	P	S	R	A	F	P	S	R	A	F	P	S
Naive Bayes	66.5	61.0	61.6	67.4	61.0	66.5	61.0	58.0	47.5	74.5	66.5	61.0	63.6	78.7	53.3
Logistic Regression	64.9	66.7	64.8	65.0	66.7	64.9	66.7	44.7	55.9	37.3	64.9	66.7	76.1	70.1	83.3
CN2 rule inducer	62.4	61.7	61.1	60.8	61.7	62.4	61.7	43.7	46.7	41.2	62.4	61.7	71.0	68.8	73.3
Neural Network	62.0	60.3	58.9	58.3	60.3	62.0	60.3	37.8	43.6	33.3	62.0	60.3	70.8	66.7	75.6
AdaBoost	60.9	64.5	64.2	64.0	64.5	60.9	64.5	49.0	51.1	47.1	60.9	64.5	72.8	71.3	74.4
kNN	59.9	63.8	51.0	59.0	63.8	59.9	63.8	3.8	50.0	2.0	59.9	63.8	77.7	64.0	98.9
Random Forest	59.7	63.1	59.1	59.7	63.1	59.7	63.1	31.6	48.0	23.5	59.7	63.1	74.8	66.4	85.6
SVM	59.3	65.2	54.0	68.6	65.2	59.3	65.2	10.9	75.0	5.9	59.3	65.2	78.4	65.0	98.9

SGD	58.7	66.0	63.5	63.9	66.0	58.7	66.0	41.5	54.8	33.3	58.7	66.0	76.0	69.1	84.4
Stacking	54.6	64.5	52.5	65.3	64.5	54.6	64.5	7.4	66.7	3.9	54.6	64.5	78.1	64.5	98.9
Tree	46.3	53.9	53.1	52.5	53.9	46.3	53.9	31.6	34.1	29.4	46.3	53.9	65.2	62.9	67.8

Source: the author

5.2 Randomized Process Experiment

The second experiment used a randomized process to select the test samples, with ten algorithms runs, according to the results shown in Tables 4 and 5. When comparing the results with the first experiment, it is possible to observe that the two manners of dividing the database do not significantly alter the results. This can be considered a good indicator that the attributes applied are enough to execute a prediction of students with a higher risk of dropping out during the first semester of the course.

Table 4. Algorithms' results taking into consideration database with school attendance attributes

	Mean (%)					Dropout (%)					No Dropout (%)				
	R	A	F	P	S	R	A	F	P	S	R	A	F	P	S
Stacking	80.0	76.9	76.0	76.3	76.9	80.0	76.9	61.6	71.2	54.3	80.0	76.9	83.5	78.9	88.6
SVM	79.8	79.4	76.9	82.1	79.4	79.8	79.4	58.9	92.2	43.3	79.8	79.4	86.2	76.9	98.1
Naive Bayes	79.3	72.3	72.9	75.0	72.3	79.3	72.3	64.7	57.3	74.4	79.3	72.3	77.2	84.3	71.2
Random Forest	78.8	79.4	78.2	79.4	79.4	78.8	79.4	64.0	79.3	53.7	78.8	79.4	85.5	79.4	92.7
Logistic Regression	77.8	77.5	75.9	77.5	77.5	77.8	77.5	59.4	77.5	48.2	77.8	77.5	84.4	77.5	92.7
Neural Network	75.8	73.5	72.8	72.7	73.5	75.8	73.5	57.5	63.7	52.4	75.8	73.5	80.8	77.4	84.5
kNN	75.0	72.5	71.9	71.7	72.5	75.0	72.5	56.6	61.4	52.4	75.0	72.5	79.9	77.1	82.9
Tree	72.7	71.3	70.3	70.2	71.3	72.7	71.3	53.1	60.0	47.6	72.7	71.3	79.3	75.4	83.5
SGD	69.7	75.4	74.2	74.7	75.4	69.7	75.4	57.9	69.8	49.4	69.7	75.4	82.6	77.2	88.9
AdaBoost	66.0	66.9	67.4	68.3	66.9	66.0	66.9	55.2	51.3	59.8	66.0	66.9	73.7	77.2	70.6
CN2 rule inducer	65.1	54.2	55.3	60.4	54.2	65.1	54.2	47.6	39.1	61.0	65.1	54.2	59.3	71.4	50.6

Source: the author

Table 5. Algorithms' results taking into consideration database without school attendance attributes

	Mean (%)					Dropout (%)					No Dropout (%)				
	R	A	F	P	S	R	A	F	P	S	R	A	F	P	S
Naive Bayes	67.3	59.2	60.0	66.8	59.2	67.3	59.2	54.8	44.1	72.6	67.3	59.2	62.7	78.6	52.2
Neural Network	66.8	65.6	64.6	64.2	65.6	66.8	65.6	44.4	49.6	40.2	66.8	65.6	75.1	71.8	78.8
Logistic Regression	64.4	64.8	63.4	62.9	64.8	64.4	64.8	41.5	48.0	36.6	64.4	64.8	74.8	70.7	79.4
Random Forest	61.7	64.8	61.4	61.4	64.8	61.7	64.8	33.2	47.2	25.6	61.7	64.8	76.1	68.8	85.1
kNN	61.0	65.0	52.9	53.5	65.0	61.0	65.0	3.4	30.0	1.8	61.0	65.0	78.6	65.7	97.8
Stacking	60.1	64.8	55.3	57.5	64.8	60.1	64.8	11.5	40.7	6.7	60.1	64.8	78.0	66.2	94.9

SGD	59.5	65.4	64.2	63.8	65.4	59.5	65.4	43.2	49.2	38.4	59.5	65.4	75.1	71.3	79.4
AdaBoost	54.0	57.5	57.7	57.9	57.5	54.0	57.5	38.9	38.2	39.6	54.0	57.5	67.4	68.1	66.8
CN2 rule inducer	53.7	56.5	56.4	56.3	56.5	53.7	56.5	35.7	36.0	35.4	53.7	56.5	67.1	66.8	67.4
Tree	53.3	56.2	55.6	55.1	56.2	53.3	56.2	32.3	34.2	30.5	53.3	56.2	67.7	65.9	69.6
SVM	49.5	65.8	55.6	60.9	65.8	49.5	65.8	10.9	50.0	6.1	49.5	65.8	78.9	66.5	96.8

<p align="center">Source: the author</p>

5.3 Test Base Experiment

For the last experiment, the real data obtained from the Academic Registry system, considering students enrolled between 2017 and 2018, was used as the database. Even if these students are still in the first few semesters if their course and might still drop out, this experiment expects to ascertain the behavior of the algorithms in real situations and observe if the results can be used as guidelines for specific academic actions. As can be observed in Tables 6 and 7 (below) the indexes are even higher than those seen in previous experiments and those presented by [17], presenting an Accuracy of 90.5% for the database that takes into account school attendance and 86.3% for the database that does not. In this manner, it is possible to determine that social economic attributes are effective for predictive systems of Students' dropout in the Business Administration undergrad course at IFES, Guarapari campus. As a consequence, this study may be used as a research model in other institutions and undergrad courses.

<p align="center">Table 6. Algorithms' results taking into consideration database with school attendance attributes</p>

	Mean(%)					Dropout(%)					NoDropout(%)				
	R	A	F	P	S	R	A	F	P	S	R	A	F	P	S
Stacking	85.5	90.5	89.9	89.7	90.5	85.5	90.5	57.1	66.7	50.0	85.5	90.5	94.7	93.0	96.4
kNN	84.7	89.5	89.1	88.8	89.5	84.7	89.5	54.5	60.0	50.0	84.7	89.5	94.0	92.9	95.2
Naive Bayes	83.2	77.9	81.0	87.7	77.9	83.2	77.9	46.2	33.3	75.0	83.2	77.9	86.1	95.6	78.3
Random Forest	82.6	88.4	87.7	87.3	88.4	82.6	88.4	47.6	55.6	41.7	82.6	88.4	93.5	91.9	95.2
Tree	81.4	89.5	88.5	88.2	89.5	81.4	89.5	50.0	62.5	41.7	81.4	89.5	94.1	92.0	96.4
SVM	78.0	91.6	90.3	91.0	91.6	78.0	91.6	55.6	83.3	41.7	78.0	91.6	95.3	92.1	98.8
CN2 rule inducer	77.9	66.3	72.0	87.3	66.3	77.9	66.3	38.5	25.0	83.3	77.9	66.3	76.8	96.4	63.9
Logistic Regression	74.0	88.4	87.7	87.3	88.4	74.0	88.4	47.6	55.6	41.7	74.0	88.4	93.5	91.9	95.2
Neural Network	69.8	73.7	77.4	84.2	73.7	69.8	73.7	35.9	25.9	58.3	69.8	73.7	83.4	92.6	75.9
SGD	69.5	71.6	76.0	85.2	71.6	69.5	71.6	37.2	25.8	66.7	69.5	71.6	81.6	93.8	72.3
AdaBoost	64.2	74.7	78.0	83.1	74.7	64.2	74.7	33.3	25.0	50.0	64.2	74.7	84.4	91.5	78.3

<p align="center">Source: the author</p>

Table 7. Algorithms' results taking into consideration database without school attendance attributes

	Mean(%)					Dropout(%)					NoDropout(%)				
	R	A	F	P	S	R	A	F	P	S	R	A	F	P	S
RandomForest	72.4	82.1	83.7	86.3	82.1	72.4	82.1	45.2	36.8	58.3	72.4	82.1	89.3	93.4	85.5
Stacking	72.4	86.3	81.0	76.2	86.3	72.4	86.3	0.0	0.0	0.0	72.4	86.3	92.7	87.2	98.8
SVM	71.4	73.7	77.2	82.9	73.7	71.4	73.7	32.4	24.0	50.0	71.4	73.7	83.7	91.4	77.1
AdaBoost	64.7	69.5	74.2	83.4	69.5	64.7	69.5	32.6	22.6	58.3	64.7	69.5	80.3	92.2	71.1
SGD	64.7	69.5	74.2	83.4	69.5	64.7	69.5	32.6	22.6	58.3	64.7	69.5	80.3	92.2	71.1
NaiveBayes	61.7	46.3	54.4	78.6	46.3	61.7	46.3	21.5	13.2	58.3	61.7	46.3	59.2	88.1	44.6
LogisticRegression	61.5	65.3	70.9	81.2	65.3	61.5	65.3	26.7	18.2	50.0	61.5	65.3	77.2	90.3	67.5
NeuralNetwork	58.0	57.9	65.0	79.7	57.9	58.0	57.9	23.1	15.0	50.0	58.0	57.9	71.0	89.1	59.0
kNN	57.3	84.2	79.9	76.0	84.2	57.3	84.2	0.0	0.0	0.0	57.3	84.2	91.4	87.0	96.4
Tree	56.9	56.8	64.1	79.5	56.8	56.9	56.8	22.6	14.6	50.0	56.9	56.8	70.1	88.9	57.8
CN2ruleinducer	50.5	57.9	65.0	79.7	57.9	50.5	57.9	23.1	15.0	50.0	50.5	57.9	71.0	89.1	59.0

Source: the author

As described in Tables 1 and 2, by not taking attendance into consideration, the classification presents an elevated false positive percentage (between 40 and 50%), which implies a significant error in the prediction and, therefore, an aspect to be improved in future studies.

Table 8. Confusion Matrix taking into consideration database with school attendance attributes

	Predicted																						
	A_1		A_2		A_3		A_4		A_5		A_6		A_7		A_8		A_9		A_{10}		A_{11}		
	E	N	E	N	E	N	E	N	E	N	E	N	E	N	E	N	E	N	E	N	E	N	Actual
E	10	2	6	6	5	7	5	7	5	7	5	7	9	3	6	6	7	5	8	4	6	6	12 E
N	30	53	4	79	3	80	4	79	1	82	4	79	18	65	18	65	22	61	23	60	3	80	83 N
	40	55	10	85	8	87	9	86	6	89	9	86	27	68	24	71	29	66	31	64	9	86	95

Source: the author

Table 9. Confusion Matrix taking into consideration database without school attendance attributes

	Predicted																						
	A_1		A_2		A_3		A_4		A_5		A_6		A_7		A_8		A_9		A_{10}		A_{11}		
	E	N	E	N	E	N	E	N	E	N	E	N	E	N	E	N	E	N	E	N	E	N	Actual
E	6	6	0	12	6	6	7	5	6	6	6	6	7	5	7	5	6	6	7	5	7	5	12 E
N	34	49	3	80	35	48	12	71	19	64	27	56	46	37	24	59	28	55	27	56	11	72	83 N
	40	55	3	92	41	54	19	76	25	70	33	62	53	42	31	64	34	61	34	61	18	77	95

Source: the author

6. Conclusion and future studies

This paper aimed at presenting the viability in applying social economic attributes to classification algorithms regarding students at risk of dropping out from IFES, Guarapari campus, undergrad Business Administration course. This paper evaluated the algorithms from a open Data Mining software through three types of experiments that are available in the tool, for two different databases, with and without school attendance information, where the last one showed the worse, but still satisfactory, performance.

These computational techniques can aid school administrators in planning pedagogical and administrative actions in direct and assertive manners. Besides, by combining social economic and school performance data, the algorithms tend to show even better results, allowing for a continued practice of students' dropout prevention. In future studies, we expected to apply these experiments in other undergrad courses on the Institute, expanding the observations and research into these technological possibilities. Therefore, with a larger amount of data available, we also expect to identify other potential uses of Data Mining in academic administration.

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Fungicides application in corn disease control and mycotoxin accumulation in grain

Gilmar Seidel, Caroline Wesp, Jana Koefender, Diego Pascoal Golle, André Schoffel, Elaine Deuner, Juliane Nicolodi Camera

Universidade de Cruz Alta

Brazil

ABSTRACT

In Brazil, corn planted area increased by 30%. Therefore, there was also an increase in the incidence of pathogens in the crop. The objective of this work was to evaluate the influence of fungicide applications on corn crops in the different growth stages for the control of the diseases and its effect on the occurrence of mycotoxins in the grain. The experiment was carried out in the 2017/2018 summer crop, in the municipality of Cruz Alta, state of Rio Grande do Sul/BR. This study used P 1630 hybrid, in a randomized block design with eight treatments (control, V8, PT, V4 + V8, V4 + V8 + PT, V8 + PT, V8 + PT + 15, PT + 15) and three replicates. The fungicide fluxapiroxade + pyraclostrobin + epoxiconazole at the dose of 1.0 L/ha^{-1} was used. The diseases that affected the crop were the white spot and helmintosporiosis, therefore, reducing the incidence of diseases. Also the highest yields were obtained where the applications started at the phenological stage V4 and V8. The levels of mycotoxins detected in this work remained within the limits of the legislation, with a significant reduction in the accumulation of fumonisin and aflatoxin with fungicide applications.

Keywords: helmintosporiosis; productivity; toxins; white spot; *Zea Mays*.

INTRODUCTION

According to data from Conab (2018), Brazil is consolidated as the third largest corn producer in the world and the second largest exporter, with a high domestic consumption of cereal as it is one of the world's leading producers of animal protein. Over the last five years, the dynamics of the corn production chain have changed significantly in the country, since the grain was no longer just a product aimed for animal feeding, but also an exportable commodity. In addition, it has established itself in the last two years as an energy matrix in ethanol production. In Brazil, the cropped area has increased by 30%, and it has changed from being only an accessory culture, a simple component of a rotation system, to a strong culture, through intense professionalization process, with the adoption of new technologies (mainly the use of transgenic) and consequent increase in the productivity (Peixoto, 2014).

As the cropped area was increased, so did the occurrence of diseases in the crop. In Brazil, there are at least 20 pathogens occurring in the culture and may cause significant damage (Reis & Casa, 1996). This

increase in diseases observed in the field may be due to the long period of time in which the crop remains in the field, with two growing seasons, crop and off-crop (*safrinha*).

Corn diseases occur on leaves, ears and stems. In the leaves, they reduce leaf area through necrosis, which reduces the photosynthetic active leaf area, thereby reducing productivity. In the ears, besides causing direct damage to harvested grains, known as burnt grains, secondary metabolites denominated mycotoxins are produced. They do not directly reflect on productivity, but are important for animal and human health, as they can cause disease through its ingestion (Guterres-Wesp *et al*., 2017). Mycotoxins reduce animal productivity as well as the contamination of the final product such as meat or milk. They generally cause lower food intake, reduce reproductive performance, leading to miscarriages, reduction in female ovulation rate, milk production and immunity of animals. They can also cause tumors and even deaths. Thus, disease management becomes a determining factor for the maintenance of crops with high productive potential (Fancelli, 2013).

Fancelli and Dourado-Neto (2004), report that during the vegetative phase, the beginning of the definition of the productive potential occurs, with the definition of the number of rows of grains in the ear, size of ear and number of ears per plant, which can justify the early application of fungicides.

Helminthsporiosis (*Exserohilum turcicum*) and white spot (*Pantonea annatis*) are among the main diseases of corn plants. When studying corn cultivation areas in India in 2003/04, Harlapur (2005) found that the average percentage of the incidence of the disease showed that it occurred in all corn crop areas in the state ranging from 20 to 86%, and 47% was the average incidence of the disease. The pathosystem of the white spot of corn (CWS) has acquired endemic character in several producing regions in the country, being able to reduce by up to 60% the grain yield (Brito *et al*., 2013). The etiological agent of CWS was initially described as the fungus *Phaeosphaeria maydis* by Rane *et al*. (1966). However, some studies have questioned the pathogenicity of *Phaeosphaeria maydis*, characterizing bacterium *Pantoea ananatis* as the CWS causative agent (Paccola-Meirelles *et al*., 2001; Lanza *et al*., 2013). A 10-20% CWS severity can reduce the net photosynthetic rate by 40% and yield losses can be as high as 60% depending on environmental conditions (Godoy *et al*., 2001).

The objective of this work was to evaluate the effect of application period of the fungicide (fluxapriroxade + epoxiconazole + piraclostrobin) on the control of helmontosporiosis and white spot diseases and on the reduction of mycotoxin levels in corn grains.

MATERIAL AND METHODS

This study was carried out in the CCGL Tecnologia experimental area, municipality of Cruz Alta/RS in Brazil, using P 1630 Dupont Pioneer corn hybrid with a super early cycle, in which one of the hybrids was more susceptible to leaf diseases.

The seeds were treated with the fungicide (Carboxin 200 gL^{-1} + Thiram 200 gL^{-1}) at a dose of 0.3 L per 100 kg of seed and with the insecticide (Imidacloprid 150 gL^{-1} + Thiodicarb 450 gL^{-1}), at a dose of 0.3 $L.ha^{-1}$. Sowing was carried out in December 2017, with a population of 75,000 plants ha^{-1}. Each plot consisted of six rows of 6 m, with row spacing of 0.47 m. The useful area of the harvested experimental

plot was 5.4 m². The soil was previously fertilized with 300 kg.ha^{-1} of formula 10- 30-20 (NPK), performing the other topdressing fertilizations and crop treatments according to recommendations for corn crop.

The applications of the treatments were done using with a ground bar, provided with six tips (double flat deflector fan model - TTJ 60 110 02 / TEEJET), with CO_2 pressurized costal sprayer, walking speed of 1 ms^{-1}, pressure 30 lbs. pol[2] and spray volume of 150 L ha^{-1}. Dates, growth stages (treatments), and weather conditions at application periods of fluxapiroxade + piraclostrobin + epoxiconazole were identified (Table 1).

Table 1. Dates, growth stages and climatic conditions at application of fungicide Fluxapioroxade + Epoxiconazole + Piraclostrobina. INMET- Cruz Alta-RS. 2018.

Treatments	Date	DAE[1]	Stage	Initial hour / Final hour	Temp. (⁰C) Maximum	Temp. (⁰C) Minimum	R.H. (%)	Wind speed (km/h)
V4	03/01	18	V4	09:00	17	15	92	1.4
				09:20	17	15	92	1.4
V8	25/01	40	V8	09:00	22	21.8	82	9.3
				09:30	22	21.8	82	9.3
PP	06/02	52	PP	09:15	16.5	15.9	88	7.1
				09:55	16.5	15.9	88	7.1
DAA	22/02	68	R2	11:00	18.8	16.9	77	2.5
				11:25	18.8	16.9	77	2.5

[1]DAE Days after emergence.

The experiment was carried out in a randomized block design with eight treatments (growth stages): Control, V8 (eight fully open leaves), PT (pre-tasseling), V4 (four completely open leaves) + V8, V4+V8+PT, V8+PT, V8+PT+15DAA (days after previous application), PT+15DAA (days after previous application), PT + 15DAA and three repetitions. Fluxapiroxade 50g.L^{-1} + piraclostrobin 81 g.L^{-1} + epoxiconazole 50 g.L^{-1} fungicide were used in all applications at a dose of 1.0 L.ha^{-1}).

The diseases occurring over the crop cycle were helminthsporiosis and white spot. Seven severity evaluations of leaf diseases that occurred throughout the crop cycle were carried out with the aid of a diagrammatic scale for white spot according to (Azevedo, 1998) and for helmintosporiosis, a scale proposed by Utfpr, (2012) was used, giving a visual plot score. With these results, it was calculated the area below the disease progress curve (ABDPC), which takes into account the intensity of the disease and its evolution over time (Shaner & Finney, 1977). In the growth phase R4 (kernel dough stage), the final severity of the diseases was evaluated. Control efficiency (EC%) was calculated in relation to the area of the disease progress curve.

Harvest was done manually on April 25, 2018, in a useful area of 5.4 m², and later threshed in a stationary machine. The grains were cleaned in a specific stationary air machine, and then the grain mass

(kg. ha^{-1}) and weight of one thousand seeds (g) were determined, by adjusting moisture to 13% of the samples collected for the productivity calculation.

For the determination of mycotoxin levels in the grain, 1 kg of the productivity samples were removed. All samples were ground in a blender for three minutes, and the blender was cleaned whenever the sample was changed, using paper towels and Vacuum cleaner, so that there was no contamination between samples. After grinding, they were stored in paper bags in a freezer until analysis.

Mycotoxin was analyzed using the standard procedure recommended by the Neogen Veratox® Kit method, based on Enzyme Linked Immuno Sorbent Assay (ELISA), was followed for aflatoxin, ocratoxin, fumonisin and zearalenone mycotoxins. The reading was performed on the specific reader (stall fax 4700) using the 650-nm filter. Results were given in parts per billion (ppb), (1 ppb is equivalent to 1 µg kg^{-1}).

The data were submitted to analysis of variance and compared using Scott-Knott test at 5% probability of error. Analyses were performed using SASM-Agri software (Canteri *et al*. 2001).

RESULTS AND DISCUSSION

The high rainfall observed in December (102.8mm) and January (361.2mm) resulted in a favorable environment for the occurrence of diseases in corn (Table 2), as well as that observed in February and March, which provided a favorable environment for the development of the diseases, in which the most common were helminths and white spot.

Table 2. Tem-day period for maximum and minimum temperatures (ºC), rainfall (mm) and average air relative humidity (%), during corn crop growth. Cruz Alta-RS. 2017/2018

		Dec	Jan	Feb	Mar	Apr
Maximum temperature *	1stten-day period	30.7	28.6	29.9	24.8	28.1
(ºC)	2ndten-day period	31.0	28.5	26.6	28.0	27.1
	3rdten-day period	29.1	25.8	27.6	25.6	29.2
Monthly average		**30.3**	**27.6**	**28.1**	**27.3**	**28.1**
Minimum temperature *	1stten-day period	17.4	17.0	17.1	16.6	15.7
(ºC)	2ndten-day period 3rdten-day period	16.5	19.0	16.6	16.1	15.9
		18.0	17.6	15.6	14.9	17.5
Monthly average		**17.3**	**17.8**	**16.5**	**15.8**	**16.4**
Rainfall	1stten-day period	25.0	22.2	23.0	15.4	29.2
(mm)	2ndten-day period	33.4	77.8	46.8	5.7	18.2
	3rdten-day period	44.4	261.2	0.4	168.0	12.6
Total (mm)		**102.8**	**361.2**	**70.2**	**240.4**	**60**
Average RH (%)		**62.5**	**74.5**	**72.3**	**71.4**	**68.2**

* INMET, CCGL weather station - Cruz Alta-RS.

All treatments reduced the final severity of helminthesporiosis when compared to the control with no treatment. Final severity was 45%. Also, the best controls were observed when the application was performed preventively in V4. In the application performed in V8, early symptoms of the disease had already been observed.

The smallest severities caused by helminthsporiosis were obtained for the treatment where fungicide applications were performed on V4 + V8 and V4 + V8 + PT, followed by V8 + PT and V8 + PT + 15DAA (Table 3). According to Boller *et al*. (2007) the effectiveness of control depends on the age of the infection. A fungicide application on newly established infections results in the death of the pathogen.

Table 3. Final severity (%), area below disease progress curve (ABDPC), control percentage (%C) of helminthsporiosis in corn, Cruz Alta-RS. 2017/2018.

Treatments	Final severity (%)	ABDPC	%C[1]
V4+V8+PT	12.0 a*	247.8 a	81.3
V4+V8	12.0 a	299.7 b	77.4
V8+PT	16.6 b	336.3 b	74.7
V8+PT+15DAA	19.3 b	372.3 c	72.0
V8	24.0 c	570.8 e	57.1
PT+15DAA	24.6 c	453.8 d	65.9
PT	29.0 d	685.8 f	48.9
Control	45.0 e	1331.5 g	0.0
C.V%	6.7	5.6	

*Means followed by the same letter in the column are not different from each other by the test of Scott-Knott at 5% probability. [1] Calculated on the basis of ABDPC.

Azevedo (2007) reports the most pronounced curative/eradicating effect of fungicides up to 48 to 72 hours after pathogen infection. In older infections, the energy no longer used for growth is reallocated for reproduction, causing lesions and forming viable or not viable spores. The cause, however, is the high number of non-visible infections at the incubation stage, which reinforces the need to apply treatments early, preemptively or at the onset of symptoms (Boller *et al*., 2007).

The ABDPC considers the evolution of the disease over time, in which the best control was observed in treatment (V4 + V8 + PT). In relation to that treatment, application started preventively (V4), in which three applications were made, therefore providing more robustness and residual necessary to protect the active photosynthetic leaf area of the crop. Data on severity, ABDPC, and percentage control of helminthsporiosis are shown in (Table 3). Cota *et al*. (2010) observed that the application of Epoxiconazole + Piraclostrobin was efficient in the control of sorghum helminthsporiosis. Moreover, fungicide was applied 45 days after sowing, which is the key point for the success of sorghum helminthsporiosis chemical control because late applications may have no effect on disease control.

Similarly, all fungicides tested in the study reduced the final severity of white spot. The best controls were observed in preventive-initiated treatments (V4 and V8), as the disease was observed in the field

seven days after application in V8. When analyzing the ABDPC, it was found that the treatment (V4 + V8 + PP) had the best controls (Table 4).

Table 4. Final severity, area below disease progress curve (ABDPC), white spot control percentage (%C), Cruz Alta-RS. 2017/2018.

Treatments	% Final severity	ABDPC	% C[1]
V4+V8+PT	20.6 a	332.7 a	79.3
V4+V8	25 b	428.7 b	73.3
V8+PT	26 b	423.3 b	73.6
V8+PT+15DAA	27.6 c	466.5 b	70.9
V8	30 d	500.6 b	68.8
PT+15DAA	32.3 d	825.6 c	48.6
PT	50 e	1094.6 d	31.8
CONTROL	56.6 f*	1605.3 e	0
C.V	5.12	5.7	

*Means followed by the same letter in the column are not different from each other by the test of Scott-Knott at 5% probability. [1] Calculated on basis of ABDPC.

Manerba *et al*. (2013) observed that at stage V8 there was a significant difference for all treatments in relation to the control up to 98 days after sowing. Also, the piraclostrobin + epoxyconazole mixture was higher at 82 DAS, probably due to a systemic residual of 20 to 30 days after application, which is a characteristic of the mixture of the strobilurin and triazole chemical groups.

The use of practices such as susceptible cultivars, non-rotation of crops, associated with favorable conditions and the occurrence of epidemics, contribute to the increase in the importance of diseases in corn and consequently the use of fungicides (Oliveira, 1997; Julliati *et al*., 2004). Thus, disease management becomes a determining factor for the maintenance of crops with high productive potential (Fancelli, 2013). In addition to the control provided by the fungicide, some of them contain in their formulation molecules belonging to the strobilurin group, which may offer additional physiological effects, which positively contribute to the productivity of some cereals (Hoehle *et al*., 2002).

One of the factors involved for the complete expression of the productive potential of an hybrid is the ability to perform photosynthesis, which is related, among other factors, to its ability to capture sunlight through its leaves. This absorption will be maximum only if leaves are green and healthy and free of pathogens that can decrease this ability to capture light through necrosis. Economic benefit and response of fungicide use in corn will be achieved according to the susceptibility of the hybrid and the expected yield potential of the crop. More susceptible hybrids in crops with higher disease occurrence are likely to respond more to the number of fungicide applications and to the early entries (Wesp-Guterres *et al*., 2017). Therefore, when analyzing the productive data achieved in this experiment, it is observed that the applications started in V4 and V8 resulted in higher yields, which corroborates the low levels of diseases

observed. Whenever disease control was started preventively, lower disease levels were observed, which was reflected in higher yields.

Brito *et al*. (2013) observed that leaf diseases *Cercosporiose* and White Spot reduced corn grain yield and this reduction was greater when diseases occurred early. In this work, it was found that the treatments (V4 + V8 + PT), (V8), (V4 + V8), (V8 + PT) and (V8 + PT + 15DAA) resulted in an average increment of 46.8 bags per hectare. Brito et al. (2013) analyzed 12 distinct corn hybrids at 3 different sites, and achieved 12% higher yield response on average compared to the use of two fungicide applications (azoxystrobin + cyproconazole) at V10 + PT, and the non-use. In treatments (PT) and (PT + 15DAA) in this work, where a disease level had been already observed at fungicide application, no significant difference of the control in relation to yield was observed. According to Fancelli and Dourado-Neto (2004), the beginning of the definition of the productive potential occurs during the vegetative phase, defining the number of rows of grains in the ear, size of ear and number of ears per plant, which can in some cases justify the early application of fungicides. For the mass of one thousand seeds, no statistical differences were obtained, as it can be observed in Table 5.

Table 5. Production (kg ha$^{-1)}$, production in bags per ha (bags/ha), difference in relation to the non-treated control in bags per hectare ($\neq$ for the control) and mass of one thousand seeds in grams (MTS), Cruz Alta-RS. 2017/2018.

Treatments	Production kg ha^{-1}		bags ha^{-1}	$\neq$for control	MTS (g)	
V4+V8+PT	10862	a*	181.0	67.5	307.7	a
V8	9825	a	163.7	50.2	275.7	a
V4+V8	9810	a	163.5	50.0	291.3	a
V8+PT	8932	a	148.9	35.3	308.7	a
V8+PT+15DAA	8676	a	144.6	31.1	295.3	a
PT	7591	b	126.5	13.0	286.7	a
PT+15DAA	7436	b	123.9	10.4	293.3	a
Control	6812	b	113.5	0.0	257.0	a
CV	12.29%				5.51%	

*Means followed by the same letter in the column are not different from each other by the test of Scott-Knott at 5% probability.

The fungicides registered for corn crop are mainly to maintain plant health, reducing colonization of pathogens that cause burned grains (Duarte *et al*., 2009). This work analyzed the presence of four mycotoxins associated with corn grains in the post-harvest, and the time when fungicide was applied had no significant effect for ochratoxin and zearalenone, with a lower accumulation of aflatoxin and fumonisin (Table 6).

Table 6. Levels of Mycotoxin (µg kg^{-1}) found in the different treatments used in the P1630 corn hybrid. Cruz Alta, RS. 2017/2018.

Treatments	Fumonisin µg kg^{-1}	Aflatoxin µg kg^{-1}	Zearalenona µg kg^{-1}	Ocratoxin µg kg^{-1}
V8+PP+15DAA	20.1 b	5.5 a	13.8 a	0.1 a
V4+V8+PT	17.2 a	5.5 a	13.4 a	0.0 a
V4+V8	17.9 a	5.5 a	7.9 a	0.0 a
V8	18.9 a	6.6 a	14.8 a	0.0 a
PT+15DAA	20.7 b	6.9 a	16.5 a	0.2 a
PT	21.7 b	7.1 a	12.5 a	0.0 a
PT+15DAA	20.4 b*	7.8 b	25.9 a	0.1 a
Control	22.4 b*	9.6 b	19.9 a	0.3 a
CV	4.38%	8.55%	23.30%	112.10%

*Means followed by the same letter in the column do not differ from each other by the Scott-Knott test at 5% probability.

Ochratoxin, which is formed by *Penicilium* and *Aspergilus* storage fungi, was detected in this study in very low amounts, so it was not possible to verify whether or not its occurrence was reduced by the application of fungicides. The low occurrence of ochratoxin was also mentioned by Feddern *et al*. (2018), when they verified in only three samples of corn plots in 2016. Also, in 2017, they found that 95.9% of the samples did not accuse the presence and samples with presence were below the tolerable threshold.

No significant presence of zearalenone was observed in corn grain, possibly due to environmental conditions during cultivation, since the average minimum temperatures were around 15.8 ºC and the average maximum values were higher than 25ºC. Although Fusarium growh is favored by these temperatures, colder temperatures (8 to 14 ºC) are required for significant levels of zearalenone. These results corroborate those of Feddern *et al*. (2018) who found Zearalenone levels within the tolerable upper threshold in 99% of corn samples analyzed in 2016 and 2017.

Aflatoxin is caused by fungi of the *Aspergilus* genus and it has been found at levels below the maximum tolerable threshold. Even so, most of the treatments tested were able to decrease their occurrence in grains when compared to the control. All treatments with the exception of treatment (V8 + PT) decreased by 26.04% to 42.7% the amount of aflatoxins compared to treatment without fungicide.

Fumonisins are produced by secondary metabolism of toxigenic fungi of the genus *Fusarium* and *Alternaria*, in which *Fusarium moniliform* strains are the most productive (Lamic, 2018). As observed in this study, there was a lower accumulation of fumonisin in the treatments (V8), (V4 + V8) and (V4 + V8 + PT); however, in the others treatments, no significant interference with mycotoxin levels was observed. Similar to the other mycotoxins, the values found in the study are below the maximum acceptable threshold. Feddern *et al*. (2018), observed that although 76.1% of corn samples were contaminated with fumonisin, only 8.3% of the samples were above the maximum acceptable threshold. Juliatti *et al*. (2007) observed a significant difference in the incidence of *Fusarium moniliform* as a function of foliar application of fungicides, with a reduction in the infection of up to 33%. Yoshida *et al*. (2008) evaluated the period of

methyl thiophanate applications in barley and concluded that applications reduce the mycotoxin content in harvested grains.

CONCLUSIONS

In relation to the diseases caused by helminthsporiosis and white spot, the best control efficiency of fluxapiroxade + piraclostrobin + epoxiconazole fungicide was obtained when applied in the V4 + V8 + PT growth stages, directly influencing the crop yield.

The highest yields of corn crop were achieved through preventive applications initiated at V4 and V8 growth stages.

Application on the levels of zearalenone and ochratoxin mycotoxins produced no effect, but a lower accumulation was observed for fumonisin and aflatoxin, but within the maximum accepted by the corn grain legislation.

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Animal production and economic viability of integrated crop livestock systems

Gustavo Antunes Trivelin

São Paulo State University (Unesp), College of Agricultural and Technological Sciences, Dracena-SP
17900-000, Brazil, gustavotrivelin@hotmail.com

Cristiana Andrighetto (Corresponding author)

São Paulo State University (Unesp), College of Agricultural and Technological Sciences, Dracena-SP
17900-000, Brazil. e-mail: cristiana.andrighetto@unesp.br. Fone 55 18 3821-8153

Gustavo Pavan Mateus

Agência Paulista de Tecnologia dos Agronegócios – Andradina-SP 16900-970, Brazil. E-mail:
gpmateus@apta.sp.gov.br

Patrícia Aparecida da Luz

São Paulo State University (Unesp), College of Agricultural and Technological Sciences, Dracena-SP
17900-000, Brazil. e-mail: patricia.luz@unesp.br

Elaine Mendonça Bernardes

São Paulo State University (Unesp), College of Agricultural and Technological Sciences, Dracena-SP
17900-000, Brazil. e-mail:elaine.mendonca-bernardes@unesp.br

Gelci Carlos Lupatini

São Paulo State University (Unesp), College of Agricultural and Technological Sciences, Dracena-SP
17900-000, Brazil. e-mail: gelci.lupatini@unesp.br

Helena Sampaio Aranha

São Paulo State University (Unesp), College of Agricultural and Technological Sciences, Dracena-SP
17900-000, Brazil. e-mail: helena-aranha@live.com

Erikelly Aline Ribeiro Santana

São Paulo State University (Unesp), School of Veterinary Medicine and Animal Science, Botucatu-SP,
18618-000, Brazil. E-mail: erikellysantana@hotmail.com

Aline Sampaio Aranha

São Paulo State University (Unesp), College of Agricultural and Technological Sciences, Dracena-SP
17900-000, Brazil. e-mail: alinearanhassa@gmail.com

Bianca Midori Souza Sekiya

São Paulo State University (Unesp), College of Agricultural and Technological Sciences, Dracena 17900-000, Brazil e-mail: bia_souza_sekiya@hotmail.com

Juliana Mara de Freitas Santos

São Paulo State University (Unesp), College of Agricultural and Technological Sciences, Dracena 17900-000, Brazil e-mail: julianazootec@yahoo.com.br

Humberto de Jesus Eufrade-Junior

São Paulo State University (Unesp), School of Agriculture, Botucatu-SP, 18610-034, Brazil. E-mail: hdjejunior@gmail.com

Abstract

Integrated crop-livestock-forest system appears as strategy to reduce pasture recovery costs and diversify farmer's income with the sale of the wood of eucalyptus trees. The objective of this work was to evaluate the animal performance and economic viability of systems without shade availability (ICL: Integrated Crop-Livestock) and with two tree densities (ICLF-1L: Integrated Crop-Livestock-Forest, 196 trees ha-1; ICLF-3L: Integrated Crop-Livestock-Forest, 448 trees ha-1). Sixty castrated Nellore cattle were used to evaluate performance during rearing and finishing. For economic analysis, the cash receipts, cash outflow, cash flow, net cash flow and internal rate of return (IRR) were evaluated between December 2012 and June 2016. The performance of the animals was lower in ICLF-3L system (P<0.05) due to the higher density of trees, and consequently, greater shading of the pasture. In ICL and ICLF-1L systems, the revenue from soybean and corn fully paid for the costs of implementing the systems, and ICLF-1L still covered the cost of forest deployment. In ICLF-3L, the costs were almost completely covered. The reduction in the productive indices also reduced the revenue from the slaughter of cattle in ICLF-3L, with the highest revenue in ICL and ICLF-1L, respectively. In addition, the IRR in ICL and ICLF-1L was higher. ICLFs contribute to the amortization of the recovery costs of the pastures and the implantation of eucalyptus. The ICL and ICLF-1L is more economically viable than ICFL-3L until the fourth year of implementation.

Keywords: Nellore; net cash flow; productivity; sustainable system

1. Introduction

Integrated crop-livestock systems provide economic and social benefits (Müller et al., 2011), such as increased productivity, diversification of farmers' income, increased profitability and can be used from livelihood agricultural production to large farms, contributing to increased food production and reduction of hunger and poverty, which affect, currently, one billion individuals worldwide (FAO, 2016; 2017).

In Brazil, another aggravating factor are degraded pastures (those with a low forage yield per area), this has negative implications for livestock sustainability, in addition to the greater costs of establishing the pasture and fertilization. Therefore, in order to have a more positive economic return, it is very important

that these pastures are used in the most efficient way possible (Balbino et al. 2011).

In this regard, the combination of integrated crop-livestock systems may be one of the best alternatives for reduce the investments needed to form and recover pastures, once the grains produced as part of the system amortized the cost of pasture renewal (Yokohama et al., 1999), making systems of low production more economically and ecologically sustainable (Bernardi et al. 2009). However, data on systems that involve trees, as well as on the assessment of the effects of its different densities on the economic variables, are insufficient. Furthermore, there is a possibility of guaranteeing economic return from the sale of the wood.

Despite the importance of the economic dimension for decision-making, most articles on crop-livestock integration are mainly related to agronomic aspects; that is, little information has been made available that focuses on the economic aspect (Vilela et al. 2012; Moraes et al. 2014). The same is true for the crop-livestock-forest integration systems, with number of published works lower than those of the crop-livestock integration systems (Moraes et al. 2014).

Therefore, based on the assumption that the economic evaluation of integrated crop-livestock systems will contribute to a better understanding of the system and bring important information to the rural producer and to the scientific community, the objective of this work was to evaluate the animal production and economic viability of the crop-livestock integration system and crop-livestock-forest integration systems with 196 trees ha^{-1} and 448 trees ha^{-1}.

2. Materials and methods

The experiment was carried out in accordance with the established ethical principles for animal tests (Protocol No. 26/2014 - ECAU).

2.1 Area characteristics

The experiment was carried out at the Agência Paulista de Tecnologia dos Agronegócios (APTA), located in Andradina (20° 53' 38" south latitude, 51° 23' 1" west longitude, and an altitude of 400 m), west of São Paulo state. In the first half of 2012, the experiment was designed, with the choice of treatments and the division of paddocks (Table 1). In the second half of 2012, soil sampling, soil analysis, liming, plastering, fertilization and the marking of treatments to start planting eucalyptus occurred.

Table 1. Paddock and experimental area treatments.

Paddock	Area (ha)	Production system
A	1.88	ICL
B	1.95	ICL
C	1.81	ICL
D	2.04	ICL
E	2.75	ICLF-3L
F	2,03	ICLF-1L
G	2.12	ICLF-1L

H	1.97	ICLF-3L
I	2.33	ICLF-1L
J	2.13	ICLF-3L
K	2.39	ICLF-1L
L	2.31	ICLF-3L
Total	**25.71**	

ICL: Integration Crop-Livestock; ICLF-1L: Integration Crop-Livestock-Forest, with eucalyptus trees planted in single lines, the distance between each eucalyptus range being 17 m to 21 m and the distance between plants of 2 m, with a density of 196 trees.ha^{-1}; ICLF-3L: Integration Crop-Livestock-Forest, with eucalyptus trees planted in triple lines, the distance between the eucalyptus ranges being 17 m to 21 m, the distance between plants of 2 m and the distance between   eucalyptus lines of 3 m, with a density of 448 trees.ha^{-1}.

In July 2012, the soil type was conditioned based on chemical analyses (0–20 cm layer), which revealed the following attributes: pH (CaCl$_2$) 4.8; M.O. 16 g dm^{-3}; P (resin) 3 mg dm^{-3}; K+, Ca^{2+}, Mg^{2+} and H+Al 1.9, 7, 5 and 20 mmolc dm^{-3}, respectively; S-SO$_4^{2-}$ 1 mg dm^{-3} and V% (base saturation) of 42%. The clay, silt and sand contents were 107, 113 and 780 g kg^{-1}, respectively. Dolomitic limestone (PRNT 80%) was applied at a rate of 1200 kg ha^{-1} and incorporated into the soil for a saturation increase of 70% bases. Agricultural gypsum was applied totaling of 600 kg ha^{-1} to supply the sulfur required by soybean and corn crops, as recommended by Bulletin 100 for the state of São Paulo (van Raij et al., 1997). Terracing, plowing and leveling were performed to prepare the soil.

2.2 Tree planting

Trees were introduced from November 2012 to March 2013 through the manual planting of the seedlings, following the level variations present in the area (Porfírio da Silva et al. 2010). The eucalyptus clone used was the I-224 of *Eucalyptus urograndis*, for cellulose production, which is the prevailing market of region. For fertilization, 350 kg ha^{-1} of the 04-30-16 (Nitrogen-Phosphorous-Potassium) formula was used, resulting of 210 g per seedling (8.4 g N, 63 g P$_2$O$_5$, 33.6 g of K$_2$O) for each planting pit. During the top dressing phase, carried out in February 2013, 37 kg ha^{-1} of nitrogen, 3 kg ha^{-1} of zinc and 2 kg ha^{-1} of boron were used, applying 50 g of urea (23 g N), 9 g of zinc sulfate (1.8 g Zn) and 12 g borogan (1.2 g B) in the form of a crown under each eucalyptus seedling. In January 2014, another top dressing was carried out with 123 kg ha^{-1} of N and using 160 g of urea (73.6 g N) in the form of a crown under each seedling.

Weed control and selective irrigation was applied to newly planted trees as needed. Due to the high temperatures and the water deficit (summer) occurred tree replanting in beginning 2013.

In each treatment, the area occupied by eucalyptus was calculated according to the number of trees in each paddock (experimental plot). Area used was 4 m² (2 × 2) per tree in the ICLF-1L treatment (single eucalyptus lines with 196 trees ha^{-1}) and 16 m² (8 × 2) for every three seedlings in the ICLF-3L treatment (triple eucalyptus lines with 448 trees ha^{-1}). The mean area covered by eucalyptus trees was 8% for ICLF-1L and 28% for ICLF-3L. This area was used for the calculation of planting and maintenance costs and to obtain crop and livestock productivity data.

2.3. Seeding and the production of soybeans

The seeding of soybeans (cultivar BMX Power) was performed in December 2012 in all systems, totaling 400,000 seeds per ha. Soybeans were fertilized with 12 kg ha^{-1} N, 90 kg ha-1 P_2O_5 and 48 kg ha-1 K_2O. The top dressing was carried out 40 days after planting, with 200 kg ha^{-1} of the formulat 00-20-20.

The weed control in the post-emergence phase was carried out on January 24, 2013, applying herbicide based on glyphosate (Zapp QI 620) in the amount of 1,240 g i.a. ha^{-1}. During the application, cobalt-molybdenum-based fertilizer (COMO Platinum) was used for the tank mix in the amount of 150 ml ha^{-1} of the commercial product. The soybean haverst was carried out in May 2013, yielding 35 bags with 60 kg ha^{-1}. Weed control followed, using glyphosate-based herbicid (Roundup WG®) at dose of 1440 g a.i ha^{-1} and a total applied volume of 250 l ha^{-1}, by means of a tractor sprayer, using fan-type nozzles with a spacing of 0.50 m. The price of one soybean sack was taken from AgriAnual (2014). The trees were in the area when the soy was planted, therefore for the tree treatments were discounted the area occupied by eucalyptus.

2.4 Corn and pasture planting and harvesting

In December 2013, the grass was sown, using *Urochloa brizantha* (Syn. *Brachiaria brizantha*) cv. Marandu, in the amount of 8.0 kg ha^{-1} of pure and viable seeds, with a spacing of 0.20 m between rows using the no-tillage seeder model SAM 200 (Semeato Ltda., Passo Fundo, RS), driven by a tractor model TL 75 4×4.

After the grass was planted, the maize was sown, with hybrid BG 7049 (Biogene), and seeds were treated with thiametoxan insecticide (Cruiser 350) at a rate of 300 ml/100 kg of seeds. The spacing between the lines was 0.80 m, aiming to reach population density of 62,500 plants per hectare, while the fertilization of seedlings corresponded to 24.8 kg ha^{-1} of N, 86.8 kg ha^{-1} of P_2O_5 and 49.6 kg ha^{-1} of K_2O. Twenty days after the emergence of maize sprouts, a top dressing was performed, using 92 kg ha^{-1} of nitrogen.

Corn was harvested in March 2014 at the silage point, the price paid by the producer was used to calculate the crop's gross revenue. A total of 79 data points was collected on the prices of silages harvested throughout Brazil under conditions similar to those of the experiment. From this data, the average price of this product was obtained.

Maize production for silage, which was used in this work, had been previously evaluated by Domingues et al. (2017), the natural matter of ICL was 19,5 t ha-1 and 17,8 t ha^{-1} of natural matter was obtained in the ICLF-1L and ICLF-3L. The treatments with contained the arboreal component, the area occupied by eucalyptus was discounted (8% for ICLF -1L and 28% for ICLF 3L).

2.5 Animal production

In September 2014, 128 animals were introduced to the area for grazing (without a division of paddocks) for 11 days, and then 167 animals were introduced for 7 days. Land use during this period was considered to be a lease (which brought additional revenue). For this value, the average price of the lease in the region was used, provided by the Institute of Agricultural Economics in 2014 (the monthly payment was US$8.56). In addition, to facilitate calculations, the monthly lease of US$8.56 was divided by 30.4 (the average number of days in a month) to find the exact value of the daily payment, which amounted to

US$0.28/ head/day.

The corn was harvested in April 2014. The area remained untouched until the introduction of the animals. Between December 8, 2014 and January 9, 2015, the forage was standardized by means of mechanical weeding at a height of 15 cm, followed by nitrogen fertilization of 40 kg ha^{-1} of N in the form of urea. In January 2015, the Nellore steers were introduced in the area to begin the experiment.

The adopted grazing method was continuous stocking with a variable stocking rate, using the put and take technique (Mott and Lucas, 1952). In each paddock, five animal testers and a variable number of regulators were used, according to the need to adjust the stocking rate to maintain the handling goal, with a mean grass height of 30 cm; this height is within the range (20 to 40 cm) that is considered to be the ideal pasture condition (Silva 2004).

In January 2015, the rearing phase started, followed by the termination of the animals. The animals started the experiment with a mean live weight of 235.43±25.46 kg and mean age of 16±2.81 months; they were slaughtered with a mean live weight of 453.68±29.69 kg and at a mean age of 34±2.81 months. The animals received supplementation during the rainy season (January to April 2015 and November 2015 to April 2016) and dry seasons (April to November 2015), consuming 0.1% of live weight. From April to July 2016, the animals were supplemented with 0.7% concentrate of live weight (17% crude protein and 82% total digestible nutrients).

Weights were recorded every 28 days, after a fast of 16 hours. The average daily gain was obtained by the difference between the final and initial weights, divided by the number of days in the period. The live weight gain by area was calculated by multiplying the mean of the average daily gain by the average number of animals per hectare and the number of grazing days. The grazing stocking rate was also calculated during the evaluated period as the number of animals, or animal units (1 AU = 450 kg PV), divided by the grazed area. Finally, the kilograms of carcass produced per hectare was calculated as: live weight gain x carcass yield, in which the carcass yields were 57.89%, 57.97% and 57.94% for ICL, ICLF-1L and ICLF-3L, respectively, evaluated for Luz et al. (2019) with the same animals of this work.

2.6 Economic evaluation

For the economic analysis, the net cash flow of each system per period was required, so that the time factor could also be taken into account. Cash flow shows the sources and uses of cash by period and by system. The net cash flow corresponds to the balance between the sources (cash receipts) and uses (cash outflow), according Boehje and Eideman (1984). For the purposes of evaluating the systems in question, the annual cash flows of each system were analyzed. Each system was interpreted as a project, starting from the purchase of the land and ending with the sale thereof. In the present study, the possible valuation of the land was not included in the land price at the end of the period and will be subject to future analysis.

From each net cash flow, the internal rate of return (IRR) was calculated for each system, according to Noronha (1987). The IRR method of analysis takes into account the time factor and depends exclusively on the cash flow of the analyzed project (in this study, of each particular system):

$$\sum_{t=0}^{N} \pi_t (1 - \rho^*)^{-t} = 0$$

Whereby: π_t = net annual cash flow; ρ^* = internal rate of return (IRR) and t = time (in years).

All revenues and expenses that occurred in the integration systems were calculated at the time when they occurred, including estimates of the future production of wood, making possible, later the analysis of the results. The clone used in the experiment was I224, with a profile suitable for cellulose exploration. It is estimated that the wood is usually ready to be harvested in 7 years, which in our case will only occur in 2020. As the period of this study does not coincide with the maturity time of the eucalyptus to be harvested, the sale of the current available volume of wood according to the area was simulated. For the conversion of the values from real (Brazilian currency) to dollar, the average value of the dollar obtained by the Central Bank of Brazil between 2007 and 2017 was used.

2.7. Statistical analysis

For the evaluations of the animal production indices, a complete block design with three treatments and four replications was used. In each repeated treatment (paddock), five animals were used, totaling 20 animals per treatment and 60 animals for the whole experiment.

Performance data were analyzed using the MIXED procedure of SAS (SAS Institute Inc., Cary, NC, USA, 2010). We used the UNIVARIATE NORMAL procedure, and the normality of the data was confirmed using the Shapiro–Wilk test (W≥0.90). The paddock was considered the experimental unit for all studied variables and the Tukey were performed to compare averages. The effects were considered statistically significant at P<0.05.

3. Results and Discussion

With respect to animal performance, there was no significant difference between treatments in terms of average daily gain (ADG). On the other hand, there were differences between the treatments for the live weight gain by area (LWG; P=0.02), stocking rate in kg and in animal units (SR; P=0.001 in both), and kilograms of carcass produced per hectare (KCP; P=0.02; Table 2).

Table 2. Performance of Nellore cattle evaluated during the rearing and finishing phases in Integrated Crop-Livestock (ICL), Integrated Crop-Livestock-Forest, densities of 196 tree.ha^{-1} (ICLF-1L) and Integrated Crop-Livestock-Forest, densities of 448 tree.ha^{-1} (ICLF-3L).

Variables	ICL	ICLF-1L	ICLF-3L	SE	*p-value*
ADG (g)	0.48	0.46	0.47	0.012	0.974
LWG kg.ha^{-1}	690 a	619 ab	572 b	14.629	0.026
SR kg.ha^{-1}	1028 a	983 a	808 b	18.602	0.001
SR UA.ha^{-1}	2.28 a	2.18 a	1.79 b	0.041	0.001
KCP ha^{-1}	399.45 a	358.80 ab	331.35 b	8.466	0.026

ADG: Average daily gain; LWG: Living weight gain per area; SR: Stocking rate; KCP: kilograms of carcass produced per hectare. UA = Animal unit = 450 kg of live weight.

Different letters in the same line differ from each other by Tukey test (*P*<0.05).

The trees present in the pastures were proven to be efficient for helping the animals to lose heat and

regulate their body temperature (Garcia et al. 2011). However, in this study, the microclimate provided by the trees at their different densities was not a determining factor to increasing the weight gain of the animals. This can be explained by the high adaptability of zebu animals to tropical climates. As these animals have a greater number of sweat glands and a larger surface area, they are better adapted to these types of climate than European animals (Müller, 1989). A similar effect was found by Ferro et al. (2016), who evaluated the performance of Nellore cattle confined and submitted to different levels of artificial shading. As a result, the authors did not find differences in the ADG between treatments. Although higher heat tolerance was observed in adapted animals, the use of shading has still been recommended to guarantee better quality-of-life conditions for animals (Ferro et al. 2016).

The SR (both in kg and AU) was lower in the ICLF-3L treatment, compared to the ICL and ICLF-1L treatments (*P*=0.001). This occurred due to the reduction of net pasture area given by the higher density of eucalyptus and also the greater shading of the pasture. Studies indicate a decrease in the productivity of forage species when they are submitted to shade (Martuscello et al. 2009; Gobbi et al. 2009). Shading caused by trees reduces photosynthesis and carbon fixation by the plant, thus reducing the dry matter production (Castro et al. 1999). Moreover, trees compete for water and nutrients, which reduces forage production, influencing the stocking rate and, consequently, the live weight gain per area (LWG; *P*=0.02).

The KCP in ILC was higher than ILCF-3L (*P*=0.02) and ICLF-1L did not differ from both treatments. Martha Júnior et al. (2006) observed that o KCP, in ICL systems, the amplitude of weight gain in the first year of pasture varied between 135 and 600 kg of carcass per hectare per year. Considering the KCP (Table 1) in the 16 months of the experiment the gain of carcass per hectare was 399,45kg; 358,80kg and 331,35kg respectively for ILC, ICLF-1L and ICLF-3L, these data are within the standards established by Martha Júnior et al. (2006).

Tables 3, 4 and 5 show the cash flow of the ICL, ICLF-1L and ICLF-3L treatments, respectively. The introduction of the animals into the system was delayed due to a problem in the construction of the fences for the division of the paddocks and, consequently, of the treatments. During this period (November to December of 2014), the pasture was high and it was necessary to introduce the animals in the area to reduce the forage mass. A total of 128 Nellore cows, weighing approximately 450 kg each, were placed in the grazing area for 11 days, and subsequently, 166 Nellore cows grazed for 7 days, resulting in 1,408 and 1,162 animals grazing daily, respectively. In order to estimate the revenue corresponding to this period, the price of the pasture lease was taken into account. There were 2,570 animals daily, and at a value of US$0.28/day (given the monthly value of US$8.56), this provided US$719.60 of revenue, which was divided equally between all treatments.

The average production of the soybean crop was 35 bags of 60 kg per hectare. Using the price of US$22.40 per bag, which was relevant for the period, the average revenue was US$784.20, U$720,26 and U$569,11 per hectare of planted soybean, for ICL, ICLF-1L and ICLF-3L, respectively.

The maize silage resulting in a revenue of US$1,461.50, US$1,240.69 and U$ 980,33 respectively for ICL, ICLF-1L and ICLF-3L per hectare. The income obtained from corn silage was lower in the ICLF-3 L (U$980,33), which has larger number of trees that occupy more space in the area.

In relation to cash flow, the largest investment for all the evaluated systems was the fences and the purchase of animals. Table 3 shows that the sum of expenses (cash outflows) for the implementation and

maintenance of the system (soil preparation, soybean, corn and pasture) until 2014, before the entry of the animals in the systems; these were US$1,781.02 for the ICL system and revenue from soybean and maize was US$2,245.70. In systems with trees (Tables 4 and 5), taking into account the implementation and maintenance (soil preparation, soybean, corn, pasture and trees) until 2014, before the entry of the animals in the systems, the cost was US$1,889.71 for the ICLF-1L and US$1,955.14 for the ICLF-3L systems, while the revenue from the harvest of soybeans and maize was US$1,960.95 and US$1,549,44 for ICLF-1L and ICLF-3L, respectively.

When subtracting the costs for the implantation of the crop, pasture and eucalyptus (ICLF-1L and ICLF-3L) from the values of cash inflow (revenues from the sale of corn silage and soybeans), the results were US$ 464.68, US$ 71,24 and -US$ 405,70 for the ICL, ICLF-1L and ICLF-3L, respectively. In the ICL and ICLF-1L systems, the income from soybean and corn, fully paid for the implementation of the systems, while ICLF-1L still covered expenses related to the planting of the forest. In ICLF-3L, the accompanying expenses were almost completely covered, accounting for the planting of the forest.

These results confirm the findings of Bernardi et al. (2009), who stated that crop in integrated production systems has been used to amortize pasture recovery investments. These results also corroborate with Alvarenga and Noce (2005), who found that the amortization of some of the costs incurred due to the renewal of pasture is possible by producing crops, thus encouraging producers to use this technology to recover their degraded areas and increase depleted production values.

The wood production of the evaluated systems was estimated using the forest inventory. The obtained volume of wood was 16.68 m³ ha^{-1} in the ICLF-1L treatment and 38.85 m³ ha^{-1} in the ICLF-3L treatment. As the wood production of the experiment focused on wood pulp production, the average amount paid for the wood used for this purpose in the region was US$19.43 per m³. The eucalyptus crop, when considered for its wood production in the fourth evaluated year, presents a higher revenue in the ICLF-3L system (US$760,91) compared to ICLF-1L (US$330,14), due to the higher density of trees (Tables 4 and 5). With the introduction of trees, it would be possible to obtain a source of revenue over a longer period of time.

The ICLF-1L has a lower tree density, with trees occupying a smaller area in the system and influencing livestock values, such as the stocking rate, weight gain per area and kilograms of carcass produced per hectare, to a lesser extent than in ICLF-3L (Table 2). The reduction in the production indexes also decreased the revenue from the slaughter of the cattle in the ICLF-3L system (US$2,945.10), with ICL and ICLF-1L revenues close to US$3,704.48 and US$3,469.17, respectively, thus contributing to a higher net cash flow in the system with a lower density of trees (ICLF-1L; US$10,334.92) compared to the ICLF-3L (US$10,258.47) and ICL (US$10,184.08) systems.

Therefore, the IRR, which was also higher in ICL (1,89%) and ICLF-1L treatment (1,81%) than ICLF-3L (1,1%); this means that the adoption of this system should be favored, since the return was greater. The ICLF- 3L showed less IRR, because it has a larger number of trees than the other systems, which decreased the income with soybean and silage, providing less IRR. It should be noted that this treatment will have a better financial return in the long term, when the trees are cut

In all evaluated ICL systems, there was a cash flow deficit until the third year after tree planting. In fact, these years usually correspond to a period of investment in forest formation. From the fourth year,

with the sale of cattle, the cash flow started to show a surplus. Trees will be cut 6 or 7 years after being planted. Greater revenue is expected with the production of wood as trees grow and with the continuation of the productive cycles of livestock. In this regard, it is advisable to seek the ideal balance between the cultures of the system so that all the integrated components are able to produce the highest possible profitability.

Table 3. Cash flow per hectare of Integrated Crop-Livestock (ICL).

IRR = Internal Rate of Return.

YEAR	2012	2013	2014	2015	2016
			US$		
CASH RECEIPTS		784.20	1,493.00		10,559.83
Harvest Soybeans		784.20			
Corn Silage			1,461.50		
Slaughter cattle					3,704.48
Sale of land					6,855.35
Lease			31.50		
CASH OUTFLOW	7,569.50	727.44	3,274.70	232.19	375.75
Buy Land	6,855.4				
Fences			1,421.40		
Drinking troughs and tube			120.78		
Soil preparation	322.42				
Planting and maintenance Soybean	391.68	199.06			
Planting and maintenance Corn		426.99	250.07		
Planting and maintenance Pasture		101.39	89.41		
Buy Animals			1,365.60		
Feeding animals			27.44	232.19	375.75
CASH FLOW					
Accumulated Cash Flow	- 7,569.50	- 7,512.74	- 9,294.44	- 9,526.63	657.45
Net cash flow	- 7,569.50	56.76	- 1,781.70	- 232.19	10,184.08
IRR					1.89%

1   Table 4. Cash flow per hectare of Integrated Crop-Livestock-Forest, densities of 196 tree.ha^{-1} (ICLF-1L).

YEAR	2012	2013	2014	2015	2016
			US$		
CASH RECEIPTS		720.26	1,267.96		10,654.66
Harvest Soybeans		720.26			
Corn Silage			1,240,69		
Slaughter cattle					3,469.17
Sale of land					6,855.35
Lease			27.27		
Cutting of trees					330.14
CASH OUTFLOW	7,593.45	800.92	3,080.71	210.30	319.74
Buy Land	6,855.35				
Fences			1,230.18		
Drinking troughs and tube			104.52		
Soil preparation	322.42				
Planting and maintenance Trees	55.91	132.80	38.90		
Planting and maintenance Soybean	359.77	182.83			
Planting and maintenance Corn		392.17	229.68		
Planting and maintenance Pasture		93.12	82.11		
Buy Animals			1,370.48		
Feeding animals			24.84	210.30	319.74
CASH FLOW					
Accumulated Cash Flow	- 7,593.45	- 7,674.11	- 9,486.86	- 9,697.16	637.76
Net cash flow	- 7,593.45	- 80.66	- 1,812,76	- 210.30	10,334.92
IRR					1.81%

2   IRR = Internal Rate of Return.

Table 5. Cash flow per hectare of Integrated Crop-Livestock-Forest, densities of 448 tree.ha^{-1} (ICLF-3L).

YEAR	2012	2013	2014	2015	2016
			US$		
CASH RECEIPTS		569.11	1,006,71		10,561.36
Harvest Soybeans		569.11			
Corn Silage			980,33		
Slaughter cattle					2,945.10
Sale of land					6,855.35
Lease			26.38		
Cutting of trees					760,91
CASH OUTFLOW	7,603.07	862.94	2,801.04	185.39	302.89
Buy Land	6,855.35				
Fences			1,190.42		
Drinking troughs and tube			101.15		
Soil preparation	322.42				
Planting and maintenance Trees	141.04	335.03	98.14		
Planting and maintenance Soybean	284.26	144.46			
Planting and maintenance Corn		309.87	181.46		
Planting and maintenance Pasture		73.58	64.88		
Buy Animals			1,141.01		
Feeding animals			23.98	185.39	302.89
CASH FLOW					
Accumulated Cash Flow	- 7,603.07	- 7,896.90	- 9,691.23	- 9,876.62	381.85
Net cash flow	- 7,603.07	- 293.83	- 1,794.33	- 185.39	10,258.47
IRR					1.1%

IRR = Internal Rate of Return.

It is important to reiterate that the area in which the systems were deployed was degraded and was unproductive before introduction of the systems. In addition to helping to recover the investment spent on pasture recovery, the integrated systems still improved the animal production indexes and promoted the appreciation of the land, increasing its attractiveness and market value. This valuation was not incorporated into the calculations. Data focused on the recovery of pastures and, possibly, the valuation of areas, should be the subject of future analyses.

5. Conclusion

Livestock productivity is similar in ICL and ICLF-1L systems until the fourth year after implementation. In the ICLF-3L, the area occupied by eucalyptus reduces the available area, decreasing livestock production, but due to the larger number of trees in this system, it is supposed higher wood production can economically compensate this difference when the trees are ready for harvest.

Pasture implantation and recovery costs are high and the integrated crop livestock systems were effective in amortizing these costs. In the ICL and ICLF-1L, the sale of soybean and corn silage in the system implementation contributed to the total amortization of costs, it can be observed in the system with trees it was also possible to amortize the costs of eucalyptus implantation.

In the ICLF-3L, the implementation costs were higher than the other systems, due to the larger number of trees, which made it possible amortize in part the costs with the sale of corn silage and soybean. Even if there is no total amortization, the result is positive, because in conventional systems, which do not use the crop for implementation, pasture recovery and tree planting, it is necessary a high initial investment with a longer financial return.

6. Acknowledgement

7. References

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Information and Communication Technologies in Education: speeches by teachers and managers of a public school in Fortaleza, Ceara State

Dr. Marcus Henrique Linhares Ponte Filho

Professor of Institute of Educational Formation, at Federal University of Cariri – UFCA.

E-mail: marcus.henrique@ufca.edu.br

Brejo Santo, Ceara – Brazil.

Abstract

This article is a product of the author's PhD Thesis, which investigated what teachers in the early years of elementary school think (and do) about the use of Information and Communication Technologies - ICT in the educational context. The research was conducted in a public school in the city of Fortaleza, Ceara State, and the data collected consists of discussions held in focus groups, with teachers and managers of the institution. The analyses were made from theoretical references of Educommunication, a field of research in expansion in Brazil, which defends the idea that educating must necessarily be a democratic and participatory act. The prevalence among educators of a discourse of fear and control over the use of ICT in school was verified through the promotion of a centralizing and authoritarian use of ICT during classes.

Keywords: ICT; Educommunication; Teachers; Speech.

1. INTRODUCTION

The interaction maintained between the school (as an educational institution) and Information and Communication Technologies - ICT, is a relationship that seems to be established between contradictory principles: if on the one hand we have an apparently optimistic and favorable discourse for the use of ICT in the educational context, on the other hand this use still seems to arouse fears about the impact of these tools (such as the computer and television) that seem to be far from the teaching methods commonly adopted in schools (NAPOLITANO, 2007).

Some technologies, such as television and cell phones, seem to arouse even greater fears, being accused of encouraging alienating, ideological postures and inadequate to school principles. This, in itself, causes the presence of technologies in the classroom to be interpreted as something "special" or "different", its use should therefore be done in an absolutely controlled and centralized way in the figure of the teacher (ANONYMOUS, 2010).

For Educommunication (a growing field of research in Brazil), the use of technologies in an educational context does not necessarily represent a problem: what really matters is the quality of communication maintained between educators and learners during the use of technological tools. Thus, the "how is it used" is more important than "what is used", because the educational processes must be dialogical, communicative and open to reflection and questioning by the students (SOARES, 2011).

In this article, we present the results of the doctoral research done by the author with educators of Elementary School, in a public school in Fortaleza, Ceara. The data presented were obtained from discussions held in focus groups with the participants of the study that aimed to discover what teachers and managers thought about the use of ICT in the educational context and how these tools were used.

It could be seen that the use of technologies always seemed to follow a philosophy of apprehension or distrust on the part of educators and the presence of technologies in classes was always done unilaterally, without the participation of students in the construction of the activities carried out and with a mechanical approach to ICT.

Throughout the text, we will present examples of educators' discourses on the use of technologies in their classes, seeking to analyze their positions in the light of educommunicative concepts. The research was registered in the Research Ethics Committee of the Federal University of Ceará, being registered under number 1,456,208. The participation of professors and managers was kept confidential, and all the names presented in this article are fictitious, with merely illustrative function in the text.

2. THEORETICAL REFERENCE

2.1 THE RELATIONSHIP BETWEEN TECHNOLOGIES AND THE SCHOOL ENVIRONMENT IN THE FIELD OF EDUCOMMUNICATION

Educommunication is an area of research in expansion in the country that does not have a delimited concept. Although the objective of this field is clear (to improve the quality of communicative processes maintained in education), Educommunication approaches several objects of study, such as the use of technologies in educational processes, media education aiming the critical interpretation of technologies and even the authorial media production by students and teachers.

Educommunication (or "Educom", as it is also known among many researchers in the field) is not an unprecedented field of study, many scholars in Latin America have already looked at the relationships between Communication and Education, emphasizing different aspects of the relationships maintained between these two fields of knowledge.

Citelli (2011) tells us that there are various ways of looking at the study of the relations between the means of communication and formal education: for him, there is an essentially epistemological way of thinking about Educommunication, making studies about the "[...] mismatches and tensions, between communication processes and education" (CITELLI, 2011, p. 59). In addition, it is also possible to focus on other issues addressed in the relationship between Communication and Education, such as:

> [...] media-school relations, literacy for communication, critical reading of the media and the statutes that animate the teaching-learning relations now promoted by new devices for the production, circulation and reception of knowledge and information. (CITELLI, 2011, pp. 59-60).

The relationship between technologies and the field of education has been intensively researched in Latin America since the 1990s, generating research with different nomenclatures for often similar objects of study. Thus, we have an immense range of research that addresses the relations maintained between

technologies, education and the human being, such as the studies on Educommunication as a field of mediations (SOARES, 2011); the investigations on the cultural impact of new technologies on the human being (MARTIN-BARBERO, 2011); the studies of reception for the critique of the media (FÍGARO, 2011); and the proposals for the creation of a "pedagogy of communication" (PENTEADO, 2001; OROZCO-GÓMEZ, 2011). We have here a vast semantic field, and kept the appropriate differences of approach between each author cited, we have basically the same field of study.

Educommunication is giving space and autonomy for students to build their knowledge through dynamic and decentralized actions (KAPLUN, 2014). This autonomy given to students can be done with or without direct participation of technologies in educational processes; however, if used, the technological resources should serve as propellants of communication maintained between teachers and students, and not as a tool for impoverishing dialogue, something that goes against the principles of hope and valuing the student as the holder of opinions and rights (FREIRE, 2014).

3. METHODOLOGICAL PROCEDURES

3.1 FOCUS GROUPS WITH TEACHERS

In our research, we sought to understand what teachers and managers in the early years of elementary school thought about the use of technologies in the classroom. To do this, we observed teachers' classes for a period of three months. In addition, we conducted focus groups with the participants of the study. During the focus group meetings, we discussed texts related to the field of Educommunication and we did group interviews as a way of verifying what educators think about the presence of ICT in the school.

Focus groups are basically discussion groups on a given topic, where the researcher, despite acting as an interviewer, behaves more as a mediator of a group dialogue than as a one-sided intervener. According to Guedes (2003), the focus group allows the researcher to adopt a less intrusive posture, from the moment he behaves as a mediator, trying to leave the interviewees freer and calmer, without feeling pressured to declare anything they believe is necessary for the researcher.

It is important to make it clear that the focus groups did not initially intend to function as a continuing education for the research participants, the intention was to provide elements (through simple materials such as texts and videos used in the meetings) that could broaden the range of arguments of the participants regarding the object of discussion of the focus groups: the use of technologies in education. However, we have noticed throughout the focus groups that the activities carried out there were interpreted by the research participants as a kind of "continuing education" or "mini pedagogical training". In a way, this surprise that the research participants gave us confirms the thought that teacher training is not always done in an intentional or planned manner, but above all "training is also a process of human development, and therefore professional" (ALVARADO-PRADA, 2010, p. 370).

4. DISCUSSION AND RESULTS

4.1 THE PRESENCE OF ICT IN SCHOOL: FROM PROHIBITION TO INSTRUMENTAL USE

Throughout this study, we noticed that among Teachers and Managers there was a predominance of a speech of apparent approval for the use of ICT. However, this "recognition of importance", which was

given to technologies, was accompanied by an extremely limited use by school management, which directed the way (and circumstances) in which each technological tool could be used in teachers' classes.

The use of ICT (TV or computer) in the teaching process was treated as something unilateral: it was a process carried out by the Teachers and inspected by the Managers, characterizing a teaching practice deeply rooted in the concept of pedagogical planning, which is seen as a didactic safety criterion (LUCKESI, 2011).

The lack of freedom to use technological resources in their classes was expressed in the discourse of the research participants in a constant feeling of "hindrance", sometimes we see an indignation or even impotence in the statements of the teachers in front of the positions demonstrated by the school management. This indignation also generated an idea about how teachers thought that technologies should be used in the classroom.

According to Martin-Barbero (2014), the school expresses its distrust of the use of technologies in the form of control. In controlling the presence of ICT, the school seems to start from the reasoning that to use these tools it is not necessary to have previous knowledge or even to learn something specific (which suggests idleness). Thus, it would not be appropriate to use computers or televisions constantly in the school context, since this would represent a threat to the pedagogical ideals defended by the school, among them the idea that one of the school duties is precisely to combat leisure and the lack of activities to occupy time (school work). Thus, the continued use of ICT in the school environment would cause the school to lose its function of educating, because otherwise, "[...] the school - which teaches to read - would have nothing to do" (MARTIN-BARBERO, 2014, p. 50).

We see an essentially instrumental use of technologies by school teachers, besides the presence of ICT being monitored in the teachers' classes, its use took place in two ways: either as a playful tool or as a tool to approach the contents worked on the textbook.

The use of ICT as a playful tool took place in a recreation class of a participant of the study (Teacher Betsy). The school's recreation classes were moments in which the teachers in each class were free to propose activities that they considered playful for the children, not necessarily having to follow the curriculum of the pedagogical contents in the classes of the other subjects (Mathematics, Portuguese, Science, History and Geography).

In the recreation class we observed, the students were accommodated by the Teacher and the animated film "The Lady and the Tramp" from the American company Disney was shown. We watched the cartoon, and the Teacher also watched the film. During the screening, the teacher complained that it was difficult to reserve the library for her class because the school did not have a video room and the screening was done in the library or in each teacher's classroom (as long as each teacher was responsible for bringing the screening material to her classroom).

Betsy also pointed out that the school management did not approve of the use of television in the classroom and did not measure efforts to prevent this use by teachers. Still according to her, using videos during classes was seen by the management of the institution as a sign of "fatigue" or "laziness", since the management of the institution thought that teachers should teach and not simply show videos, said the Teacher.

The fact that the use of technologies is considered something "lazy" by the teachers who use them

is explained by Gauthier (2014, p. 133), when he states that modern pedagogical thinking boils down to "how to teach groups of children, during a continuous period, in a given place and making them learn more, faster and better". The school, as an educational institution, is in a hurry: a hurry to teach and to reap the results of this teaching. And from this point of view, the use of TV seems to be seen as something contrary to this principle, or at best as something that slows down teaching, precisely because it "slows down" it, since according to teacher Betsy, using TV was synonymous with "rolling lessons" for the management of the institution.

Throughout our observations we also realized that the use of ICT in the public school portrayed did not always seem to be seen in a pernicious way, in some opportunities the technologies could "save" the unjustified absence of teachers, as stated below by another research participant:

> **Teacher Mary:** "As I told you, in elementary school when a teacher is missing, management has a rule there that is a law that comes "from above", which cannot release the student for anything. So, what happens? That teacher when she's missing, that class she goes to the library. There's a movie going on. There, the school coordinator or someone goes there, she follows this class, but with the video. So the priority was for those classes that were without a teacher".
> **Researcher:** "So, when a teacher is absent, the class goes to the library so as not to be released"?
> **Teacher Mary:** "Yes".
> **Researcher:** "And she watches a video"?
> **Teacher Mary:** "A film."
> **Researcher:** "But this film is from that missing teacher's class"?
> **Teacher Mary:** "No it isn't. I don't know which ones, because I didn't have access to them, she has some films and she passes these films on to the students".
> (Group interview, 2nd Focus Group - Teacher Mary).

Mary makes it clear that the greatest concern of the school management was the occupation of the space of the institution by the students during the school term: the school (as an educational institution) has goals to be met (number of enrollments and approval rates) that directly result in the volume of investments that will be allocated to the institution itself by the Government. In order to achieve these goals, the so-called "time use" discourse is used: it is better to have a child inside the school (even if he is not attending class) than outside it, where he would be subject to the dangers of society, and to keep the students inside the school in an eventual absence of teachers, the school used any strategy, even using resources (in this case, technologies) criticized by the school itself.

For Saviani (2013), the eagerness of school managers for quantitative results is a "[...] neotechnicalism, where the decisive control shifts from process to results". This makes "the evaluation of results seek to ensure efficiency and productivity" (SAVIANI, 2013, p. 439).

We realized that the use made of television inside the school was a use that could gain any nature: playful, illustrative or instrumental. Everything depended on the context, TV was used to remedy any situation of absence or inefficiency of the school system, such as the lack of pedagogical activities within the formal school schedule, but the technologies were not used from the principle that they could be approached as integrating tools of the educational process, providing collective actions through the joint

participation of educators and students in the production of content.

For Soares (2011, p. 17-19), Educommunication works from three basic premises: 1º) to build a dialogue between the field of communication and the teaching institutions, starting from the idea that "[...] education is only possible as a communicative action"; 2º) to present itself to the public as a field of interfaces, precisely because the act of teaching is an act of communicating something, which makes the two areas (education and communication) allow, one in front of the other, to build"[...]. ...] judgements of value and indicators of evaluation, allowing each one to distinguish and affirm itself socially"; and 3º) to propose the action of Educommunication in the educational system, both in the area of school management, as well as in the disciplinary area (of contents) and transdisciplinary (in the proposal of activities involving the means of communication and digital technologies).

Thinking about the application of Educommunication (or its principles) did not seem to be a simple task for the teachers we observed in the public school of Fortaleza. The educators did not seem to be adapted to a more intense dialogue with the technologies, television and computer seemed "strange objects" to the teachers, and an educommunication approach to the technologies sounded to them as something almost inapplicable.

According to Penteado (2001), one of the ways of trying to begin the approach of Educommunication in schools could be precisely the initial reflection on the teaching practice itself, through an "autorreflection" (which would require an exercise of humility on the part of the educators). The concept defended by Penteado about what this "self-reflection" would be lies in the fact that dealing with technologies requires a recognition that these tools are already used by teachers in their classes, and this use can not always be classified as something democratic, bearing in mind that students hardly participate in the process of knowledge construction that is approached in class. The humility recommended in this self-reflection would thus consist in the recognition that a re-education regarding the use of technologies in the classroom could be possible through the generation of a new pedagogy, the so-called "pedagogy of communication," in which the teacher would need to "review himself before the other-student" (PENTEADO, 2001, p. 23).

In conversation with the Principal, we understood better what her perception of the use of ICT in her school was. On that occasion we asked the manager what she thought of the institution's teaching staff showing programs on open TV channels:

> **Researcher:** "If any teacher in the school came to work with video and used television in his class, and chose to broadcast a program of open TV channels like Globo, SBT or Record, a video, a documentary, a soap opera episode, at last, something from open TV. What would you think"?
>
> **Principal:** "As long as it was to teach something. So... that it had a feature. Why am I showing a movie? To teach it. To make the student think about it. Got it"?
>
> (Group interview, 3rd Focus Group - School Principal).

For the school's principal, television had the function of enriching the transmission of the content being worked on in the classroom. For her, the media could be used "as long as it had a function"; and the function was precisely this: to illustrate something "bigger" than the technology itself, and priority to the

school: the textbook.

We see that pedagogical planning has, in the view of the Principal, great importance for the teaching action, this is a valid concern, since planning is a primordial part of the teaching action and no pedagogical action can be developed without having been properly planned, which obviously includes the use of technological resources. However, we must emphasize the fact that from the way it was presented to us by teachers and managers, pedagogical planning seemed to be interpreted as a salvation of teaching practice through techniques for obtaining short-term results, no matter at what price (LUCKESI, 2011).

The school is an environment that works on the basis of goals, with previously defined objectives, where the professionals involved (Teachers, Coordinators, Principals) act in an attempt to shape the attitudes, behaviors and beliefs of the students based on the values propagated by the current educational system (LUCKESI, 2011). Thus, the act of using technologies must also obey this pedagogical tradition, since this codified know-how reaches not only the contents to be taught, but also all aspects of class life (TARDIFF, 2010). This, however, ends up stereotyping the function of the technologies, which when used in a delimited and controlled way in schools, start to serve as real tools for maintaining a pedagogical order that is alien to themselves, since

> [...] the means of communication enter as instruments of pedagogical action, but not as a fundamental part of one's own pedagogical being, as means that establish new dimensions of the process of expression of significant social mediations. Radio or TV are used as instrumental means of disseminating a previous theoretical proposal, where the medium itself is forgotten, except for its multiplying character and its effectiveness. (MORAN, 2001, p. 39)

4.2. EDUCOM AT SCHOOL: IDEALIZATION OR LACK OF HOPE?

When we speak of a more democratic approach to information and communication technologies and a more participatory use of them, we are referring to the application of educommunicative concepts, not only in a solitary and individual way, but as a collective, political and participatory process, offering a formation thought out in multiple dimensions, "placing communication at the service of solidarity, transversality, interdisciplinarity and citizenship" (SOARES, 2011, p. 58).

In fact, the question is not whether or not to use ICT in schools, but how to make this use something less targeted, since it is necessary that this openness to new technologies "[...] respects the educational mission of the school and the development of the student, and not caprices of society or economic issues" (KARSENTI, 2010, p. 340).

The intense clash of interests between teachers and the management of the school we visited in Fortaleza, regarding the use of technologies in the classes, seemed to lead the teachers interviewed to a kind of mental exhaustion. This exhaustion, at times, resembled discouragement; at others, it resembled a romantic vision of Educommunication. The following dialogue (conducted with teachers) presents this idealization around what Educommunication means and what it needed to be accomplished in schools. At the time, the teachers participating in the research were asked what they thought was necessary for Educommunication to be implemented in the school:

Teacher Betsy: "So, we're putting a lot of the vision of three teachers. But in the school itself we know that we would also..."

Teacher Newton: "Resistance"! (Interrupts the teacher's speech).

Teacher Betsy: "The resistance... there are teachers... we even feel this way: you brought the project, you asked us for help to do this work with Educommunication, what is left? Three teachers. How many of us are there? So there is a resistance. To get to Educommunication we have to be prepared, you know? We have to be prepared, we take even the reality of the school that we work in (another school) that has computers: everything you said there ... we do not have this room for filming, but we have computers that film, and there is resistance from teachers, there are teachers who do not use. We have computers in the classroom and there are teachers who don't use them, and still so there on the blackboard writing... do you believe that? So..."

(Group interview, 3rd Focus Group - Teacher Betsy and Teacher Newton).

The issue of teacher training was directly addressed by Teacher Betsy in her statements. For her, even if the school had an ideal infrastructure (well equipped computer rooms, sufficient TV sets for use by the whole teaching staff, etc.) the application of Educommunication would still face serious difficulties in the institution because of the resistance shown by the teachers themselves to use the technologies. In this case, we realize that Professor Betsy has linked the application of Educom to the field of ICT, when in fact the educommunicative philosophy proposes more a change of pedagogical bias than a technical field of the use of technological devices (OROZCO-GOMEZ, 2011). Nevertheless, Professor Betsy made a point of exemplifying the fact that few teachers in the school participated in the research, claiming that there was a resistance (or displeasure) of the institution's teachers with everything connected to the use of technologies.

For Teacher Betsy, applying Educommunication in school was an action that would necessarily require further training on this subject, since the teacher stressed that it was not enough to equip the institution with state-of-the-art equipment, since in her words "for Educommunication to arrive we must be prepared". This reasoning demonstrated by the teacher takes us back to the question that the application of Educom really requires a pedagogical training that enables teachers to apply it differently, in ways that are usually undemocratic by which ICT are already used in the classroom (SOARES, 2011); and in Betsy's words, she does not feel prepared to apply either Educommunication or any concept of educommunicative character that is related to the use of technologies in the classroom. It would then be necessary to have a continuous formation in Educommunication, which would not be offered only as a provisional solution on an extraordinary basis, but as something "permanent or lifelong [...] understanding in principle that the formation of these professionals does not stop with a degree and that it is necessary to update oneself to exercise the profession" (ALVARADO-PRADA, 2010, p. 376).

The discursive struggle to which the school's teachers were subjected (being in conflict with the interests of the institution's management) apparently wore them out and took away their hope for a better future, generating a pessimistic, resigned and melancholic discourse. The lack of hope in the future or in the improvement of something that is considered wrong is a hard blow on the human being, which on some occasions even makes him give up thinking about the future, proving that "the unproblematicity of the future [...] is a violent break with human nature" (FREIRE, 2014, p. 71). We have here a discourse that expresses the extremes of the situation raised: if on the one hand the teachers of the school criticized the lack of vision of the management of their institution regarding the use of technologies, on the other hand they themselves (teachers) seemed to see Educommunication as a "pedagogical salvation".

It is worth pointing out that there was no "salvation" available for the pedagogical practice of the teachers of Fortaleza, because the activity of these teachers had nothing to be "saved". To think this way is to admit that there was something wrong with the pedagogical experiences of the teachers who participated in the study, and the objective of the research was not to "save" the reality of the educators, but to understand this reality from their own speeches. Thus, there was a lot to reflect on (but not save).

The skepticism manifested in the speeches of the research participants at school shows us that there is an uncomfortable lack of hope in the teachers regarding improvements that might occur in the school, either in its physical structure or in its pedagogical nature. If for some teachers the implementation of Educommunication was seen almost as a "dream" in the discussions held in the Focus Groups, how could we face the "reality" of the teachers in that institution?

In any case, the lamentations demonstrated by the participants of this study are not without regret (from the Freirean point of view), since it is important that every teacher has hope in his teaching practice and in the improvements that the future can bring, because without hope "[...] there would be no history, but pure determinism". (FREIRE, 2014, p. 70).

5. FINAL CONSIDERATIONS

We live in a time full of stereotypes that tend to simplify and impoverish the essence of the concepts in which we deepen our reflections. In this "wave of prejudice", education and its professionals find themselves surrounded by reductionist or even redundant thoughts regarding the use of Information and Communication Technologies - ICT in educational processes.

Much is said about the importance of using new technologies in the classroom, the need to rethink pedagogical methods, the importance of making the classes "attractive"; however, even with the offer of technological apparatuses, the quality of student learning and communication maintained between teachers and students still seems to be an unknown guided by quantitative targets and rigid planning.

The melancholic view of the teachers participating in the study, regarding the use of technologies in their classes, although sincere, did not cease to be somewhat stereotypical: while the participants were indignant and dissatisfied with the control that was exercised by the school management regarding the use of ICT, the teachers also demonstrated technicalist ideas regarding the use of the technologies themselves, taking a mechanical and undemocratic approach to technological tools.

We still perceive a distance between teaching practice and Educommunication (as a pedagogical and research field). The school still faces the presence of technologies in its premises with discord and a certain severity; this mistrust is due to the fact that ICT call for themselves many obligations that the school considers exclusively of it.

In this eventual "ideological war", the school institution only tends to lose out, since the action of ICT extends beyond the school walls. In this case, it would be up to the school itself to review its ideological and defensive positions towards ICT: how could the use of these technologies be done in a non-technical way? How could technological resources be seen as something more than a tool for "retransmitting content"? What can be done not to present the computer and TV as "enemies of education"? These are the questions that need to be asked about the relationship between ICT and education.

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Analysis of kefir information propagated in digital media

Luana Carolina Manara

Nutrition Course, Unimogi, Mogi Guaçu, São Paulo, Brazil

Janaína Aparecida Saulino Fagundes

Nutrition Course, Unimogi, Mogi Guaçu, São Paulo, Brazil

Prof. Dr. Daniele Flaviane Mendes Camargo

Nutrition Course, Unimogi, Mogi Guaçu, São Paulo, Brazil

Prof. Dr. Ana Lúcia Alves Caram

Nutrition Course, Unimogi, Mogi Guaçu, São Paulo, Brazil

Prof. Dr. Mõnica Roberta Mazalli

Faculty of Animal Science and Food Engineering, University of São Paulo, Pirassununga, São Paulo, Brazil

Prof. Dr. Eliana Setsuko Kamimura

Faculty of Animal Science and Food Engineering, University of São Paulo, Pirassununga, São Paulo, Brazil

Prof. Dr. Rafael Resende Maldonado (Corresponding author)

Food Department, Technical College of Campinas, University of Campinas, Campinas, São Paulo, Brazil
e-mail: ratafta@unicamp.br

Abstract

The amount of available information in the media grows continuously and, frequently, it does not have a basis in the scientific literature. In the area of food and nutrition, the contents are available on social media profiles, websites and blogs, which usually appoint some foods as "superfoods" – able of curing diseases or inhibiting their development –   or, on the other hand, classifying other foods as the cause of damage to health. Kefir-based products can be classified in the first category, being considered a "superfood" by the media. Thus, the aim of this study is to search for information about kefir in digital media and to evaluate such information based on scientific articles. The contents were collected from 50 websites or blogs, using Google as a search tool. The data obtained were divided into 25 positive categories and 5 negative categories. One made a comparison with the scientific literature. Analyzing the information about kefir, the majority has a scientific basis, however, digital media put the research data in a superficial way, without clear information to readers.

Keywords: Kefir; fermented milk; media; health benefits.

1. Introduction

The consumption of natural products has been gaining prominence in nutrition and human health, among them, especially fermented milks produced by microorganisms through the fermentation of milk. These have therapeutic properties because in their composition they contain bacteria such as *Lactobacillus* and *Bifidobacterium* that have characteristics of probiotics. They are being used to promote effects on the health of the consumers, such as relief in lactose intolerance, action against pathogenic microorganisms, anticarcinogenic action and modulation of immune system, among other benefits [1, 2].

Among fermented milk products, kefir is a well-known food in many regions of the world and has become popular in Brazil. Kefir was originated in the Caucasus Mountains and it is traditionally consumed in the Czech Republic, Poland, Slovakia, Bulgaria and Hungary. Its characteristics are yellowish color, balanced and fermentative aroma. The flavor is acid but refreshing, and its texture is quite thick [3].

Kefir is a fermented product mainly obtained from milk through the action of kefir grains, which are symbiotic associations between microorganisms, including: yeasts, lactic acid and acetic acid bacteria coated with polysaccharides known as kefiran, which surrounds and maintains the kefir microbiota immobilized on the grains and ensuring its preservation. This can be fermented in goat, sheep, cow or buffalo milk, and also in soy extract. This drink is rich in carbon dioxide, vitamin B12 and polysaccharides that grant particular sensory characteristics. Lactic acid acts as a natural preservative, so kefir becomes a safe product for consumption [4-6].

This fermented milk differs from other because it has in its composition several microorganisms with potential probiotic capacity, that is, in its composition there are live microorganisms that, when administered in adequate doses, are able to improve the intestinal microbiota, consequently generating beneficial effects to the health of the consumer. Lactobacilli are present in greater quantities in kefir grains, however, the composition of the grains varies according to their origin, time of use, the substrate that will be used for fermentation and care in handling [7-9].

To be considered probiotics, microorganisms must survive stomach conditions and colonize the intestine - by adhering to the intestinal epithelium - and they must have the capacity to produce antimicrobial compounds and remain in the intestine when exposed to bile. In the food industry, the use of probiotic cultures with appropriate technological properties (a good multiplication), promoting appropriate sensory characteristics in the product. These microorganisms must be invariable during storage, and can thus be manipulated and added to food products without losing their functionality, resulting in products with adequate consistency and aroma [10].

Besides improving the intestinal flora, other benefits of kefir are: reduction of the effects of lactose intolerance, immunomodulation, defense against pathogenic microorganisms, cholesterol modulation, anticarcinogenic action, reduction of chronic disease risks and prevention of metabolic and gastrointestinal diseases, ischemic heart disease, allergies and hypertension [11, 12].

The consumption of kefir has been increasing around the world due to the promotion of well-being and health [7, 13]. Therefore, it is possible to find numerous articles about the benefits of kefir in wellbeing

area in digital media. However, none of this information goes through inspections before publishing and they may be vague, with few details or even flawed and with difficult comprehension to the ordinary readers, especially when is necessary to distinguish what is real and what is not well established [14].

Media plays an important role in society. Media can be understood as means of communication and information that include books, magazines, newspapers, press, radio, television, internet, cinema, posters, pamphlets and other means of disseminating information. The media is a way that helps in receiving and transmitting information, therefore, it helps in global communication. The way that the media uses to propagate its information, constitutes instruments that formulate and enable the individuals to create opinions, knowledge, values and norms. Media uses strategies that direct the message to the interlocutor, significantly influencing consumption, one of these consumptions can be the food habit that receives influences from lifestyle, cultural values and knowledge about food [15, 16].

Individuals in developing countries are the ones who seek the most for healthy food, with consumers paying more for foods that provide greater health benefits. Most consumers have been buying and looking for foods that have nutritional appeals like the ones that claim to have low fat levels, low cholesterol, and low sodium or originated from natural ingredients. However, when the nutritional table is presented, individuals have difficulties to understand it. According to the Comitê Gestor de Internet (Brazilian Internet Steering Committee), known as CGI, "health" is one of the topics that has received the most access, posts and sharing in recent times in Brazil. The search for health information is the second interest of Brazilians, this interest may be related to the fact that individuals have been concerned with health in recent years [17, 18].

The media induce the consumption of food, as the act of feeding involves both the individual's need and desire. Nowadays the media (mainly digital media) represents a great source of information, transmitting how people behave, dress, how they think and what they eat, constructing and deconstructing behaviors, including feeding habits [19, 20].

Due to the freedom present on the internet, any individual can produce information, therefore, health issues can be found on non-governmental and governmental websites, on social networks among patients and professionals. Thus, the dissemination of news may be incomplete, with little information, contradictory or incorrect, or else be correct and difficult to understand [17].

Therefore, considering that kefir is a probiotic potential and that it has several properties that confer health benefits and most consumers obtain information on digital media, the objective of this study is to compare the nutritional information found on digital media (websites and blogs) on kefir with the information presented in scientific articles.

2. Methodology

The study was carried out by collecting information found on digital media about kefir. Positive and negative points about kefir were analyzed in 50 digital sources, which are non-specialized websites and blogs, using general search tools, in Google. One excluded from the study the sales websites, advertisements and videos. After data collection, the information was tabulated, grouping them into categories (positive or negative), then the percentage of frequency with which each appeared was calculated

[21].

After collecting and systematizing the data, one carried out a bibliographic search in scientific studies in order to analyze whether the information found in the digital media about kefir has scientific basis or not. The articles for analysis were collected in the databases *Pubmed*, *Scientific Electronic Library Online - Scielo* and *Google Scholar* using the descriptors "kefir", "fermented milk", "media", "benefits" and "health", including articles published until the first semester of 2019. Finally, one performed an analysis on the contents found, identifying which information had and which did not have a scientific basis.

3. Results and Discussion

After the data collected on digital media, the information was grouped into 25 positive categories and 5 negative categories according to the information of the presence of kefir in the diet. **Table 1** lists the positive and negative categories that one considered in the study, with the frequency that each one appeared expressed in **Figures 1 and 2.**

Table 1. Information categories about kefir on digital media

Positive Categories	Negative Categories
1. Restores and balances the intestinal microbiota	1 - Contraindicated for people who have digestive disorders
2 - Benefits the immune system	2 - Not recommended for lactose intolerants
3 – Combat inflammatory process	3 - Liver overload, due to the presence of alcohol
4 – Antiallergic properties	4 - Not suitable for those who use medicines
5 – Reduction of lactose intolerance symptoms	5 - Not suitable for people with weakened immune system
6 – Reduction of cholesterol	
7 – Assists weight lost	
8 – Anticancer properties	
9 - Combat osteoporosis	
10 – Helps fighting against depression, insomnia and anxiety	
11 – Benefits digestion process	
12 – Antioxidant	
13 - Antibacterial, antifungal and antimicrobial properties	

14 – Improves nutrients absorption	
15 – Controls high blood pressure	
16 – Benefits vagina health	
17- Reduction of glycaemia	
18 – Maintains healthy skin, hair and nails	
19 – Reduces fat liver	
20 – Promotes sense of satiety	
21 – Prevents heart diseases	
22 – Helps healing process	
23 – Benefits people that use medicines	
24 – Helps combating Crohn's disease	
25 – Helps muscle construction due to large amount of protein	

Source: Authors, 2020.
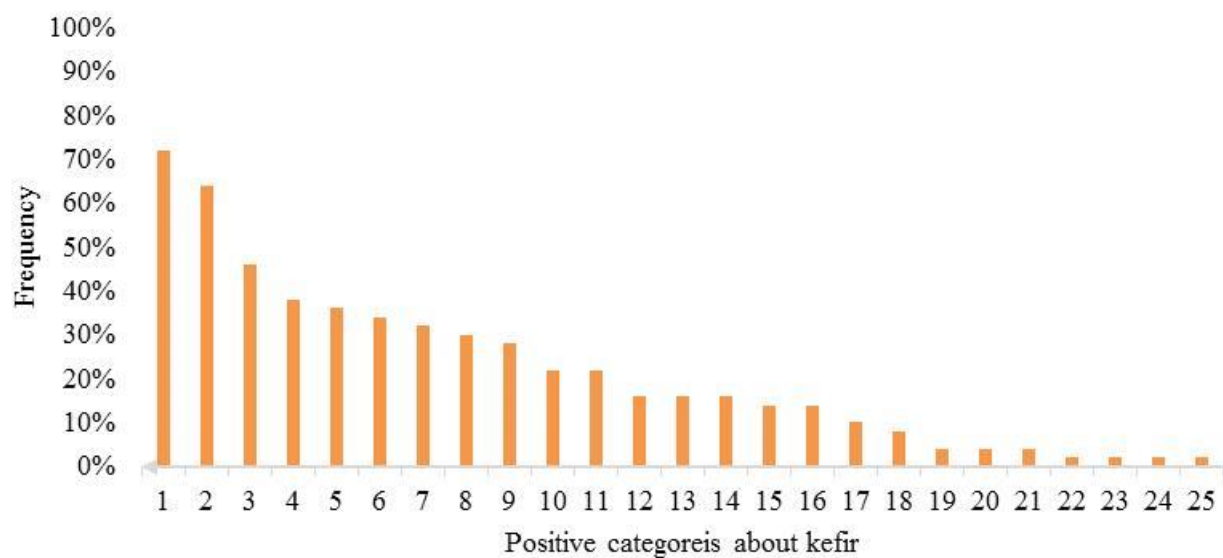
Figure 1. Frequency of positive categories about kefir information.
Source: Authors, 2020.
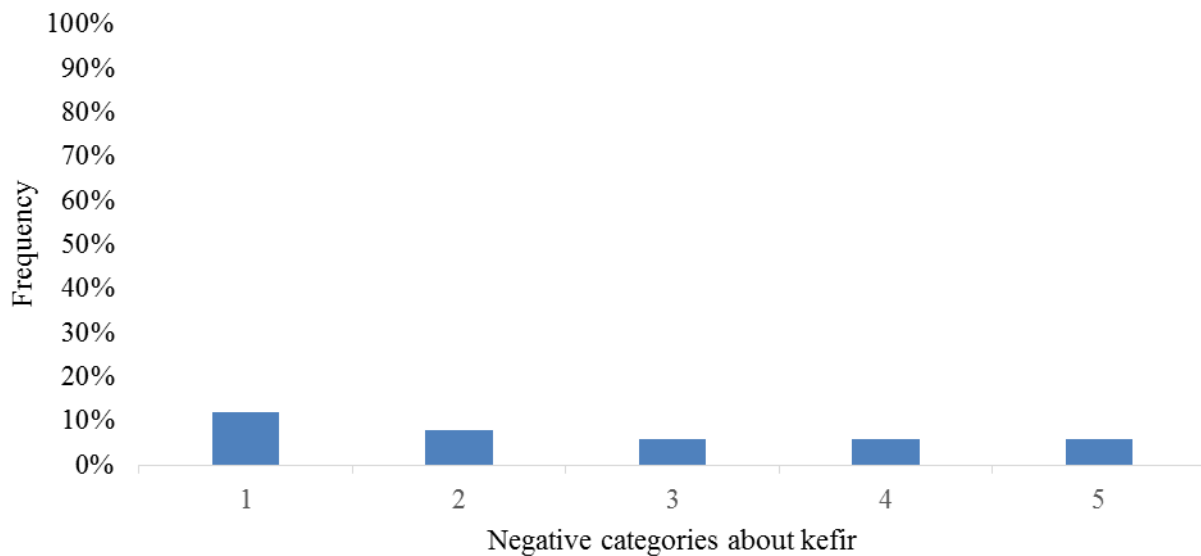
Figure 2. Frequency of positive categories about kefir information.
Source: Authors, 2020.

Based on the data found, it was possible to verify that in digital media (websites or blogs) there is more positive than negative nutritional information about kefir in food, both in the categorization and in the frequency that each information appears. The positive categories found from 1 to 8 and categories from 1 to 2 were the ones that appeared most frequently.

When analyzing the content, one can note that some information are contradictory, for example, there is a mention to kefir as helping the immune system versus not indicated for people with weakened immune systems; reducing symptoms of lactose intolerance *versus* not recommended for lactose intolerants; reduction of liver fat *versus* liver overload; bringing benefits to those who use medicines *versus* not indicated for those who use medicines; benefit digestion *versus* contraindicated for people who have digestive disorders. These discrepancies in the information already characterize a problem for individuals who seek information about kefir, because depending on the source that was consulted and the level of knowledge to discern the content, the reader may obtain erroneous information about the benefits or harms of kefir in the human diet.

The kefir has in its composition microorganisms that bring beneficial effects to the health of its consumers, effects that were highlighted in this study to compare information from digital media and data present in the scientific literature. However, the information found in the scientific literature indicates that studies with kefir present interventions in small groups and for short periods, with more studies on animals than on humans, and the study designs often lack clarity, causing difficulty to the reader in interpreting the data. In addition, the conflicts found in the study may be due to the type of stump used, the fermentation conditions to which the product was submitted, the lack of standardization in kefir cultures and the dose that was administered; so there are many factors that can affect the results. Therefore, it is necessary to carry out well-designed studies on this topic to a better comprehension of kefir effects.

The categories that appeared most frequently were compared with some studies found in the scientific literature.

3.1 Restores and balances the intestinal microbiota

A study was conducted on 20 patients with functional constipation. They were divided into two groups: 10 patients in the normal transit group (NT) and 10 patients in the slow transit group (ST). All patients received 500 mL/day of kefir for 4 weeks. Stool frequency, stool consistency, degree of effort and laxative consumption were registered in the patients' diary [22].

Another study was carried out with 45 patients, 23 men and 22 women. They were divided into two groups: 25 for the treatment group for Inflammatory Bowel Disease and 20 for the control group, with the aim of analyzing the effects of kefir consumption on fecal microflora and on symptoms of patients with inflammatory bowel disease. Patients were given 400 mL/day of kefir, twice daily for 4 weeks. The control group did not consume placebo because it was not possible to prepare a product similar to kefir. Yogurts are similar to kefir, however they also have *Lactobacillus* which can affect the microbiota [23].

In the study developed by Erdogan et al. [24] 30 mice were divided into a control group (CK), which received a placebo; kefir group (GK) and kefir group of initial culture (SK). The animals received 0.3 mL/day of kefir via oral gavage for 15 days and 0.3 mL of sterile water.

In a study carried out with 125 children aged 1 to 5 years, 61 children in the active group received 150 mL of kefir, and 64 children in the placebo group received 150 mL of heat-treated drink to damage all *Lactobacillus* cultures. Both products had a lemon flavor and the same texture and appearance. These children used antibiotic drugs to treat respiratory tract infections. This study lasted for 2 weeks and children could not consume another type of dairy product, neither fermented nor probiotics [25].

After collecting the data, one analyzed that the information on this topic presented in digital media appeared more frequently, in a percentage of 72% in our research. The scientific literature reveal some studies that show that kefir is effective in restoring and balancing the intestinal flora, showing that the information present in the digital media has a scientific basis. In the study developed by Turan et al. [22], kefir significantly treated constipation, and the patients showed improvement in stool consistency and less effort in bowel movements. In the study conducted by Yilmaz, Dollar & Ozipinar [23], the objective was to analyze whether the kefir fermentation was effective in Inflammatory Bowel Disease.   The individuals undergoing treatment obtained a reduction in pro inflammatory factors; in addition, symptoms such as swelling were reduced. According to Erdogan et al. [24], the consumption of kefir provided an increase in lactic acid bacteria (LAB) in the intestine, in addition to surviving stomach acid, allowing improvement in the intestinal microbiota. On the other hand, in the study developed by Merenstein et al. [25], when analyzing whether kefir consumption would reduce diarrhea in children who use antibiotics, one found that there were no improvements in the symptoms of diarrhea, vomiting and fever. In this study, kefir was not effective as a treatment. adjuvant for individuals using antibiotics.

3.2 Benefits to immune system

Medrano et al. [26] conducted a study on the effect of Kefiran on immune cells. In this research, 6 to 8-week-old mice were divided into groups (control and experimental) of 5 to 7 animals. One administrated the international diet and water *ad libitum* to the control group and for the experimental group, Kefiran (300 mg/L) was administered, with 0.9 to 1.2 mg/day of kefiran for each mouse, and water *ad libitum*. The experiment lasted for 7 days.

Another study was carried out with 5 groups composed of 3 healthy women. For 4 days, they received the following diets: K (control group), P1 (treatment group with 0.5% concentration kefir), P2 (treatment group with 1% concentration kefir), P3 (kefir treatment group of 2% concentration), P4 (kefir treatment group of 5% concentration). The results were examined by the percentage of cells T CD4 + T CD8 + IFN-Y, IL-4 and levels of IL-2, IL-10 [27].

In our study, we analyzed that the media has information about the topic "kefir helps the Immune System" with a frequency of 64%. Medrano et al. [26] found that the consumption of kefiran is an efficient immunomodulator capable of improving the immune response by increasing the immunoglobulin-IgA cells, which is an antibody that acts to protect against the proliferation of viruses and bacteria. Another study by Wisudanti [27] showed that there was an increase in the stimulation of Interleukin - IL-10, which has the function of inhibiting inflammatory factors, in addition to assisting in the secretion of pro-inflammatory cytokines IFN-Y and IL-4. These results show that kefir has the ability to modify the balance of immune cells.

3.3 Combats inflammatory processes

Chen et al. [28] developed a study using female mice, (group 1) with 6 animals, and (group 2) with 8 animals. Group 1 received 10^7 *Lactobacilus Kefiranofaciens* M1, another group received 10^8 *Lactobacilus Kefiranofaciens* M1 daily for 14 days, and in the last 7 days, 2% Dextran Sodium Sulfate (DSS) was added to the water to induce colitis.

Another study was carried out with healthy, 4-week-old male mice, with the objective of evaluating the properties of kefir together with changes in the gut microbiota. The animals were divided into 2 groups of 12 animals each, the LK group received 10^8 CFU of *Lactobacilus de kefiri* via gavage, and the PBS (control group) received the placebo [29].

In the study developed by Chen et al. [28], the animals that received the treatment had their intestinal barrier restored, in addition to reducing pro-inflammatory factors by increasing the Interleukin IL-10. In another study by Carasi et al. [29], the treatment with the probiotic increased the Immunoglobulin - IgA in the feces, reducing pro-inflammatory mediators, inducing Interleukin - IL-6. Analyzed samples collected from the ileum and the colon demonstrated anti-inflammatory effects. Therefore, both studies show that kefir is important in the regulation of intestinal homeostasis. On websites and blogs, the combat against the inflammatory process appeared in 46% of the analyzed data.

3.4 Antiallergic properties

A study carried out with mice, with serological tracking of similar respiratory pathogens, the mice were sensitized by ovalbumin via air, which was emulsified in 2 mg of aluminum hydroxide. Three times every 24 hours, 50mg of kefir was administered intragastrically. The levels of Interleukins IL-4, IL-13 and levels of Immunoglobulin E - IgE were reduced [30].

Another research performed by Hong et al. [31], with the objective of evaluating the antiallergic properties of kefir, used mice that received 20mg of ovalbumin intraperitoneally. In addition to receiving a bottle of kefir with 1.5 x 10^7, 3 x10^7, 6 x10^7 UFC/day.

Theme 4 appeared in our study in 38% of searches on digital media. One can see that, in the study

performed by Lee et al. [30], the consumption of kefir inhibited inflammatory cells, in addition to improving the airway that was sensitized by ovalbumin. In the study by Hong et al. [31], kefir inhibited the production of immunoglobulin-IgE in response to ovalbumin, playing an important role in antiallergic activity.

3.5 Reduction of lactose intolerance symptoms

Vrese et al. [32] conducted a study with the objective of evaluating the lactose present in kefir fermentations. The research used 10 pigs fed with kefir and an increase in plasma galactose was related.

Another study with 15 participants, 8 men and 7 women with lactose intolerance, consumed 5 different types of dairy products (plain kefir, raspberry flavored kefir, plain yogurt and raspberry flavored yogurt) administered on 5 different occasions. The tests were administered to the participants in random orders [33].

In the bibliographic reviews carried out by Rosa et al. [34] and by Ahmed et al. [35], one reported that there are only a few studies on kefir in lactose intolerance. They show that after the fermentation period, there is a reduction in lactose due to enzymes that are released by the microorganisms present in the kefir grains. In the present study, no recent research on this topic was found. In the research carried out by Vrese et al. [32] kefir administered to pigs favored intestinal hydrolysis of lactose due to the increase in galactose and consequently the enzyme p-galactosidase used in the break of lactose. Another study by Hertzler & Clancy [33] showed that kefir and yogurt are supported by patients who have lactose intolerance, as it has a reduction in hydrogen, in addition to decreasing of individuals' flatulence (around 50 to 70%), when compared to milk. Some sites and blogs show on their pages that kefir can be a good association for those who have lactose intolerance. This information was present in 34% of performed searches.

3.6 Reduction of cholesterol

Huang et al. [36] developed a study with the objective of evaluating the hypocholesterolemic activity of *Lactobacillus plantarum* isolated from kefir grain. Twenty mice were fed with diets rich in cholesterol. They were divided into 2 groups: the group 1 received a high cholesterol diet, and the group 2 received a high cholesterol diet plus *Lactobacillus plantarum* isolated from kefir during 4 weeks.

Zheng et al. [37] evaluated the functional properties of lactic acid bacteria isolated from kefir grains. They used 40 mice divided into 4 groups of 10 animals each. The group 1 (control) received a high cholesterol diet plus placebo; group 2 (LA15) received a high cholesterol diet plus *Lactobacilus acidophilus*; group 3 (B23) received a high cholesterol diet plus *Lactobacilus plantarum;* group 4 (D17) received a diet rich in cholesterol plus *Lactobacilus kefiri* for 28 days.

Another study compared the effect of kefir and banana pulp on the serum levels of total cholesterol, High Density Lipoprotein-HDL, Low Density Lipoprotein-LDL and triglycerides. This study used 30 mice divided into 5 groups. During 21 days, these animals received hypercholesterolemic diets, except the control group. The animals received the following diets: GC group received a standard diet; HIP group received a hypercholesterolemic diet;, F group F received a hypercholesterolemic diet plus 1% banana peel flour and 7% banana pulp flour; Q group received a hypercholesterolemic diet plus kefir by oral infusion, and the group FQ received a hypercholesterolemic diet plus 1% banana peel flour and 7% banana pulp

flour, plus kefir 1.5 mL/animal [38].

Topic 6 was present in 34% of the digital media surveyed, and the studies above show that kefir has a beneficial effect in reducing cholesterol levels. Huang et al. [36] observed a significant reduction in total cholesterol levels in mice fed with a diet rich in *Lactobacillus plantarum*, in addition, there were decreasing liver fat and triglycerides. Zheng et al. [37] analyzed the properties of kefir fermented with different strains showed that all kefir cultures have the capacity and reduction of total cholesterol, triglycerides and Low Density Lipoproteins (LDL). The animals also showed an increase in High Lipoprotein Density (HDL), and the levels of fecal cholesterol and bile acid also increased in the feces of these animals after supplementation with kefir. This shows that kefir can be used as a probiotic potential. In the study developed by Angelis-Pereira et al. [38], supplementing animals with bananas did not affect HDL and LDL cholesterol levels, but reduced triglyceride levels by 22%. However, kefir showed a reduction in levels of total cholesterol and low-density lipoproteins and triglycerides, increasing HDL levels. Animals that received diets high in cholesterol showed a reduction in total cholesterol, in addition to decreasing triglycerides compared to the control group, such results show that kefir can have a beneficial effect in preventing or reducing these diseases.

3.7 Assists weight loss

A study was carried out with 75 women aged 25 to 45 years. The participants were divided into 3 groups: group 1 (control) received a diet of two portions of dairy products with low fat content, in addition to energy maintenance foods; group 2 (milk) and group 3 (kefir), received a weight maintenance diet containing two additional servings/day of skimmed milk products or commercial kefir drink respectively. Only 58 people completed the study for 8 weeks [39].

Kim et al. [40] conducted a study to evaluate the effects of kefir on obesity and liver disease. Twenty mice were divided into two groups, and both received weekly animal feed; the kefir group received 0.2 mL of kefir orally, while the other received 0.2 mL of milk for 12 weeks.

Another study, carried out by Bourrie et al. [41], aimed to evaluate kefir's ability to control weight, using 56 mice distributed in groups. The control group(LDF) received a low-fat diet and standard rodent feed. The other groups (HDF, HDF + ICK, HDF + IR9, HDF + IR10, HDF + Ger) received a high-fat diet, which contained 40% fat supplemented with 1.25% cholesterol by weight, and kefir was administered. The study lasted 12 weeks.

Fathi et al. [39] found that both showed a reduction in waist circumference, weight and body mass index, so this shows that there were no differences between them. However, the study carried out by Kim et al. [40] found that animals supplemented with kefir reduced weight and pro-inflammatory markers, showed small accumulations of fat around the liver and improving liver damage; thus kefir showed an improvement in obesity and liver disease. Bourrie et al. [41] observed in their study that animals fed with kefir showed less weight gain, reduced levels of total cholesterol and triglycerides. In addition, they obtained evidences that kefir modulated the intestinal microbiota, which shows that this product has the capacity to improve the dysfunction associated with obesity. As this theme appears in 32% of the digital media researched, one can analyze the veracity of this information as explained above based on scientific sources.

3.8 Anticancer properties

A study with the objective of evaluating if kefir would be able to prevent pre-neoplastic lesions induced by azoxymethane (AOM) used 18 mice. The animals were divided into 3 groups of 6 animals: control group, disease group and treatment group. The control group and the treatment group received respectively 5 mL/kg of 0.9% saline solution and kefir solution once a day. For the disease group, azoxymethane (AOM) was diluted in 0.9% saline solution and injected into the animals once a week at 15 mg/kg for 2 weeks and more kefir administered via gavage. The study lasted 8 weeks [42].

Reis et al. [43] developed a study with the objective of evaluating the effect of daily kefir consumption in reducing the development of pre-neoplastic lesions in the colon of rats. They used 30 animals divided into 3 groups. In the first five weeks for the animals in the control group, 1 ml of distilled water was administered; the milk group received 1 ml of pasteurized whole milk, and the kefir group received 1 ml of milk kefir, all via gavage. In the second moment, the rats were submitted to the induction of pre-neoplastic lesions with 1,2-dimethylhydrazine. After the post-induction phase, which lasted 15 weeks, the animals continued to receive their respective treatments. The duration was 20 weeks.

In the study developed by Melo et al. [42], they showed that animals supplemented with kefir reduced the foci of aberrant crypts by 43% in height and 20% in width, proving to be effective in reducing aberrant crypts. Another study by Reis et al. [43] evaluated that kefir has the capacity to reduce 36.7% of the incidence of outbreaks of aberrant crypts in the colon of animals supplemented with the product, increasing the catalase antioxidant activity in the colon and reducing the concentration of fatty acids in the cecum feces. . These two studies show that kefir has an anticarcinogenic action. In the survey, we analyzed that this information appears in 30% of the sources.

3.9 Other studies

In a study by Ostadrahimi et al. [44] with the objective of determining the effect of kefir on the control of glucose and lipid profile of patients with Diabetes Mellitus, sixty diabetic patients aged 35 to 65 years participated in the research. They were divided into 2 groups: the kefir group received 600 ml/day of fermented milk by kefir, and the control group received 600 mL/day of traditional fermented milk, both for 8 weeks. One collected blood samples and fasting glycaemia tests, HbA1C, triglycerides, total cholesterol and High Density Lipoprotein-HDL and Low Density Lipoprotein-LDL.

Rosa et al. [45] carried out a study with the objective of verifying the toxicity of kefir, administered orally in normal doses and overdose, in addition to evaluating parameters of body weight, chemical blood hematology, bacterial translocation and integrity of the intestinal mucosa. Three groups of six animals were divided; control group received 0.7 mL/day of water; kefir group received 0.7 mL/day of kefir and Hkefir group received 3.5 mL/day of kefir administrated by tube-feeding for 4 weeks.

Another study aimed to verify the antimicrobial activity of kefir against pathogenic microorganisms. Twenty strains of lactic bacteria were isolated and their inhibition capacity was evaluated through the biocines action. The strains of *Escherichia coli*, *Staphylococcus aureus* and *Salmonella typhimurium*, were grown in soy broth. Antimicrobial activity was evaluated by the formation or not of an inhibition zone around the cavity [46].

Monteiro [47] carried out a study that aimed to analyze the effect of kefir on endothelial dysfunction

in rats with renovascular hypertension. The animals were divided into 3 groups: group 2R1C-kefir received kefir in the dose of 0.3 mL/100g; two other groups (Sham and 2R1C) also called as "vehicle groups" received whole UHT milk, all received a gavage diet for 60 days.

Ostadrahimi et al. [44] analyzed that glycated hemoglobin (HbA1C) significantly decreased in the probiotic group compared to the control group. The levels of serum triglycerides and total cholesterol, LDL and HDL did not show significant differences among the groups after the intervention. This shows that the kefir can be used as an adjunct in the treatment of diabetes. In the analysis carried out on digital media, 10% of the sources presented this information. Rosa et al. [45] analyzed in their study that the administration of kefir in normal doses and overdose did not affect animals, body weight, hematological indicators, blood chemistry and potential pathogenicity in tissues, demonstrating that the consumption of kefir in normal doses and overdose is safe, in addition to reducing cholesterol levels and improving the intestinal mucosa of animals. In the research conducted on digital media, this topic did not appear on websites and blogs, however in scientific literature, the studies show that kefir does not present any harm in overdoses.

When analyzing kefir antimicrobial activity, Tussolini et al. [45] found that 90% of 20 strains had antimicrobial action against the *Staphylococcus aureus* strain; the action against *Salmonella typhimurium* was 85%, and the action of *Escherichia coli* 95%. Therefore, it was possible to analyze that strains of lactic acid bacteria isolated from kefir grains have the capacity to inhibit pathogenic microorganisms. In our study, the antimicrobial capacity appeared in 16% of the evaluated digital material. Monteiro [47], when analyzing the effect of kefir with hypertensive rats, showed that the group under treatment with kefir obtained a reduction in mean arterial pressure. In addition to decreasing the activity of the enzyme ECA - Angiotensin-converting enzyme, improving oxidative stress. Among the analyzed sources, 14% of them reveal that kefir controls hypertension. The scientific literature above demonstrates the veracity of the information.

4. Conclusion

From the comparison made between the most frequent data obtained in digital media and the data taken from the scientific literature, it was possible to analyze that there is a large amount of positive information about kefir. The majority of the categories that appeared most often have recent articles on the beneficial effects of kefir on health. Of the 17 categories with less frequency such as "helps combating osteoporosis", "benefits digestion process", "acts as an antioxidant", "antibacterial, antifungal and antimicrobial properties", "improves nutrients absorption ", "controls high blood pressure", "benefits vaginal health", "reduction of glycaemia", "reduction of fat liver", "prevents heart diseases", "helps healing process" and "helps combating Crohn's disease", appeared in the scientific literature.

Categories such as "maintains healthy skin, hair and nails", "promotes sense of satiety", "benefits people who use medicines", "helps muscle construction due to large amount of protein", did not appear in the scientific literature, showing that the digital media analyzed do not have a scientific basis for such information, and can therefore confuse consumers, who seek to be informed through this media.

Therefore, in what was analyzed, we found that there are not many myths in the information disseminated in digital media regarding the general consumption of kefir. However, there are several cultures of kefir used by the studies, which the websites and blogs do not specify for the reading public,

not indicating, therefore, which strain should be used to obtain the   related results, making the passage of the contents to the electronic media superficially, missing the scientific content, unclear to the lay public.

However, people who seek to use this product should search scientific information or professionals who can help in the best way to consume them. They will clarify how the consumption should be, the ideal amount and how to handle the product properly.

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Evaluation of the quality of wood from naturally fallen trees in the central Amazon

Mirella Sousa Vieira1, Claudete Catanhede do Nascimento[2], Niro Higuchi[2], Karla Mazarello Maciel Pacheco[3]

1 Master's Postgraduate Program in Forestry and Environmental Sciences - PPGCIFA, Federal University of Amazonas-UFAM, Manaus/AM, Brazil (mirella.sou@gmail.com)
2Researcher at the National Institute of Amazonian Research / INPA, Manaus / AM, Brazil, 3 Federal University of Amazonas-UFAM

Abstract

The objective of this study was to assess the quality and potential of wood from naturally fallen trees in the forest for product development and to provide subsidies for the use of raw material. The inventory of fallen trees was carried out along the road from the Experimental Station of Tropical Silviculture of the National Institute for Research in the Amazon (EEST / INPA) - Nucleus ZF-2, at km 23 of the ZF-2 road that starts to the left of km 50 of Highway BR-174 (Manaus-Boa Vista).   Only trees that had fall characteristics due to natural factors, that is, that had exposed roots, were considered for the inventory. It was also stipulated as a requirement for measurement the diameter class of trees of 25 cm ≤ DBH ≤ 45 cm. From each naturally fallen tree, the diameters (largest and smallest) and their length were measured. 5cm thick discs were removed from the trees to obtain samples for scientific identification of the wood and determination of physical properties. Based on the inventory, it was identified that many of the trees naturally fallen in the forest are in good conditions of use, considering their woody material and their volume. The Alexa grandiflora species presented the highest volume with 2,788 m³ for a single tree, followed by the species Ormósia sp. with 2,287 m³ and Protium tenuifolium Engl with a volume of 1,269 m³. Regarding the health of the inventoried trees, all from the species Byrsonima crispaJuss. had no sign of degradation, followed by the species Croton lanjouwensis and Ingá sp. The most frequent class was medium density with 9 species with a variation of 0.47g/cm3 to 0.62g /cm³. Eperua schomburgkiana Benth was the most dense with 0.78g /cm³.The levels of degradation found and the intrinsic characteristics of the species did not compromise the possibilities of using this wooden product, and can represent an excellent opportunity for economic return, contributing to minimize the pressures exerted around the living forest.

Keywords: forest management, fallen tree wood, wood technology, product design.

1 INTRODUCTION

The woods of naturally fallen trees have been studied for some time, under the context of community forest management, and in Conservation Units in the Amazon. The importance of these studies encompasses both

the identification of the volume available in the forest and the development of socioeconomic alternatives for community members of Resexs. In some countries like Costa Rica, this wood is measured and estimated in forest inventories, however its evaluation in economic terms is too limited (ALONSO-MARTINEZ & BEDOYA, 1997; NASCIMENTO et al, 2010).

In Brazil, Bahia was the first Brazilian state to receive a normative act, aimed at the use of forest waste of this nature, for production purposes. And even though it is considered as one of the states that most contributed to the devastation of the Atlantic Forest according to INPI data, it obtained positive results, managing to overcome this situation. Currently, it destines this raw material mainly for the furniture sector, characterizing its products as coming from low impact processes.

Experiences like these demonstrate the excellent opportunity to work with these woods, in view of the scarcity of timber resources in various regions of the world. In addition, it is observed that the forests while managed can offer much more than the living raw material, being possible to find a large volume of wood also in the fallen wood available in the soil (HIGUCHI, 2006). In the Amazon, for example, about twenty-four trees with a diameter greater than 20 cm die per second, in one minute this number corresponds to 1,440 trees, which represents a considerable amount of wood without any use, until then (NASCIMENTO et al ., 2010).

All decaying dead matter is responsible for the emission of gases known to be responsible for the greenhouse effect, such as: carbon dioxide (CO^2), methane gas ($CH4$) and nitrous oxide ($N2O$). This phenomenon also occurs as a result of the decomposition of these trees, added to activities such as burning, burning fossil fuels and misuse of the land. However, when this organic matter is used, which significantly contributes to the amount of carbon emitted by the forest into the atmosphere, has its carbon fixed in the wood, preventing its release into the atmosphere (ROCHA, 2010).

In addition, the use of fallen wood is excellent for capturing timber resources fairly, through the use made available naturally by the forest. Making it necessary to study how much can be used and at the same time leave this raw material in the forest for the formation of nutrients in the soil.

Studies carried out in the region have already attested to the existence of a significant volume of wood available for exploration in the soil, even allowing the identification of species in the field. This is relevant, considering the commercial value of many of these, often used in local joinery. Making the investigation into its potential for indisputable use, given the existing volume of raw material found. And although many works have been experimenting with the use of fallen wood in community management practices. It is also necessary to validate products with higher added value and greater competitiveness in the wood products market.

Likewise, it is said that projects of this type have been used in other states of Brazil, however without a regulation that causes a greater impact and change in the practices of using this raw material. Only in Bahia these woods are used for the manufacture of objects of value, while in other states, such as Paraná, a state regulation, restricts the use of fallen wood for energy purposes. Thus, in view of the scarcity of this resource, mainly of some species, the use of fallen wood in the sector is urgent and must be evaluated as a way to be explored.

This investigation was supported by the existing opportunities surrounding the use of fallen wood. And in the utilization experience carried out in other states of Brazil, as well as in the results obtained in research

on the volume of fallen wood available in some regions of the Amazon. In order for these studies to provide the technical and scientific knowledge necessary to contribute to the research. However, it is necessary to emphasize that it did not aim at making a specific product, but at investigating the use of wood more widely. Aiming to obtain information and data on its quality, generating records, which favor the use of this raw material for the development of any future products.

Wood technology was also one of the main factors considered in this investigation, since some of the characteristics of wood correspond to its quality and behavior, especially when destined for making products. Among the many reasons that justify the accomplishment of this work, the incentive to form a legislation for the practices of exploration and commercial use, is one of the main ones, without disregarding the importance of the management practices in this process. Thus, it is intended to contribute to the generation of public policies that collaborate for the development of the State's timber sector in a fair manner with the forest.

2. MATERIAL AND METHODS

The inventory of fallen trees was carried out along the road from the Experimental Station of Tropical Silviculture of the National Institute for Research in the Amazon (EEST / INPA) - Nucleus ZF-2 -, at km 23 of the ZF-2 road that starts on the left of km 50 of Highway BR-174 (Manaus-Boa Vista).

The choice of this perimeter was the large number of fallen trees naturally close to the road, as well as the easier access to individuals. Only trees that had fall characteristics due to natural factors were considered for the inventory, that is, those with exposed roots, figures 1A and B. It was also stipulated as a requirement for measurement the diameter class of trees of 25 cm ≤ DBH ≤ 45 cm. Twenty-four trees in total were measured, in view of the difficulties encountered in measuring some. For although the trees were located close to the road, many of them presented unfavorable conditions to the measurements due to the way they fell.

Figure 1 - Tree fallen naturally in the forest

From each naturally fallen tree, the diameters (largest and smallest) and their length were measured. These values obtained in the measurement were used to estimate the volume of the woody material of each individual, using the Smalian equation.

VL (m^3) = (g$_1$+ g$_2$) * L/2 (1)

$g_1 = \P. D 1^2/4$

$g_2 = \P. D 2^2/4$

The use of this equation was also applied to determine the hollow (void) volume found in some trees. Thus, the real volume of the woody material was estimated through the difference in the total log volume and the hollow volume, expressed by the following equation:

$VR = V1 - V2 (m^3)$

Where:

VR (m^3) = Actual log volume

V1 (m3) = Total log volume

V2 (m3) = Total hollow volume

5cm thick discs were removed from each tree to obtain samples for scientific identification of the wood and determination of physical properties.

Determination of physical properties

Through the collected discs, 2x2x3cm specimens were prepared, properly oriented, to determine the physical properties of the wood, such as basic density and dimensional stability.

The basic density was determined as a function of the green volume, and the samples were subjected to saturation in water (immersion method by displacement of liquid). Subsequently, oven dried at a temperature of ± 103°C, to obtain the dry weight according to ABNT NBR 11,941 (2003).

The retractability of the wood was obtained from measurements on the specimens in the longitudinal, transversal and radial sections, with the aid of a digital caliper, in the saturated and kiln-dried condition. In addition to the contractions of the wood, the anisotropy coefficient was determined in each specimen in the heartwood and sapwood.

In this research, descriptive and experimental statistics were used for data analysis. While the variables studied were: volume of woody material (diameter, length of logs), physical properties (density and dimensional stability).

3. RESULTS AND DISCUSSION

In Table 1, the commercial heights and the diameter of the inventoried trees are identified, noting that the species *Byrsonima* crispa was the most frequent with three trees, followed by *Cecropia sciadophylla* with two trees.

Table 1. Species of fallen wood inventoried

Tree	Species	Family	H (m)	DBH (cm)
1	*Alexa grandiflora* Ducke	Fabaceae	18.9	82
2	*Holopyxidium latifolium*	Lecythidaceae	13.5	49
3	*Ormosia* sp	Fabaceae	-	-
4	*Byrsonima crispa*Juss	Malpighiaceae	17.17	27
5	*Byrsonima crispa*Juss.	Malpighiaceae	10.9	23
6	*Croton lanjouwensis*	Malpighiaceae	9.9	26
7	*Byrsonima crispa*Juss.	Malpighiaceae	12.2	40
8	*Miconia cf. poeppigii*	Melastomataceae	12.3	45
9	*Ocotea cf. caudata* (Neea.) Mez.	lauraceae	9.59	41
10	*Cecropia sciadophylla* Mart	Cecropiaceae	13.2	32
11	*Cecropias ciadophylla* Mart	Cecropiaceae	14	29
12	*Eperua schomburgkiana*Benth.	Caesalpiniaceae	11.95	43
13	*Protium tenuifolium*Engl.	Burseraceae	15	45
14	*Caryocar villosum* (Aubl) Pers	Caryocaraceae	8.6	28
15	*Inga* sp.	Mimosaceae	6.6	20

The heights of the trees identified ranged from 6.6 to 18.9 m, with diameters from 26 to 82 cm. However, of the 24 inventoried trees it was possible to measure the volume of only 14, given the difficulty of access for cubing. Table 2 shows the volume of the commercial shaft, hollow volume and the actual volume of each tree.

Table 2. Volumetry of inventoried trees

Tree	Species	V^1	V.M.D^2	V.R.^{3}
1	*Alexa grandiflora* Ducke	5.985	3.1978	2,788
2	*Ormosia* sp	2.546	0.2592	2,287
3	*Byrsonima crispa*Juss	0.973	-	0.973
4	*Byrsonima crispa*Juss	0.378	-	0.378
5	*Croton lanjouwensis*	0.506	-	0.506
6	*Byrsonima crispa*Juss	1.242	-	1.242
7	*Miconia cf. poeppigii*	1.150	0.4649	0.685
8	*Ocotea cf. caudata* (Neea.)	1.088	0.126	0.961
9	Mez	0.842	0.359	0.483
10	*Cecropia sciadophylla* Mart.	0.743	0.2352	0.508
11	*Cecropia sciadophylla* Mart	1.502	0.34416	1.158
12	*Eperua schomburgkiana*Benth.	1.701	0.432	1.269
13	*Protium tenuifolium*Engl	0.373	0.0086	0.1987
14	*Caryocar villosum* (Aubl) Pers	0.187	-	0.187
	Inga sp.	**19,251**	**8,527**	**10,689**
	TOTAL			

1) Cubage Volume. (2) VMD = Volume of Degraded Material. (3) VR = Real Volume.
The *Alexa grandiflora* species showed a larger volume of 2,788 m³ for a single tree, followed by the species *Ormósia* sp. with 2,287 m³ and *Protium tenuifolium* Engl with a volume of 1,269 m³. Regarding the health of the inventoried trees, it was observed that all trees of the species ByrsonimacrispaJuss. had no sign of degradation, followed by the species *Croton lanjouwensis* and *Ingá sp*. Studies carried out by Medeiros (2019) to verify the feasibility of using hollow logs wood with a sign of significant degradation of around 40% achieved a satisfactory result when using this raw material in the manufacture of real estate products with fine finishing and high added value, believing It is observed that a similar result can be verified with the wood of trees naturally fallen in the forest.

-Quality of wood of species
As for the density of the species, 13 wood species from fallen trees, had density ranging from 0.35 to 0.89 g / cm³. The greatest variation occurred with the species *Croton lanjouwensis* Jablonski., followed by the species *Byrsonima crispa* Juss in two trees.

 Table 3 shows the basic density of the 13 species of wood from fallen trees, with a variation from 0.35 to 0.89 g / cm³.

Table 3. Basic density of the 13 species of fallen tree wood.

Tree	Species	Average	Values Min.	Values Max.	CV (%)
1	*Ocotea* cf. *caudata* (Neea.) Mez.	0.35	0.31	0.39	8.57
2	*Crotonlanjouwensis*Jablonski.	0.38	0.33	0.43	10.53
3	*Crotonlanjouwensis*Jablonski.	0.42	0.31	0.48	19.05
4	*Cecropiasciadophylla* Mart.	0.47	0.41	0.54	8.51
5	*Holopyxidiumlatifolium* (AC Sm.). R. Knuth.	0.54	0.52	0.56	1.85
6	*Alexagrandiflora*Ducke.	0.54	0.52	0.57	3.70
7	*Byrsonima crispa*Juss.	0.56	0.47	0.63	12.50
8	*Inga* sp.	0.58	0.53	0.63	8.56
9	*Byrsonima crispa*Juss.	0.60	0.48	0.64	11.67
10	*Byrsonima crispa*Juss.	0.62	0.59	0.66	5.56
11	*Miconia* cf. *poeppigii*Triana.	0.67	0.62	0.71	4.48
12	*Ormosia* sp.	0.71	0.64	0.77	7.04
13	*Eperuaschomburgkiana*Benth.	0.89	0.88	0.92	2.25

In the analysis of variance, the F test was significant at a probability level of 1% ($p < .01$) for basic density among the mentioned species. Table 4 shows the comparison test of means of species with the formation of six distinct groups.

Table 4. Test for comparing the average for the basic density values.

Species	D_b (g/cm³)	Groups					
Alexa grandiflora Ducke	0.54	-	-	c	d	-	-
Holopyxidium latifolium (AC Sm.). R. Knuth.	0.54	-	-	-	d	e	-

Species	Density						
Ormosia sp.	0.71	-	B	-	-	-	-
*Byrsonima crispa*Juss.	0.62	-	B	c	d	-	-
*Byrsonima crispa*Juss.	0.56	-	-	-	d	e	-
*Crotonlanjouwensis*Jablonski.	0.38	-	-	-	-	-	f
*Byrsonima crispa*Juss.	0.60	-	B	c	d	-	-
Miconia cf. *poeppigii*Triana.	0.67	-	B	-	-	-	-
Ocotea cf. *caudata* (Neea.) Mez.	0.35	-	-	-	-	-	f
Cecropiasciadophylla Mart.	0.47	-	-	-	-	e	-
*Croton lanjouwensis*Jablonski.	0.42		-	-	-	e	f
*Eperuaschomburgkiana*Benth.	0.89	a	-	-	-	-	-
Inga sp.	0.58	-	B	c	d	-	-

Note: Equal letters mean that there is no significant difference between species.

Based on the classification proposed by the ABNT standard, only three groups were considered for the species. The first class is for low density wood, the second medium density and the third high. The most frequent class was medium density with 9 species. While the so-called low density species, they were only *Ocotea* cf. *caudata* (Neea.) Mez. (0.35g / cm³) and *Croton lanjouwensis* Jablonski (0.38g / cm³) and the *Eenthua schomburgkiana* Benth species with 0.89 g / m³.

Basic dimensional stability of wood species from fallen trees
Table 5 contains the minimum, maximum and average data contractions in the tangential and radial directions, which were considered for the determination of the anisotropy coefficient.
Table 5. Dimensional Stability

Species	Contraction								C.A.
	Tangential				Radial				
	Md	Min	Max	CV (%)	Md	Min	Max	CV (%)	
*Alexagrandiflora*Ducke.	6.82	6.45	7.53	8.94	2.72	2.17	3.10	17.65	2.5
Holopyxidiumlatifolium (AC Sm.). R. Knuth	5.74	4.65	6.47	12.89	3.86	3.31	4.32	11.66	1.5
Ormosia sp.	7.55	6.47	8.76	11.79	3.70	3.42	3.86	4.59	2.0

*Byrsonima crispa*Juss	11.75	11.28	12.50	5.57	7.13	6.91	7.35	3.14	1.6
*Byrsonima crispa*Juss	8.00	6.12	9.95	21.38	5.84	5.54	6.44	7.02	1.3
*Crotonlanjouwensis*Jablonski.	5.72	5.40	6.32	7.34	3.23	2.82	3.99	17.03	1.8
*Byrsonima crispa*Juss	8.43	6.50	9.66	14.23	4.81	4.00	5.71	15.38	1.7
Miconia cf. *poeppigii*Triana.	6.15	5.04	8.27	24.21	4.54	4.30	5.03	7.29	1.3
Ocotea cf. *caudata* (Neea.) Mez.	5.64	4.99	7.02	14.72	3.13	2.61	3.80	14.70	1.8
Cecropiasciadophylla Mart.	7.24	6.19	8.16	9.39	4.32	3.04	5.68	19,21	1.7
*Crotonlanjouwensis*Jablonski.	10.09	7.99	11.53	14,87	4.86	3.74	6.15	20.78	2.1
*Eperuaschomburgkiana*Benth.	9.75	8.95	10.55	6.67	4.95	4.58	5.38	7.68	1.9
Inga sp.	7.41	6.24	8.26	14.25	4.38	3.86	5.06	13.98	1.7

Analysis of variance was also performed for data obtained from dimensional stability. In which, the F test showed a significant difference at a confidence level of 1% probability ($p < .01$), and when the Tukey test was applied, five different groups were observed (Table 6).

Table 6. Tukey test for dimensional stability.

Species	C.A.	Groups				
*Alexagrandiflora*Ducke.	2.5	a	-	-	-	-
Holopyxidiumlatifolium (AC Sm.). R. Knuth.	1.5	-	b	c	d	-
Ormosia sp.	2.0	a	b	c	-	-
*Byrsonima crispa*Juss.	1.6	a	b	c	-	-
*Byrsonima crispa*Juss.	1.3	-	-	c	d	e
*Crotonlanjouwensis*Jablonski.	1.8	a	b	c	d	-
*Byrsonima crispa*Juss.	1.7	a	b	c	-	-
Miconia cf. *poeppigii*Triana.	1.3	-	-	-	d	e
Ocotea cf. *caudata* (Neea.) Mez.	1.8	a	b	c	-	-
Cecropiasciadophylla Mart.	1.7	a	-	-	-	e
*Crotonlanjouwensis*Jablonski.	2.1	a	b	-	-	-
*Eperuaschomburgkiana*Benth.	1.9	a	b	c	-	-

Inga sp.	1.7	-	-	c	d	e

Note: Equal letters mean that there is no significant difference between species.

The highest anisotropy coefficient ranged from 1.3 for *Byrsonina and* Miconiae2.5 for *Alexa grandiflora*, followed *by* Ormosia and croton.

These data corroborate the indication that it is possible to find a great variability of densities among the species of fallen wood available in the forest. It also reinforces the countless possibilities for using these woods, especially for product development.

Some studies show that trees with a lower diameter class decompose faster than large trees (Chambers, et al, 2000). A different result was found in this research with the *Alexa grandiflora* tree with 82cm of DBH showed a 50% degradation level.

This research also made it possible to obtain the values related to the dimensional stability of the species. According to Galvão and Jankowsky (1985), this knowledge has practical implications that make it of great importance, especially to the use of wood. And that it can collaborate for the use of species with less stability, when its characteristics are studied. This is because, stability as a physical property, is also a parameter for drying and depicts the behavior of wood with respect to its use, machining, workability.

The biggest difference between the relation of the averages obtained in the tangential and radial directions were for the species *Croton* lanjouwensis Jablonski , *Eperua* schomburgkiana Benth., *Alexagrandiflora* Ducke and *Ormosia* sp. When these absolute dimensional variations are shown to be high, it means that there may be a greater movement of wood (GALVÃO and JANKOWSKY, 1985).

Based on the range of variation of anisotropy proposed by Galvão and Jankowsky (1985), nine species in this research are classified as normal, for having anisiotropy> 1.5 <2, two stable (> 1.5) and an unstable greater than> 2.6.>> The most stable ones considered to be of excellent quality were *Byrsonima crispa*Juss. E *Miconia* cf. *poeppigii* Triana. And as unstable, differentiating itself from the other classes, the *Alexa grandiflora* Ducke species, with an absolute value of 2.9.

It is noteworthy that the class with the highest frequency observed in this research, has wide use in the timber market according to the diagnosis made by (Sousa in 2015), and currently can be identified in product development, previously developed only with high density wood.

It should also be noted that good parts of the studied species have commercial value and cost on average in the market, around R$ 800.00 per cubic meter. Which represents an economic gain, once they are managed, by the way they can be obtained without exploring the forest. Thus, the management of fallen tree wood for commercial purposes also offers a wide field for its use due to its quality. Combined with the numerous alternatives for adding value through technological insertion, transforming them into solid wood panels, floors, and even high standard furniture, which expands its potential for use and minimizes questions about its quality. The results achieved can be considered as indicators for environmental agencies to release the use of fallen tree wood on a small scale by community members, avoiding unnecessary forest exploitation.

CONCLUSION

Based on the inventory carried out, it was identified that many of the trees naturally fallen in the forest are in good conditions of use, considering their woody material and their volume.

The physical properties analyzed indicate that the wood of the quantified trees has quality for making products.

About 70% of the identified fallen tree species are traded by the timber sector in the municipality of Itacoatiara.

The levels of degradation found and the intrinsic characteristics of the selected species did not compromise the possibilities of using this wood in the manufacture of products, being able to be used in products of high commercial value.

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Method as a Creative Instrument for Researching on the Formation of the Teacher Trainer of Teachers (Mathematics)

Deise Leandra Fontana

PhD student at the Graduate Program in Education at Federal University of Paraná (UFPR). Professor at Federal Institute of Paraná (IFPR). E-mail: deise.fontana@ifpr.edu.br. +55 41 3535-1647

Ettiène Cordeiro Guérios

PhD in Education at Campinas State University (Unicamp). Professor at the Postgraduate Academic Programme and at the Postgraduate Educational Practice Programme at Federal University of Paraná (UFPR).   E-mail: ettiene@ufpr.br. +55 41 99972-2140

Abstract

This text derives from a doctoral research that investigates the aspects of education of the teacher trainer who instructs mathematics teachers. It has as main theoretical reference Gaston Pineau and Edgar Morin. The general goal of this work is to present moments of an investigative process that has as its area of study the formation of the teacher trainer who instructs mathematics teachers. The methodological assumptions include building blocks of eco-systemic and complex thoughts. The method adopted is relational between Oral History and Grounded Theory. The method unveils possible dimensions in the formation of the teacher trainer in a qualitative research. The results of this study can help to understand the nature of dimensions of the teacher trainers´ formation, which are based on their experiences with themselves, with others and with the environment.   Thus, it includes a new approach to temporalities in the formation of the teacher trainer, from the insertion of the principles of complex thoughts.

Keywords: teacher trainer; method; creative insubordination; grounded theory; oral history;

1. Introduction

This text presents extracts from a doctoral thesis that investigates the possible formative temporal movements in the formation of the teacher-trainer of teachers who teach Mathematics, thereby constituting the dimensions of teacher training. Some of the theoretical-interpretative moments of the investigative process was shared here. Firstly, it was addressed some of Pineau´s contributions to the study of the bios-logos dialectics, which is fundamental for understanding the movement of origin of life histories that are in formation.

Secondly, this paper highlights the polysemy of the oral history concept, through the knowledge of the "oral history method". Sequentially, it is presented the Grounded Theory (GT) and a general construction of this theory, from the perspective of Charmaz (2009). Therefore, the writing is moving towards the

constitution of a methodological dimension of research in a complex and creative insubordination perspective. Some gaps from previous developed studies are presented, evoking the initial theoretical assumptions. It is emphasized some central ideas of the theoretical relations constituted, and of the expectations for the continuity of this study, as a provisional conclusion.

2. Theoretical Basis

Pineau (2006) is a genealogical reference for thinking about life stories as arts that shape existence, from a synthesis of the historical panorama of dialectics that exists between discourses (logos) and life journey (bios). For the author, "[...] the terminological fluctuation around stories and life reports, biographies and autobiographies it is the indicator of a fluctuation of meanings attributed to these attempts of expressing the one´s personal temporality experienced." (Pineau, 2006, p. 42, emphasis added). These attempts reveal scientific positions and evoke science with awareness of existence.

Pineau and Le Grand (2002) conceive life stories as an autopoietic practice of research and construction of meaning which is based on personal temporal facts, and involves a process of expression of experience. Morin (2011b) addresses the essence of meaning, based on two propositions: "1. meaning is an emergency that, coming out of the activities of language, not only has an uninterrupted feedback on these activities, but constitutes its global synthetic level. [...] 2. The meaning is hologrammatic." (Morin, 2011b, p. 207-209). According to Morin (2011a) life mobilizes "[...] formidable organizational complexity" and "[...] must adapt, that is, must be inserted and integrated into its means of existence, and this means of existence, that is, the ecosystem, imposes its determinisms and influences on all living creature. " (Morin, 2011a, p. 79). Thus, the ecosystem circumscribes the expressions of life experiences.

For revealing historical background of dialectics between discourse (logos) and life journey (bios) the author cited uses Dufour´s matrix (1990 cited by Pineau, 2006). The matrix represents three major historical periods - pre- modern, modern and postmodern - and the bio-logos dialectics. The model assigns different senses (affective, connotative and cognitive), however intertwined. It seems to oscillate between two poles: the existential, of personal life journey, and that of formal signs, of transpersonal discourses. In the pre-modern vestiges of philosophical dialogues, it is perceived the different attempts of writing the self. According to the author:

> Reserved for Lyceum and a political elite as a philosophical art of knowledge and self-care, the bios develop socially in Greece and in the Roman empire as a media art of social communication for the lives of notables or people deemed exemplary. Plutarch, in the first century of our era, was considered the father of biography with his Lives of illustrious men. From the beginning, they appear the two major functions of the construction of traces of union between logos and bios: forming unique lives and communicating them socially. (Pineau, 2006, p. 47, emphasis added).

Pineau (2006) also highlights the hybrid power of writing - the written word and the appropriation of

scientific discourse - and of its appropriation for science construction. From this perspective, he remarks that the postmodern and transdisciplinary periods use multimedia forms of expression and communication, changing the bio - logos dialectics. According to the author:

> This postmodern and transdisciplinary multimedia explosion develops the more the movement of life expression by the living creatures outside the professional, scientific and political-religious spheres, which were inherited, as life itself is problematized, in all its multiple ways of living synchronously (unifying psychic, social, organic biodiversity), and diachronicly (joining before and after, memories and futures, from pre-birth to post-death). (Pineau, 2006, p. 52).

The entry of life into history proposes reflections on the new conceptual spaces that are developed in order to questioning vital problems. There are rustles of a bio-question: what is life? Is a question to be discussed in biological modernity or an original epistemological bio-obstacle? This is the challenge the author presents. In the body of the thesis there is the study of the experiences of teacher trainers who teach mathematics as a conceptual space of knowledge and training.

The research participants are teacher trainers who work in Pedagogy and / or Mathematics degree courses at private and public higher education institutions. It was adopted the geographical proximity of higher education institutions (HEIs) as inclusion criteria. Moreover, it was adopted non-signature of Informed Consent (IC) as exclusion criteria, as well as, non-performance in undergraduate courses that educate teachers who teach mathematics.

Training, seen as a relational and interdependent system, includes self-training and eco-training as opposite and complementary poles. Such discussion will not be addressed here because the main goal is to approach complementary methods as a possibility for a theorizing practice in the field of education of teacher trainer who teaches mathematics.

The life that seeks to enter in history is also that who engage in the exercise of action-training research of vital problems, building meanings and introducing temporalities. Therefore, for representing some conditions for the bio-formative exercise of the arts of existence, Pineau (2006) remarks four of the items that structure the ethical charter of the Associação Internacional das Histórias de Vida em Formação (ASIHVIF) [International Association of Life Stories in Formation]. In summary, the conditions are: a) performing a personal experiential learning – someone life story; b) establishing means and procedures for learning from researching partners; c) producing shared material forms and, d) determining work meanings, its sensitization, its orientation and its significance.

This is the basis on which it was created an investigative process that addresses creativity in an educational research dynamic, rooted on ethical bases. The constitutions of creative insubordinations are constituted by different questions, among them, the methodological positions (D'Ambrosio & Lopes, 2015). The creative insubordination resulting from this perspective can bring a dialogue between the theories of education and mathematical education for the development of research. Based on D'Ambrosio and Lopes (2015), creating in a research practice it comes from the need of promoting learning from the training of researchers into mathematics education.

The interfaces of researching with the concept of creative insubordination are revealed by admitting the principles of complex thoughts, which help us to overcome the dichotomous way of thinking of Cartesian dualities: subject-object, reason-emotion, among others (Descartes, 1996). These dualities are manifested in the modes of perception of reality.

2.1 Oral History

Pineau presents, in historical-scientific terms, the polysemy of the term life stories. In view of the use of this method in the process of developing this research, it is opportune to address an introductory reflection on the addition of "oral" to life stories. Oral history, initially conservative, around 1948, emerges at Columbia University.

> Innovations in Oral History are based on its new approach, which is aimed at the provisional historical construction of versions and new ways of thinking, feeling and knowing. These forms are explained by interviews and produced jointly by interviewer and interviewee in the face of stimuli capable of allowing the reconstruction of subjective experiences and states. These elements reveal the representations of self and reality through narrative. (Ataide, 2006, p. 314).

The oral life story allows a more subjective view of the participants' experiences, based on the records of integral and singular reports. The documents are organized during a research process and developed based on a relationship of trust and interaction between interviewer and interviewee. Ataide (2006) exposes a theoretical discussion that consolidates the interdisciplinary character of oral history.

Authors such as Meihy and Holanda (2007) present some concepts of oral history, highlighting that this is a systemic process of acquiring interviews that is registered "in the present time". Oral history, as a method, centralizes interviews as a fundamental point of analysis. In addition, according to the authors: "for being assured as a method, the interviews need to be highlighted as the nerve of the research, and on them the results are implemented. Any complementary documentary dialogues should keep an eye on the themes arising from the interviews." (Meihy & Holanda, 2007, p. 72). It is possible to think about the time of interview perceiving the intensity of this process. Le Ven, Faria and Mota (1997) reflect on the process of remembering at the time of the interview in life history. According to these authors:

> Memory is neither chronological nor linear and we perceive it as a set of experiences that take place in space and time different from the current time - in the time of "remembering". And the moment to remember implies of remembering and imagining because only some of traits of the experiences can be evoked; they will never be represented - brought into the present again - as they happened in the past. Furthermore, although we can rescue the past, there are always gaps in memory: the memory of forgetfulness. (Le Ven, Faria & Mota, 1997, pp. 214-215).

Hence, the present moment that moves the memory is the intensive interview. Past emerges from lived moment and it is expressed through signs. Besides, there is the argument about "[...] the impossibility of revisiting the recorded experience, mainly in the face of all the distance from what had happened, and the countless experiences-memories accumulated in the present." (Montenegro, 1997, p. 200). Therefore, there would be a permanent movement to give new meaning to memory, which it is also supposed to be an experimentation movement.

From this perspective, "Life history, which is defined here as searching and construction of meaning which is based on personal temporal facts, involves a process of expression of experience." (Pineau & Le Grand, 2012, p. 15). This involves the individual's place of origin and his/her extension in biosphere. The experiences captured by interviews, as a mode of expression, through a project that integrates Charmaz's grounded theory (2009) and the oral history method (HO), explain one of the basic points that distingue oral history from conventional interviews.

2.2 Grounded theory

In the middle of the 1960s', sociologists Glaser and Strauss, by opposing the methodological assumptions of that period, proposed a systematic qualitative analysis, with its own logic, which was able to generate theory. Grounded theory in its origin starts from divergent disciplinary traditions: on one hand, the positivism of Columbia University; on the other, the pragmatism of the Chicago school. Therefore, the guidelines these authors wrote about the conduction of qualitative research modified the oral tradition and made the analytical guidelines accessible.

Charmaz (2009) clarifies that the grounded theory guidelines describe the stages of the research process and provide paths to this process:

> A process consists of revealed time sequences that can have identifiable boundaries with clear beginnings and endings, and reference marks between them. Time sequences are associated with a given process and lead to modification. Thus, individual events become associated as part of a broader totality. Even the most streamlined process may surprise, because the present results from the past, but it is never quite the same. The present raises with new characteristics (Mead, 1932). Consequently, however small, experience and the result of a specific process have some degree of indeterminacy (Charmaz, 2009, p. 24).

In further accordance with the author these guidelines are used with the 21st century's assumptions and approaches. It is highlighted an overview of the construction of grounded theory, from Charmaz´s perspective (2009). It is emphasized some research moments: a) collection of relevant data, with intensive interview and textual analysis; b) codification in practice of the grounded theory - initial coding and focused coding; c) writing memos - with extensive notes; d) theoretical sampling and saturation; e) reconstruction of theory in the studies of grounded theory - concepts of theorization; f) writing for elaboration of an analysis; g) reflection on the research process.

It is sought to reveal the movement of the grounded theory process. In this regard, It is emphasized some

of the stages of analytical understandings of actions and meanings apprehended. It happens in the ongoing research, from the sensitizing concepts to the writing of the first drafts.

3. Methodological Aspect

The methodological standpoint adopted in this text contemplates the constitutive assumptions of eco-systemic and complex thoughts (Morin, 2011a). In this perspective, "[...] reality is dynamic, changeable and multidimensional, at the same time continuous and discontinuous, stable and unstable. It is an uncertain reality and of a complex nature". (Moraes; Valente, 2008, p. 19). This reality is also constituted of non-linear and self-organizing processes. Moreover, according to the authors:

> [...] from complexity, subjectivity, intersubjectivity and the active, constructive, affective and historical learner character are rescued, as well as the relational dynamics that occur between the apprentice and his/her environment. For this theoretical construction, there is no objective reality independent of subjective experience which is unconnected to circumstances surrounding the individual. Hence the importance of self-organization processes, which nourish co-determined, enactive and emerging processes, as well as of life stories and their influences in shaping research. (Moraes; Valente, 2008, p. 23).

Objectivity and subjectivity are not mutually exclusive in research practice, but instead, complementary. This understanding arises from the principle of intersubjectivity. Therefore, the knowledge resulting from research is the result of processes that involve interpretation, creation, intuition, self-organization and co-determination, on the part of researcher in relation to research object. The research practice, understood as a system of a complex nature, is nourished by an ethical principle. Thus, the importance of using instruments such as Informed Consent (IC).

The cognitive operators of Edgar Morin's complex thoughts help us to understand the developmental processes of the investigative process. Moraes and Valente (2008) emphasize the following principles in their work: a) the systemic-organizational principle, which links the knowledge of the parties to the knowledge of the whole, integrating the analytical and synthetic dimensions; b) the holographic principle, which shows the paradox of complex systems; c) the retroactive principle, which breaks with linear causality due to self-regulatory processes in the entire system; d) the recursive principle, which represents the self-organization of the system, and is characterized by an evolutionary spiral; e) the dialogical principle that constitutes the operative form of complex thoughts. They also emphasize that, in order to "think well", especially in educational research, they would add other principles, among which, the ecological principle of action, by Edgar Morin, which incorporates uncertainty as a permanent category of scientific search.

Addressing the methodological dimension, Moraes and Valente (2008) note that method illuminates the path for a researcher, that requires action strategies and procedures adaptable to reality. It results that "[...] there is a recursive relationship between theory and method, between method and strategy. In this relation method is generated by theory which, at the same time, regenerates theory itself, as well as the

methodological strategies which regenerate the method which gave rise to them." (Moraes & Valente, 2008, p. 57). Based on these assumptions, it is possible to see that different methodological perspectives can be complementary for the study of certain problems. The problem that instigates this work enables two methodological movements: one theoretical and the other interpretive-analytical. They become complementary during the process of writing the thesis.

The researcher's responsible subversion actions "[...] arise from the challenge presented to them in multiple situations for which they do not find pre-established answers". (D'Ambrosio & Lopes, 2015, p. 4). In this bias, the principle of uncertainty and openness to the new is elucidated.

Creative insubordination is also inscribed in reflective actions, committed to the improvement of the investigative and human practices. D'Ambrosio (2016) recommends us to go beyond the space of cages by instigating us to break with closed rationality. In this perspective, D'Ambrosio (2016) considers that the ideal of respect, solidarity and cooperation among all individuals and nations demands transdisciplinarity and transculturality. When approaching life and the evolution of our species D'Ambrosio (2016, p. 230) uses the following metaphor: "I accept life as the conjunction of six elements: nature, individual, other(s) and the relationships between them". In this union, the activation of this "system" is given by a pulse of survival and transcendence, as a consequence, "[...] the homo species have developed the perception of past, present and future, and resources to explain their enchainment and to comprehend and explain facts and phenomena observed in nature and in society". (D'Ambrosio, 2016, p. 232). It is thus a process of human philosophy, which has been inspired by the searching for explanations for the knowledge of a social-planetary-cosmic reality in harmony with itself, with others and with nature. Moraes (2008) specifies that Böhr's principle of complementarity helps us to fully understand the triangle of life represented by D`Ambrosio (2016). This principle shows us the interdependence and complementarity between individual, society and species. It explains dependence on the environment (ecosystem) and the context in which someone lives.

In a panel at "The Second International Conference on Creative Insubordination in Mathematics Education" (ICOCIME2), Arthur Belford Powell (2019) suggests as themes to be subverted and decolonized the ontological and epistemological positions, as well as ways to search (ways of searching). Thus, precedents are opened to question rationality and reasonableness of science.

Edgar Morin (2014b) and Paul Feyerabend (2011), for presenting distinct but complementary epistemological bases, give a possible attempt at an answer to reflect on rationality and reasonableness in science. Morin (2014b) suggests that there are, in both science and philosophy, "the thinkers of science and the thinking scientists. On the other hand, Feyerabend (2011) proposes abandoning the boundary criteria between philosophy and science. In his work "Against Method" Feyerabend presents a direct criticism of rationalism translated by "uniqueness" of the method of science, which constitutes one of the founding ideas of his theory epistemological anarchism. He suggests that all rules have their limits and that there is no encompassing rationality. From that point of view, science is plural and dynamic (with irrational components) and there is no total separation between discovery and justification context.

Lopes, Peres and Grando (2017) consider that being subversively responsible is "[...] to take curiosity as basis for knowledge production and to make its unfinished a constant searching movement". (Lopes, Peres & Grando, 2017, p. 3). In other words, it is to perceive the temporariness of all knowledge,

assuming itself as being inconclusive.

Science announces the rise of new theories that express new epistemic configurations. Some of these are the studies on Heisenberg's quantum indeterminacy with his principle of Uncertainty, Böhr's Principle of Complementarity and the different levels of reality explained by Basarab Nicolescu. These theories largely converge in the theoretical construction of Edgar Morin's complex thought.

The principle of uncertainty originates in Werner Heisenberg's mathematical elaboration in addressing the behavior of particles. According to Santos:

> The concept of uncertainty contrasts with the dichotomized dualist messages, which only prioritize the dimension that adds to construction of order, of certainty, becoming a partial, reductionist, determinist and objectivist point of view. This is the concept spread by modern science and the scientific method of proving it. Considering the principle of complementarity of opposites, the articulation of dualities (in this case, certainty and uncertainty) necessarily comes into question, and not their dichotomization. (Santos, 2009, p.30).

As made explicit in previous studies, it is necessary to confront the complexity of reality, by awakening to a self-reflexive science and open rationality (Morin, 2014b). Therefore, "[...] open reason is not only method. It is an aptitude to elaborate systems of ideas, but systems that are not given as definitively fixed and that can be remodeled". (Morin, 2014b, p. 171). And, in turn, an evolutionary reason, with invariable characteristics.

knowledge derived from this research process is explained in the adopted method and theory. The complexity of this process can be represented in the form of a recursive circle, in which organized ideas become organizing ideas and conversely (Figure 1).
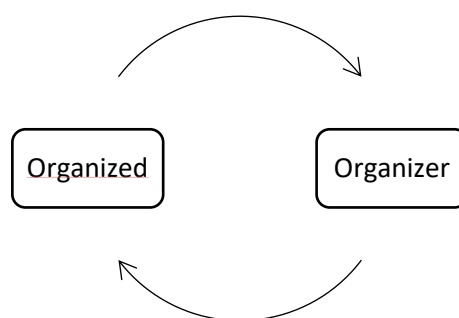
Figure 1. Knowledge organization adapted from Morin (2014b, pp. 136-137).

Morin (2014b) highlights that we find in ourselves, in the world and in life the key to complexity whereas the key to life's problem resides in the originality of the living organization.

It is thought some issues that guide the research in a transdisciplinary approach. The first question – to recognize oneself in the research process - directs us towards the self-knowledge/self-training that surrounds us. The second question - to meet again in time - reveals the relived memories and

self-reflection in our human constitution. The third question - to know the parts of a whole - is born from the understanding of the interrelationship part all in our species. The fourth question - life stories - comprises a dynamic system in which different participants and their stories interact. The fifth question - a story in formation - understands our history as a singular and emerging process. It is a moment of learning and education.

In this respect, a complex and transdisciplinary methodology is presented. But what is transdisciplinarity? Transdisciplinarity predicate an open rationality. For this, it was considered one of the articles adopted at the First World Congress on Transdisciplinarity (art. 2), since it contemplates the ontological process of research.

> Article 2 - The recognition of the existence of different reality levels, ruled by different logics is inherent to the transdisciplinary attitude. Any effort of reducing reality to a single level governed by a single logic is not in the field of transdisciplinarity (Charter of Transdisciplinarity, 1994).

It is brought the reflections of Guérios (2019), in an articulated manner, by presenting the corollary that it is not enough to know, it is necessary to think. It is thought this way from a complex and transdisciplinary perspective. To which degree do the different levels of reality translate the different dimensions of the trainer education? What does the existence of different levels of reality has to do with the process of knowledge construction? It is recognized a multidimensional reality that goes beyond classical thinking and that embraces the possibility of the existence of interconnections.

Moraes (2008) reflects about the multidimensionality of being and reality. According to him:

> Although there are different levels of reality, each phenomenon, event or process manifests itself from what the observer can perceive, interpret, construct, deconstruct or reconstruct. Such multidimensional reality can no longer be divided into organic and inorganic, into animated or non-animated, since the real is made up of dynamic beams of energy and standards of interconnections. Therefore, the capacity of perceiving each level of reality depends on the levels of perception of each observer and their developing consciousness (Moraes, 2008, p. 88).

In this regard, reality and the human being (part of this reality) operate from a complex engineering, disclosed in the representation of Figure 1. The human being is a complex, integral being, in whose dimensions of being and doing are mutually nourished by the act of thinking and acting. In this respect, being and reality would be irreducibly intertwined.

> The learner, in his/her relationships with reality, participates with all integrity, nourished by emotions, intuitions, desires and affections, which are inseparable from his/her life story. In one' s learning processes mind and body, reason,

emotion and intuition are no longer separated, as well as past, present and future. (Moraes, 2008, pp. 88-89).

Based on cognitive operators of complex thought, complexity and transdisciplinarity develop the epistemological scenario of the research. In this sense, the cognitive operators of complex thought help us to understand the complexity of reality. Transdisciplinarity as an epistemological principle makes it possible to experience dynamic and relational thinking seeking to overcome the frontiers of knowledge by integrating concepts and methods.

3.1 Data Description and Analysis

The early study of this research was a systematic review of key terms, which included: self-training; ecotraining or eco-training; self-eco-organization. This initial search was conducted in three databases: Education Resources Information Center (ERIC); Periodical Portal of the Coordination for the Improvement of Higher Education Personnel (CAPES) and Scientific Electronic Library Online (SciELO). A protocol designed for this work was used   for analyzing 39 documents that had been found. Afterwards, a new systematic review was developed in the database of the Brazilian Digital Library of Theses and Dissertations (BDTD), complementing the initial study. This allowed new analyses and the inclusion of 49 new documents. In in the second phase of this researchsanalyzed what had been produced by the graduate programs. There is a lack and/or invisibility of investigations in the field of teacher training during the search process when it is included the key terms elucidated in the different phases of the systematic review.

The ongoing theoretical study will enable a comprehension of the possible relationships between Pineau´s and Morin´s theories, and between the theory resulting from the empirical practices adopted in this research. The focus lies on the formation of the teacher trainer of teachers who instructs mathematics. The objective is to reveal possible dimensions of this formation. Therefore, Box 1 represents the principles of complex thought and their applications in the development of this research practice.

Table 1. Principles of complex thought adapted from Ribeiro & Moraes (2014, pp. 228-240)

Principles	Applications in Research
Organizational System	Research is a global unit structured by interrelationships.
Hologramatic	The hologram explains the interdependence between the investigated dimensions and the possibility of the interviewee to self-eco-organize, transcending factors attributed in isolation.
Retroactive	Existence of a complex logic.
Recursive	The dialogic exercise resulting from the research process synthesizes a new knowledge, a new reading of what is already known and what is already produced.
Self-eco-organization	Any production that results from a process of self-eco-organization results and happens as a co-emergence, noticed and welcomed by the to be/being.

Dialogue	In the logic of complexity there is complementarity and inclusion that links principles or notions that would commonly be excluded, but in the same reality, they are considered inseparable and irreducible.
Reinsertion of the Cognoscent individual	It rescues the human protagonism in the processes of construction, design and production.

The complex thought principles will underpin the interpretative analyses of data and the writings of research memos. The contributions of the present research to the field of mathematics education cover the theoretical and interpretative elements that result from a research procedure on the temporalities in the education of the teacher trainer. Recognizing this relational past-present movement, established in this formative process, may reveal possible dimensions of the education of the teacher trainer who teaches mathematics that add, beyond the present space-time, a past (re) signification. In this sense, the view is directed toward the formation of the teacher-trainer assuming the existence of a time that goes beyond us and that involves different formative natures. In this research it has been chosen to define these formative natures of dimensions that include elements which is particular of human specificity, the to be-being past-present.

4. Temporary Considerations

The initial theoretical premises of this research indicate possible learning dimensions of teacher trainer, as follows: a) the internal learning dimension (self-training); b) the external learning dimension (eco-training); c) the learning dimension of organizational formation (self-eco-organization). It was developed systematic studies on Gaston Pineau's tripolar education theory and Edgar Morin's complex thought to develop the theoretical assumptions.

Pineau (2003) builds the tripolar theory of education in a perspective of continuing education. He mentions eco-training in his studies, which is the most silent formation pole. This is one of the poles that it is aimed to emphasize in the research, integrating it with Morin's self-organization (2014a).

The core ideas derived from this relational and systematized study concentrate on the following reflective points for the teacher training field: a) self-eco-organization seen as an autonomous process dependent on the environment; b) self-learning perceived as a continuous and interdependent process between two temporal poles: self-training and eco-training.

Self-eco-training is what turns training into a complex system that integrates an internal learning dimension (self-training) and an external learning dimension (eco-training), from a continuous movement of self-eco-organization, which characterizes the autonomy and dependence of this system.

Self-training aims to understand the autonomisation of teacher trainers, which "[...] provokes a movement of personalisation, individualisation, subjectivation of training". (Pineau, 2003, p. 157). It is also understood that teacher trainers relate to others (heteroformation). Therefore, it is a permanent in movements in a relational system. Eco-training entails a reciprocity of training, because the environment, in its magnitude, shapes us. The need for forming a vital environment arises from this premise.

Morin (2011a) discusses eco-dimensions (from environment to ecosystem) by framing the principle of knowledge that can embrace life. "Cosmophysical cycles are within every living human being. And the eco-organization is characterized by building a polyrinth time". (Morin, 2011a, p. 43).

From this investigative process, in a complementary sense, the two research methods - oral history and grounded theory - allow a foretaste of the construction of a theory of the learning dimensions of teacher trainer of teachers who minister mathematics. The resulting key ideas come from a relational system and enable formative dialogues in the field of teacher training. This is the challenge!

The data derived from this research may reveal a formation movement of the teaching process of the teacher trainer who minister mathematics (the educational dimension), as well as the implicit or explicit educational movement of the environment about this process. It is also feasible to think how this movement self-eco-organizes itself in the environment, through and with the environment, in the interaction with itself, with others and with things.

It is fundamentally important to establish a relational dynamism between the data acquired with both oral history and grounded theory methods. The oral history method reveals the continuous past-presents and provides us with evidence of a training process. The grounded theory helps us to develop concepts, categories and a theorizing practice based on the elements obtained from the analyses of a textual body.

> The audacity of doing science may contribute to foster a human education that allows individuals to take social action based on solidarity and ethical values. Researches may serve a spiral movement, which allows for a reflection on what is set, a disruption with rules and norms, a free and creative search for other focuses, focuses and contexts. (Lopes; Peres & Grando, 2017, p. 3).

The aim here is to provide some challenges regarding creative insubordination in the process of research development. It is approached methods that complement each other in the process of research construction and that become "a path that is made in the journey". In this path, we create and insubordinate ourselves with pre-established ideas and pursue to make the new sprout.

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Intellectual Property Indicators in the Mesoregions of the State of Alagoas-Brazil

Luanna Pereira de Morais

luannapereiramorais@gmail.com

PostGraduate Program in Intellectual Property Sciences,

Federal University of Sergipe, São Cristóvão, Sergipe, Brazil.

Silvana Nunes de Queiroz

silvanaqueirozce@yahoo.com.br

PhD in Demography (UNICAMP); Post-doctorate from PPGDem / UFRN;

Adjunct Professor at the Department of Economics at the Regional University of Cariri, Crato, Ceará, Brazil.

Cristiano Quintino Furtado

Cristiano.furtado@ifal.edu.br

Master in Chemical Engineering (UFCG);

Professor at the Federal Institute of Alagoas, Brazil.

Gabriel Francisco da Silva

gabriel@ufs.br

Doctor in Food Engineering from the State (UNICAMP);

Professor of Petroleum Engineering and Graduate Programs in Chemical Engineering, Intellectual Property Science and Northeastern Biotechnology Network, Federal University of Sergipe, São Cristóvão, Sergipe, Brazil.

Absctract

The objective of this study is to analyze local, innovative and sustainable development in the three Mesoregions of Alagoas, through intellectual property indicators (patents, trademarks, industrial design and geographical indications). The methodology consists of the analysis of secondary sources extracted from the Statistical Database on Industrial Property (BADEPI), available on the website of the National Institute of Industrial Property (INPI), for the years 2010 to 2017. The results point out marked differences, with the eastern Alagoas mesoregion concentrating the intellectual property indicators with two geographical indications, 95.93% of the patent deposits and 84.73% of the deposits of trademark registrations, as well as industrial designs and computer programs. Agreste Alagoano presents a reasonable amount of intellectual protection, with emphasis on the municipality of Arapiraca. Sertão Alagoano, on the other hand, has the worst situation, low amount of intellectual property, even in a region with a diversified cultural and environmental environment. Thus, it was found that the Mesoregions of

Alagoas need an ecosystem that invests in the innovation process in the region, especially the Sertão Alagoano.

1 Introduction

In the last two decades of the twentieth century, there was an increase in the perception of developed and developing countries in relation to the value of innovative activity. Perception arising from the development and consolidation of economic analysis and the proposal for regional development based on sustainability and innovation.

The focus of regional development for the growth of its territory/ location, in part, depends on what is being placed on human capital (education and knowledge in innovation). Thus, the sustainable innovation system is based not only on an economic category, but above all on a social system with cooperation playing an important role (Pelse et al., 2018). Capello and Lenzi (2019) reiterate that the insertion of human capital in local environments is beneficial in strengthening knowledge networks and local economies.

Thus, according to Tkachenko and Bodrunov (2014), there is a direct relationship between the economic development of a region and the formation of elements of the knowledge-based economy. With that, it becomes important to increase the intellectual potential, the adequate infrastructure for development and an innovative regional policy. However, it is not enough to just develop these factors, it is necessary to combine regional innovation policy with regional economic policy, to ensure that the population has quality of life, opportunity and development of creative skills, that is, the development of human capital, at the local level.

According to Lentz (2019), in regional development it is necessary to pay special attention to the social side, or better, the local knowledge of the population and the people who live in the region. In addition, one must understand the whole process, given the complexity of the actors that make up such an ecosystem and, with this, perceive the correlation of land use, agrarian technologies, business needs and social and demographic changes.

The innovation and knowledge networks are gaining visibility due to the political mechanisms aimed at regional development. Political actions include investments in directly productive activity and indirect social capital, in addition to strengthening intraregional migration as a means of obtaining and attracting individuals with varied backgrounds, resulting positively for innovation in these regions (Van Aswegen; Retief, 2020).

In the face of changes and business complexity, the search for competitive advantage has been changing the way organizations are positioned in the market. In this scenario, the practice of product and process innovation has become increasingly relevant for business maintenance, since innovation needs proper planning of activities, realistic goals, permanent monitoring of activities under development and measurement of results (Kisman; Tasar, 2014; Vázquez - Barquero; Rodríguez - Cohard, 2018).

The innovation process needs to be stimulated by the creation of an economic environment, companies need to be encouraged to do their part in this process, as knowledge will be transformed into products and production processes, and alignment with universities, research institutions and scientists is important. , given that there is a debate on how protection mechanisms can guarantee the best returns for society, with better and cheaper products and services. However, it should be noted that there is a fine line in over-protecting assets and the impact on innovation that could prevent new technologies from being developed (Negri, 2018).

Considered a measured value that provides information about a specific phenomenon or a status quo for companies, the indicators are fundamental for managing and controlling the various innovative ideas and concepts to which they are submitted. Equally important are the selection criteria for allocating resources and assessing performance at each stage of the innovation process efficiently (Dziallas; Blind, 2019; Sleuwaegen; Boiardi, 2014; Pelse et al., 2018).

The need for intellectual protection as a way to guarantee economic rights over technological innovations in the world, definitively established the importance of consolidating National Innovation Systems as a means for the economic development of nations.

From this perspective, there is an important growth in the number of intellectual protections worldwide, as well as the formation of technological innovation clusters in specific regions of the globe and in the most diverse thematic areas (Streltsova; Linton, 2018).

Technological innovations have caused conceptual changes in several aspects, both for causing greater flexibility in production processes and for causing changes in the productive structure of countries and their regions (Fochezatto; Tartaruga, 2018).

It must be agreed that the search for a real understanding of the phenomenon of technological innovation has stimulated the development of methods aimed at measuring it. This aspect is relevant to the proposed discussion about the referred process regarding the factors that influence and contribute to innovation in different regions of the Brazilian territory.

An innovation process must observe the economic and geographical position, the level of socioeconomic development and the economic specialization of the region (Mikhaylova, 2019). Thus, the challenge for regional development lies in the fact that the regions are complex systems, and the appropriate thing would be not to map but to decide what would be mapped and why, identifying problems and solutions, guaranteeing the sustainable prosperity of the place (Harrison et al., 2020).

Under these aspects, the main objective of this paper is to analyze local, innovative and sustainable development in the three Mesoregions of Alagoas, through intellectual property indicators (patents, brands, industrial design and geographical indications), from 2010 to 2017.

Thus, it is intended, in a theoretical way, to strengthen the field of intellectual property research and its interrelation with regional development, in addition to the relevance of the study with an interdisciplinary approach, with innovative, local and sustainable development for the Mesoregions of Alagoas. In addition, it highlights the importance for the knowledge of public policy makers, by contributing to the visualization of how investments can be directed and are being directed in the Mesoregions of the state of Alagoas.

2 Methodology

What are the intellectual property indicators in the Mesoregions of the state of Alagoas? To answer this question, a survey of information / data was carried out on the indicators of patents, brands, industrial design and geographical indications located in the municipalities that make up the three Mesoregions of Alagoas, formed by the, East Alagoano, Agreste Alagoano and Sertão Alagoano, to an overview of the distribution of intellectual property in that state.

The research used was carried out by means of secondary sources from the extraction of information through the Statistical Database on Industrial Property (BADEPI), available on the website of the National Institute of Industrial Property (INPI), for the years 2010 to 2017, regarding patent indicators, trademarks, industrial design and geographical indications. Regarding the processing of information, Microsoft Office Excel 2019 software was used. Thematic maps were made using the QGIS software.

In theoretical terms, readings were carried out in journals, monographs, dissertations and theses. Other sources of information were the websites of the Brazilian Institute of Geography and Statistics (IBGE), Atlas of Human Development (UNDP), National Institute of Industrial Property (INPI), DATASEBRAE, Food and Agriculture Organization of the United Nations (FAO) and the data available at the State Secretariat of Planning, Management and Heritage of Alagoas (SEPLAG-AL).

3 Population, Territorial, Economic, Educational and Social Characterization of the Mesoregions of the State of Alagoas

The state of Alagoas has 102 municipalities divided into three Mesoregions (Figure 1), East Alagoano, Agreste Alagoano and Sertão Alagoano, with a population of 3,120,494 inhabitants in 2010, and a territorial area of 27,843,295km² (Table 1).
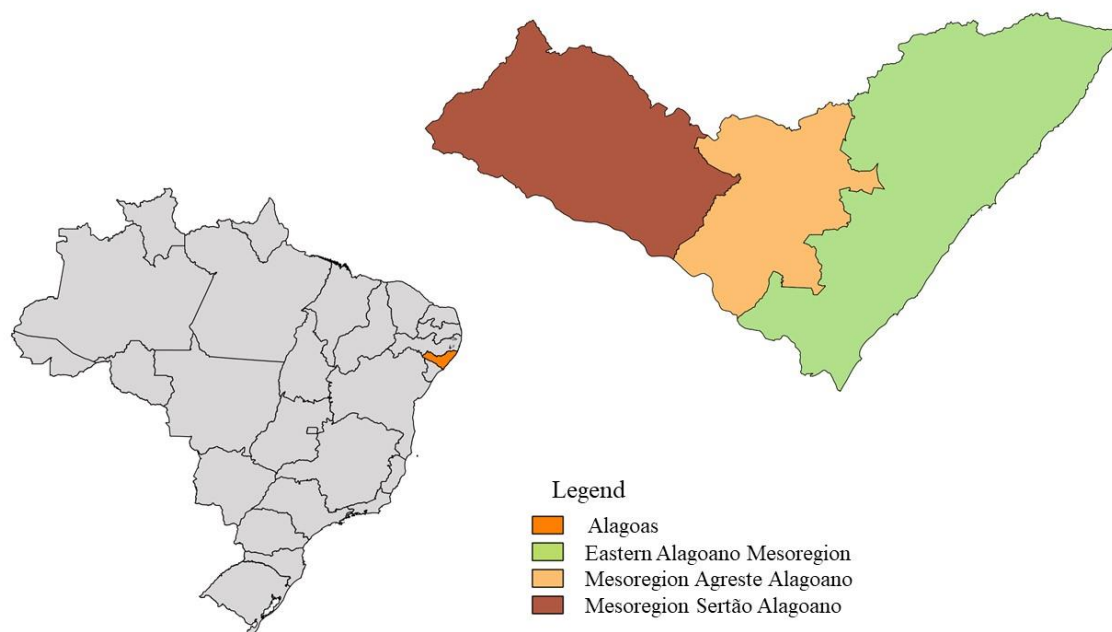
Figure 1 - Map of the State of Alagoas and its Mesoregions
Source: Prepared by the authors from Map portal – IBGE (2019).

The state's Human Development Index (HDI) in 2010 was 0.631, the worst or lowest among Brazilian states. With regard to GDP, Alagoas obtained, in 2017, equivalent to 52.843 billion reais, 41.31% of which is concentrated in the capital Maceió. In Alagoas, 36,149 companies and other organizations were registered in 2018. With regard to higher education, the state has 29 public and private institutions registered in the Higher Education Census, 18 of which are located in the capital and 11 in the interior (SEPLAG-AL, 2019; Cities - IBGE, 2020; INEP, 2019).

Table 1 - Resident population and territorial extension - Mesoregions of the state of Alagoas - 2010

Alagoas Mesoregions	**Resident population**		**Territorial extension**	
	Abs.	**%**	**km²**	**%**
East Alagoano	2.064.525	66,16	13.241	47,66
Agreste Alagoano	623.302	19,97	5.770	20,77
Sertão Alagoano	432.667	13,87	8.769	31,57
Total	**3.120.494**	**100,00**	**27.780**	**100,00**

Source: Prepared by the authors from Cities - IBGE (2020); Atlas of Human Development in Brazil – UNDP (2013).

With regard to the East Alagoan Mesoregion, it has 52 municipalities, with a population of 2,064,525 inhabitants, in 2010 and, thus, concentrates 66.16% of the inhabitants of the state, in a territorial area of 13,241 km², which represents almost 48% of the Alagoas territory. The capital Maceió stands out as the largest economy in the state, with a GDP (R$ 1.000) of 21,827,917 in 2017. This value is mainly driven by the industrial sector for the manufacture of food products and the manufacture of organic and inorganic chemicals. As well as civil construction, the result of building construction and infrastructure works, in addition to the services sector. In 2018, 17,841 companies and other active organizations were registered. With regard to the population of the capital (Maceió), in 2010, this alone concentrated almost 30% of the state or 932,728 people, in a territory of 509,320 km², and the Municipal Human Development Index (HDI-M) of 0.721 considered as a high level of human development (SEPLAG-AL, 2019; Cities - IBGE, 2020).

Agreste Alagoano, on the other hand, is formed by 24 municipalities, in a territorial extension of 5,770 km², with a population of 623,302 inhabitants, in 2010, corresponding to 19.97% of the state's residents. The main municipality in the mesoregion is Arapiraca, which has the second largest GDP in the state, with R$ 4.100.975,00, for the year 2017, reflecting the service sectors and its sub-sectors, such as administration, education, health, public research and development, defense and social security; trade, maintenance and repair of motor vehicles and motorcycles. And also due to the agricultural sector, being in 3rd place in relation to the other municipalities in the state. In this category, the result was driven by tobacco, cassava and pineapple crops. In addition, 4,100 companies and other organizations active in Arapiraca were registered in 2018. The Municipal Human Development Index (MHDI) was mean represented by 0.649, and has a population of 214,006 people, and a territorial area of 345,655 km², in 2010 (SEPLAG-AL, 2019; Cities - IBGE, 2020).

With regard to the Alagoas Hinterland, composed of 26 municipalities, in a territory of 8,769 km², with a resident population of 432,667 inhabitants in 2010, which represents only 13.87% of the Alagoas population. Santana do Ipanema is the municipality of the mesoregion with the best placement, and according to the 2017 GDP, it was R$ 513.982,00, making it the 13th economy in the state. This result is due to the industrial and service sectors. Regarding the number of companies and other active organizations registered in Santana do Ipanema, in 2018, it was 514. The municipality's population was 44,932 people in 2010, in a territorial extension of 437.875 km², and has a Municipal Human Development Index (MHDI) of 0.591 classified as low in 2010 (SEPLAG-AL, 2019; Cities - IBGE, 2020).

It should be noted that due to the socioeconomic, demographic and higher education indicators presented, the Mesoregions of Eastern Alagoas and Agreste Alagoano have the best indicators. In turn, the Sertão Alagoano mesoregion is characterized as the least populous and with the least economic development, however, it has the second largest territorial dimension (31.57%) of the state, in an extension marked by the presence of the São Rio Francisco and the caatinga biome, which presents a lot of diversity and riches (SEPLAG-AL, 2020). Thus, these three Mesoregions, in particular the Sertão Alagoano will be analyzed in section 4, the spatial distribution of intellectual property, in the Mesoregions of Alagoas, a factor that may be capable of triggering local, innovative and sustainable development, especially in less developed mesoregion, the Sertão Alagoano.

4 Results and discussion

In this section, we will highlight the profile of intellectual property by the industrial property indicators (patents, trademarks, industrial design and geographical indications) existing and distributed in the state of Alagoas, selected municipalities and in the three Mesoregions of the state and in some municipalities with greater highlights.

4.1 Distribution of Patents, Brands and Industrial Designs in the Mesoregions of Alagoas

In the state of Alagoas, from 2010 to 2017, 246 patents were filed, fluctuating over the years, and from 2014 it grows uninterruptedly. In 2017 alone, Alagoas had 60 patents deposited, this amount being pulled by the capital Maceió (53 patents). If we consider Mesoregions, in Agreste Alagoano we have Arapiraca and Palmeira dos Índios; in Eastern Alagoas, Junqueiro, Maceió, Marechal Deodoro, Rio Largo, Santa Luzia do Norte and São Miguel dos Milagres; and in the Sertão Alagoano, no patents were registered.

Table 2 - Deposits of types patents (Invention + Utility Models) by municipalities in the state of Alagoas from 2010 to 2017

Municipalities	Years								Total
	2010	2011	2012	2013	2014	2015	2016	2017	
Arapiraca	2	0	2	1	1	0	0	3	**9**
Junqueiro	0	0	0	0	1	0	0	0	**1**
Maceió	23	8	12	35	24	34	37	53	**226**
Marechal Deodoro	0	0	0	0	0	0	4	2	**6**

Palmeira dos Índios	0	0	0	0	0	0	1	0	**1**
Rio Largo	0	0	0	0	0	0	0	1	**1**
Santa Luzia do Norte	0	0	0	0	1	0	0	0	**1**
São Miguel dos Milagres	0	0	0	0	0	0	0	1	**1**
Total	**25**	**8**	**14**	**36**	**27**	**34**	**42**	**60**	**246**
Percentage	**10,16**	**3,25**	**5,69**	**14,63**	**10,98**	**13,82**	**17,07**	**24,39**	**100,00**

Source: Prepared by the authors from INPI (2018).

Note: Considers the 1st resident depositor

With regard to the two municipalities with the highest patent filings after the capital Maceió, Arapiraca filed 9 patents in the analyzed period, with the largest filings in 2010 (2), 2012 (2) and 2017 (3). Such conditions are due to the fact that this municipality is the 2nd largest economy in the state and has the 2nd largest number of inhabitants among the municipalities. Marechal Deodoro represents the 3rd municipality with patent filings. As for the aspects that may be responsible for the deposits, this municipality has the 3rd largest GDP in Alagoas, pulled by the secondary sector, particularly the chemical-plastic chain, in addition to public and private universities (SEPLAG-AL, 2019; Cities - IBGE, 2020).

Regarding the requests for registration of trademarks, in the state of Alagoas, or better, in the three Mesoregions of Alagoas, in the period from 2010 to 2017, 4,335 were made (Figure 2). The highest percentages of orders were in 2017, with 20.35% (882) of the total, followed by 2016 with 16.08% (697). On the other hand, the years with the lowest percentage were 2010, with 6.69% (290), and 2012 with 7.98% (346).
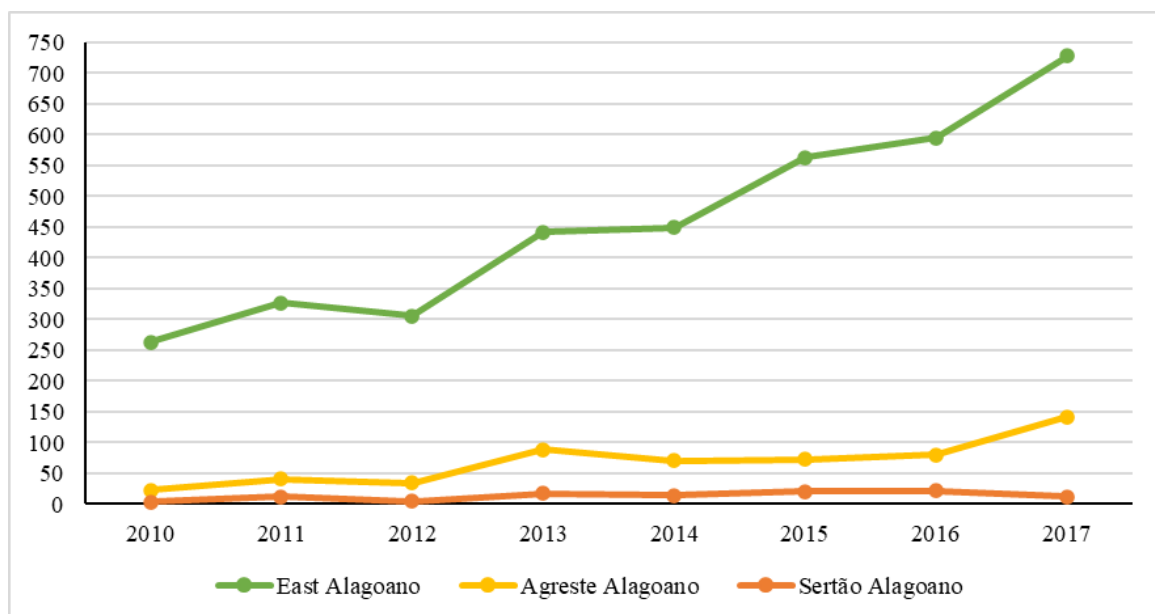
Figure 2 - Trademark registration requests - Mesoregion of Alagoas - 2010 to 2017

Source: Prepared by the authors from INPI (2018).

By mesoregion, Eastern Alagoas concentrates the largest number of trademark applications (3,673), with the largest applications in 2017 (728) and 2016 (595), and the years with the lowest applications were

2010 (263) and 2012 (306). By municipalities, the capital Maceió presents more orders, corresponding to 3,207, followed by Marechal Deodoro (60) and Maragogi (54), but with much lower values compared to the capital. The other municipalities range from 1 to 43 trademark registration requests.

In Agreste Alagoano, 554 registration requests were made, with the highest numbers in 2013 (89) and 2017 (80) and the lowest in 2010 (23) and 2012 (35). The municipalities that contributed to the total requests for trademark registrations in the mesoregion were Arapiraca (439) and Palmeira dos Índios (62), the other municipalities oscillating between 1 to 10 requests.

Considering the Alagoas Hinterland, it presented the lowest number of trademark applications (108) among the Mesoregions of the state. The largest orders were in 2016 and 2017, with 21 and 22 orders, respectively, and the smallest quantities in 2010 (4) and 2012 (5). The municipalities with the highest number of requests were Santana do Ipanema with 27, Delmiro Gouveia with 30, Piranhas with 10 and Major Isidoro with 14. The rest of the municipalities ranged from 1 to 7 in terms of registration requests.

With regard to industrial designs, (Figure 3) shows a total of 54 deposits in selected municipalities. The years 2013 and 2014 had the highest quantities, 13 and 12, respectively, and the lowest were in 2010 (1) and 2015 (2). These values are concentrated in two Mesoregions, East Alagoano, with Maceió (52), which has the largest amounts of industrial design deposits, and Agreste Alagoano with two municipalities (Arapiraca and Palmeira dos Índios), with 1 deposit in each municipality, with no values found in any municipality that is part of the Mesoregion of Sertão Alagoano.
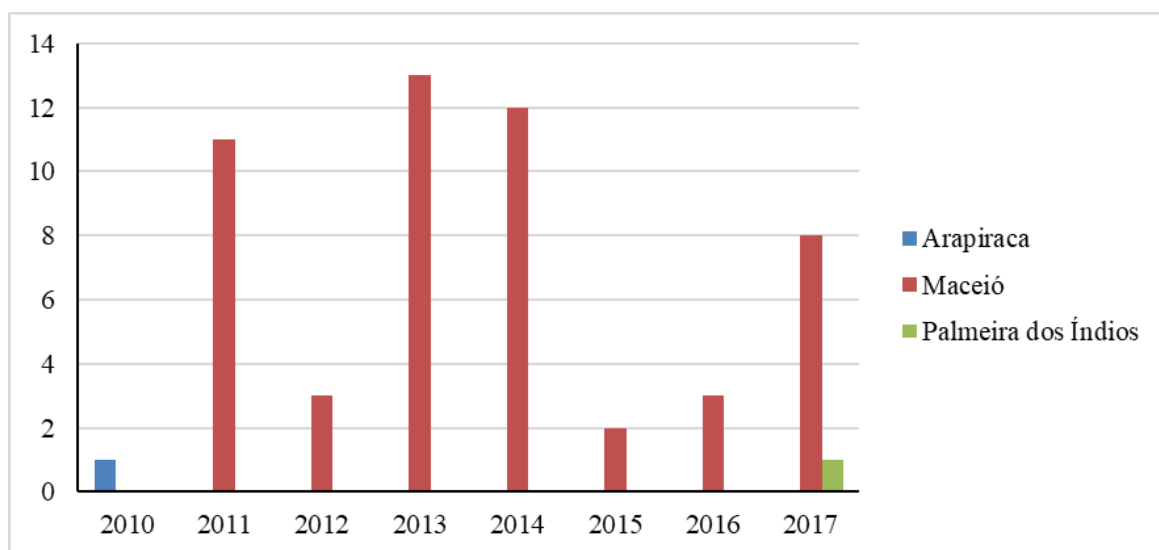
Figure 3 - Applications for deposit of industrial designs - Selected municipalities -2010 to 2017
Source: Prepared by the authors from INPI (2018).

In summary, there is a concentration of intellectual property in the mesoregion of Eastern Alagoas, particularly in the capital Maceió, possibly associated with factors such as: concentration of public and private universities, industries and companies. Given this context, for a state to grow and develop, it is necessary to advance in its entire territorial extension: capital, metropolitan area and interior. With this, it will be possible to promote local development also in the interior and in the regions characterized as

poorest, such as the mesoregion of the Sertão Alagoano, which has a low rate of intellectual protection and local development.

From these results, it appears that patent filings could serve as an indicator for the achievement of the Sustainable Development Goals (SDGs), in this case, SDG 9 (industry, innovation and infrastructure) and SDG 17 (partnerships and means of Implementation). SDG 9, for thinking about a more sustainable and inclusive industrialization and an environment that fosters innovation that values local businesses and communities, and SDG 17, for advocating internationalization, that is, the circulation of knowledge.

Thus, brands have the mechanism of adding value and credibility to the product, as it is a visual form that can make a product known, but unlike geographical indications that have a seal that is also a collective brand, it does not have the function of determining origin and product quality. However, in many cases they will have similar functions as a marketing tool (Calboli, 2015), promotion of local territorial development (Carvalho; Pereira; Ferreira, 2017), essential for international trade (Mancini et al., 2016).

In addition, certifications and brands that protect and value heritage and typical products should be given attention by policy makers (Lorenzini; Calzati; Giudici, 2011). In many European Union countries, the Community trademark was introduced as a substantial element of uniformity in the scenario of the valid internal market (Machnicka, 2014).

An important element is the creation of technological centers in Alagoas, which are geographically divided into three environments, whose mission is research, scientific development and technology. Two are in activity, one in Agreste, in the city of Arapiraca (Agribusiness Technological Pole), and another in Sertão, in the municipality of Batalha (Agribusiness Technological Pole). On the other hand, the third is located in Maceió (Information, Communication and Services Technology Hub), and is still being finalized.

It is important to highlight that these environments are indispensable for innovative development, as they are directly linked to scientific research, for the transformation and consequently applicability in the university, productive sector and society (Silva; Silva Neto, 2018).

4.2 Geographical Indications in the Alagoas Mesoregions

In the scope of the diversity of strategies for product differentiation, Geographical Indications (IGs) provide interested parties with an opportunity for products with characteristics strongly linked to the territory of origin. However, the protection and regulation mechanisms for the use of GI, require individuals to be organized and collaborate in the process (Quiñones-Ruiz et al., 2016).

In the Northeast of Brazil, there are 14 geographical indications, 11 of which are in the Northeastern Semi-arid. As for the state of Alagoas, it has two IGs (Region of Lagoas Mundaú Manguaba and Manguezais de Alagoas), all located in the eastern Alagoas mesoregion, with no IG in Agreste Alagoano and Sertão Alagoano (Giesbrecht, 2014; DATASEBRAE, 2020; INPI, 2020).

The geographical indication Region das Lagoas Mundaú Manguaba (Figure 4) was registered in 2016, whose protected product is fillet embroidery. The geographical area corresponds to 252 km², around the Mundaú and Manguaba Lagoons, located in the Center-East portion of the state of Alagoas, comprising part of the territories of the municipalities of Marechal Deodoro, Pilar, Santa Luzia do Norte, Coqueiro Seco, Satuba and Maceió. This mesoregion is populated and inhabited by fishermen and shellfish gatherers who make a living or supplement their household income by making the embroidery traditionally produced

in the region. In addition, it is characterized by being a tourist area and a diverse gastronomic pole. Thus, the place that was established with fillet embroidery, developed a production chain that covers populations and communities (DATASEBRAE, 2020; Giesbrecht, 2014; INPI, 2020).
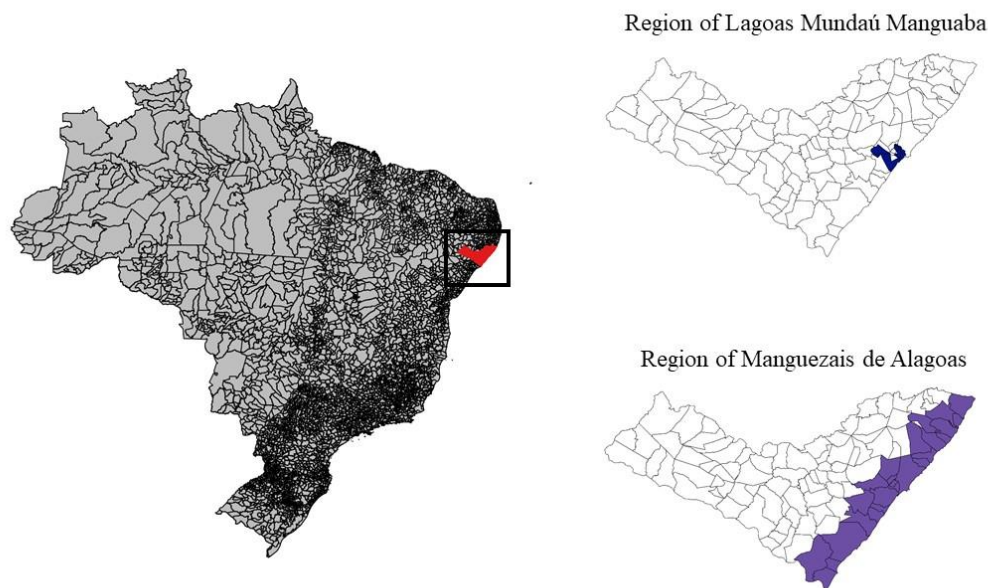
Figure 4 - Map of the Geographical Indication of map of Alagoas-Brazil
Source: Prepared by the authors from Map portal – IBGE (2019).

The IG Manguezais de Alagoas (Figure 4) was registered in 2012, with red propolis and red propolis extract extracted from the legume *Dalbergia ecastophyllum* as a protected product. It should be noted that the chemical and pharmacological characteristics of propolis are unique. Regarding the geographical area, the coastal region and lagoon complex of the state of Alagoas is delimited (DATASEBRAE, 2020; Giesbrecht, 2014, INPI, 2020).

Thus, it appears that the geographical indications in the state of Alagoas are located only in the mesoregion of Eastern Alagoas. Therefore, it becomes necessary to explore the potential of Agreste Alagoano and especially the Sertão Alagoano, by contributing economically and socially to deal with the economic problems of communities that have traditional characteristics and the differential of being located in a rich and little explored biome.

In this sense, some aspects and characteristics of the geographical indications must be analyzed for a greater basis in relation to this important mechanism for local development, sustainable development and with social innovation.

According to Maiorki and Dallabrida (2015), the geographical indication could contribute to the development of the local territory, by adding value to the production chain and local trade, however, it is not able to develop a territory alone, there are other factors that need to be considered. acquired and put into practice.

Registration with the National Institute of Industrial Property (INPI) alone does not guarantee that the result of the process is responsible for bringing together multiple sectors such as tourism and services, framing the territory with the appreciation of its tangible and intangible assets (Lima Medeiros; Terra; Passador, 2019; Maiorki; Dallabrida, 2015; Silva et al., 2012).

According to Billi (2016), it is essential that the actors are involved and articulated, cooperating to achieve common goals. Since the beginning of the GI process, there must be a feeling of belonging by the actors, and at the same time they must be able to claim the collectivity (Kizos et al., 2017).

As listed by Nascimento, Nunes and Bandeira (2012), associating the product with the region's historical and cultural heritage, with the strengthening of tourism consisting of welcoming tourists, tourist routes and organizing events, provides the development of other activities and services, encompassing the entire community in the process.

Most GI products are associated with the agricultural environment, many coming from poorer regions (Cerdan, 2014). In this sense, GI products would contribute to stimulating and supporting the rural environment for local sustainable development processes. It is worth highlighting the multiple dimensions involved in IG, with regard to the development of intellectual property, with the policy of agricultural markets, social policy, food security, preservation of local natural resources, food culture and tourism promotion (Belletti; Marescotti; Touzard, 2017).

Thus, according to FAO (2019), a successful IG when it has the possibility of creating jobs, fosters local development, provides means to guarantee food security, preserves traditional products and services and biodiversity.

Another point to be addressed is the potential of geographical indications for sustainable development, based on production geared towards sustainability and environmental preservation, and also contributes to achieving the Sustainable Development Goals (SDGs) and Agenda 21, including the SDGs 2 (eliminating hunger and improving nutrition), SDG 12 (sustainable patterns of food production and consumption) and SDG 5 (women's empowerment) (FAO, 2019; FAO, 2018).

Therefore, the capacity of the state of Alagoas with the geographic indication tool is verified, through the IGs Region of Lagoas Mundaú Manguaba and Manguezais de Alagoas, each with its own specificity. In this context, the local knowledge of the Mesoregions of Agreste Alagoano, and notably the Sertão Alagoano, could be evaluated, which could contribute to the generation of jobs, female empowerment, maintenance of the population in the countryside, preservation of the environment and a feeling of appreciation for the local culture.

5 conclusion

It emerged from the study that the state of Alagoas must seek to decentralize industrial properties, given that the mesoregion of eastern Alagoas, mainly the capital Maceió, accounts for the largest amounts of intellectual property. It is necessary to create an ecosystem of investments in public policies and innovation, in order to develop an innovative culture throughout the state, especially in the Sertão Alagoano mesoregion, as it is the least developed, but it presents remarkable characteristics in the diversity of local knowledge.

In addition, research must be supported by public and private entities, in order to meet the objectives of regional / local market demands for new products and processes. So that it is the beginning of a virtuous and diffuse cycle, based on the emergence of innovative products, the technological supply of the market, an increase in production capacity and efficiency and an increase in competitiveness. These factors, to a certain extent, would be capable of enhancing the economic and social development of the regions, as is the case of the state of Alagoas and its Mesoregions.

Some limitations of the study, it is due to the INPI data, to verify only the 1st resident depositor, not being possible an overview of the other depositors and if the product and / or process development was through both national and international partnerships in the case of patents. Another limitation is the non-possibility of crossing variables, for example, number of 1st resident depositors per university or company. In addition, the variables may not represent the complete reality of the regions. Thus, for future research, focus on a micro region or municipality in Alagoas, through field research.

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Evaluation Model of Virtual Learning Environments: A Pilot Study

Alane de Almeida Ferreira

Programa de Pós-graduação em Ciências Computacionais

Rio de Janeiro State University, Rio de Janeiro, Brazil.

e-mail: alane.ferreira.af@hotmail.com

Neide dos Santos

Programa de Pós-graduação em Ciências Computacionais

Rio de Janeiro State University, Rio de Janeiro, Brazil.

e-mail: neide@ime.uerj.br

Rosa Maria E. Moreira da Costa

Programa de Pós-graduação em Ciências Computacionais

Rio de Janeiro State University, Rio de Janeiro, Brazil.

e-mail: rcosta@ime.uerj.br

Fernando Antonio de A. Carneiro

Departamento de Geometria - Instituto de Matemática e Estatística

Rio de Janeiro State University, Rio de Janeiro, Brazil.

e-mail: carneiro@ime.uerj.br

Vera Maria B. Werneck

Programa de Pós-graduação em Ciências Computacionais

Rio de Janeiro State University, Rio de Janeiro, Brazil.

e-mail: vera@ime.uerj.br

Abstract

Virtual learning environments (VLE) have frequently been used in educational practices, and the evaluation of their effectiveness as instruments to support learning gains must consider several dimensions. This paper presents an evaluation model for VLE, called MA-AVA (Model for the Evaluation of VLE), built after a review of the literature and focused on verifying students' learning gains. The MA-AVA evaluation model was applied in a pilot study to an undergraduate engineering class, using a VLE, Educ-MAS-GA, in the discipline of Analytical Geometry. The results indicate that, although students' perception of learning in VLE is relevant, the knowledge acquired is more subtle and difficult to assess. Therefore, a VLE learning evaluation model should include different dimensions of learning, such as the students' perceptions and their measures of learning gain.

1. Introduction

The dissemination of computing in education evolves the possibilities of theoretical-practical investigative analysis, considering the use of virtual environments in different models of teaching-learning processes. Currently, virtual learning environments (VLE) have been used not only in distance education situations but also in hybrid classroom education processes (Nepomuceno, 2019).

Although some studies (Rahimi, 2015, Gustafsson, 2017) present the use of the virtual learning environment to improve the educational process, there are few analyses of the benefits acquired applying this resource. Most works on VLE evaluation focus on the development process of the virtual environment, or the interface and usability evaluation, not considering the gains in learning (Sandars, 2010, Sternig, 2017, Agredo-Delgado, 2019).

Some evaluation models for VLE have been developed. However, the learning dimension still needs improvement, as in many cases, it consists only in obtaining the user's opinion concerning their knowledge gain after using the environment (Lin et al., 2013, Sabourin et al., 2013, Pastushenko, 2018).

Aiming to expand the possibilities of evaluating the learning of the students who use a virtual environment in learning processes, this work presents the MA-AVA (Model for the Evaluation in VLE), which is an evaluation model focused on learning in VLE. In this context, the learning evaluation considers the combination of a value obtained from the knowledge measure with student´s perception of learning. A pilot study was carried out with two engineering undergraduate classes, using software to support the learning of Analytical Geometry, Educ-MAS-GA, to consolidate the MA-AVA activities defined in its modules.

This paper is organized into six sections, this introduction, followed by section 2, which presents an overview of Virtual Educational Environments evaluations. Section 3 describes the proposal learning evaluation model, its definition, measurement instruments, and steps to be adopted for its practical application. Section 4 details the use of the MA-AVA evaluation model in the context of an Analytical Geometry discipline, and section 5 discusses the results. Section 6 presents the conclusion of the work and future works.

2. Related Works Review

There are several approaches for the evaluation of virtual environment regarding its interface or functionalities (Sandars, 2010, Sternig, 2017, Agredo-Delgado, 2019). Few approaches, however, focus on the learning process evaluation. To expand knowledge about the evaluation of VLE, several studies present how the evaluation methods can be improved (Rahimi, 2015, Anonymous, 2016, Gustafsson, 2017).

Keller (2009) designed the ARCS model (Attention, Relevance, Confidence, Satisfaction), which aims at employing motivational strategies in the design of educational materials. This model can be used to evaluate students' motivation when using educational materials.

Kirkpatrick (1996) developed a training model composed of four levels: Reaction, Learning, Behavior, and Results. Level 1 evaluates students' reaction to educational content; Level 2 establishes the evaluation of learning gain obtained during a training program, using test methods before training (pre-test) and after

training (post-test); Level 3 determines an evaluation of the behavior considering the effect of learning acquired during a training program; The last level aims to evaluate the practical effectiveness of the training, and it is necessary to use methods that can capture such change. Thus, it must make an individual evaluation to check if the effect has been achieved.

Savi (2011) used aspects of the two previous works and proposed a model for evaluating educational games based on level 1 of the Kirkpatrick training evaluation model (1996), in the motivational strategies of Keller's ARCS model (2009), in the user experience and the Bloom taxonomy (Bloom, 1956). The ARCS model was developed with a proposal to evaluate students' motivation. In this case, aspects related to fun and pleasure influence students' motivation and, therefore, facilitate the learning process. Savi (2011) added Bloom's concept of taxonomy to the strategy of Moddy and Sindre (2003), intending to evaluate the learning effectiveness using Bloom's first three levels of taxonomy: knowledge, use, and application. Although quite comprehensive, the Savi model has many dimensions and questions that the user must answer, which can cause impatience and weariness.

A systematic literature review (SLR) on VLE evaluation was performed in November 2016, looking for papers from 2010 to 2016 (in the relevant libraries in education information technology area) (Anonymous, 2016). Initially, the search returned 302 papers and 46 papers remained in the final selection. Most of the works (48%) have virtual environments for higher education students from different areas, followed by VLE for elementary school students (28%) and VLE for high school students (15%). The results identified in this study indicate that the evaluations have been positive considering the use of virtual environments as a tool in the teaching and learning processes. The perception of the effectiveness of learning process using these environments was pointed out in 41% of the papers. Different models of learning evaluation have been proposed, using questionnaires and pre/post tests. Therefore, most studies used questionnaires to obtain information about the personal characteristics of each student and their opinion regarding the VLE activity (Bruso,2016).

From the study of these different works, the MA-AVA evaluation model was developed, combining characteristics of these works.

3. MA-AVA Model

MA-AVA aims to analyze student performance in virtual learning environments, to measure knowledge gain about motivation, user experience, and learning, from the perspective of students' profile, perception (Kirkpatrick level 1) and learn (Kirkpatrick level 2) (Kirkpatrick, 1996). Savi's model (2011) was chosen as the basis, because this model emphasizes on learning, considering the perception of increased knowledge.

To support the measurement of motivation (Kirkpatrick level 1), the model relies on the structure already used by Savi (2011), but with simplifications, since this author's questionnaire is quite exhaustive. The model includes a pre and post-test to support the measurement of learning (Kirkpatrick level 2), and, with that, MA-AVA verifies if its use allows a significant learning gain.

The dimensions Motivation, User Experience and Learning Reaction are evaluated through adaptations of the dimensions of the ARCS model (Savi, 2011). Based on the integration of parts of models proposed in the literature and specific changes, the MA-AVA model has the structure shown in Figure 1.
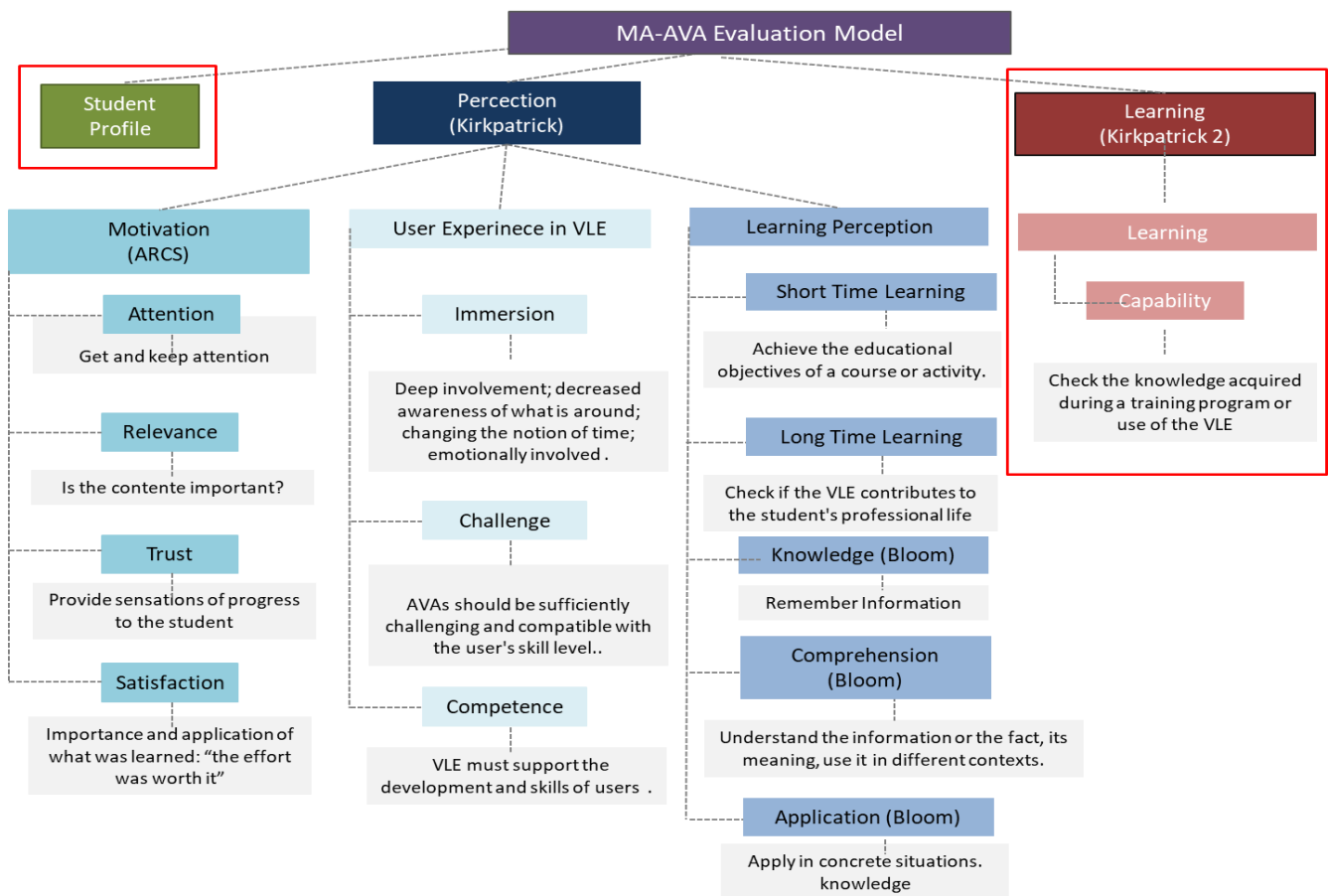
Figure1. Characteristics of the MA-AVA Evaluation Model

Savi (2011) used a questionnaire, that has a specific answer format that corresponds to the indication of the agreement or not of each the educational objectives perceptions. In the MA-AVA model, the scale was adapted to better understand the students, and the variation was between 0 and 4, which 0 means that the student strongly disagrees, and 4 that the student strongly agrees. Thus, according to the chosen value, the student can indicate the intensity of a certain aspect such as the example shown in Table 1.

Table 1. Questionnaire Model

The VLE contributed to my learning in the discipline		
Strongly disagree	0 1 2 3 4	Strongly agree

Source: Adapted from Savi (2011).

3.1. Motivation

Motivation for learning are related to student engagement and autonomy. For the motivation evaluation, it was used an adaptation of the questionnaire developed by Savi (2011), described in Table 2.

Table 2. Motivation

#	Objective	Dimension
1	The variation (form, content, or activities) helped me to keep an eye on the VLE.	Attention
2	The AVA content is relevant to my interests.	Relevance
3	It was easy to understand the VLE and start using it as study material.	Trust
4	I am satisfied because I know that I will have opportunities to use in practice things I have learned from VLE.	Satisfaction

Source: Adapted from Savi (2011).

3.2. *User Experience*

The User Experience dimension focuses on making it clear whether VLE provides a good user experience, which is essential to stimulate the learning process (Savi, 2011). The evaluation of the user experience uses only four items from the original 16 of the Savi model considered the most relevant for the work (Table 3).

Table 3. Questionnaire to evaluate User Experience

#	Objective	Dimension
5	I felt more in the VLE environment than in the real world, forgetting what was around me.	Immersion
6	The VLE evolves at an appropriate pace and is not monotonous - it offers new obstacles, situations, or variations in activities.	Challenge
7	I managed to achieve the goals of the VLE through my skills.	Competence
8	I had positive feelings of efficiency in the VLE.	Competence

Source: Adapted from Savi (2011).

3.3. *Learning Perception*

The Learning Perception dimension is evaluated in two ways. The first is regarding short and long-term learning, and tree items from Savi's original questionnaire were used (Table 4).

Table 4. Questionnaire to evaluate Learning Perception

#	Objective	Dimension
9	The VLE contributed to my learning in the discipline	short-term learning
10	The VLE was efficient for my learning, in comparison with other activities of the discipline.	short-term learning
11	The experience with VLE will contribute to my performance in my professional life.	long-term learning

Source: Adapted from Savi (2011).

The second way is to evaluate learning through the educational objectives. Savi (2011) uses Bloom's taxonomy and presents a questionnaire with these objectives (Knowledge, Comprehension, Application). The student only assigns a grade that corresponds to his level of learning before and after using the VLE.

Thus, the grade can vary on a 5-point scale depending on his/her level of knowledge. In the MA-AVA, the scale was adapted to the variation was between 0 and 4 as presented in Table 5. This part of learning evaluation is more associated with retaining the content worked on in a learning situation. In this case, the results of evaluations before and after using the environment are considered.

Table 5. Questionnaire to Evaluate Learning Perception of the Concepts
– Assign your level of knowledge before and after AVA to the concepts listed in the table below:

0	None
1	Weak
2	Regular
3	Good
4	Very Good

Concepts	Remember what it is		Understand how it works		Apply in practice	
	Before	After	Before	After	Before	After
My understanding of Conics						
Notion of Parabola						
Graphical representation of the Parabola and its variations						

3.4. *Evaluation Process with MA-AVA*

The MA-AVA model consists of five evaluation instruments: (i) the user profile questionnaire which the student describes his/her characteristics through pre-defined questions, such as sex, age, frequency of computer use, the possibility of accessing the internet and the level of knowledge in the theme to be studied; (ii) the perception questionnaires that capture the user's opinion with the union of the dimensions of motivation, user experience and learning perception (short and long-term), (iii) the learning questionnaire of the students' knowledge, comprehension, and application concepts before and after using the VLE; and (iv and v) to measure the gain of learning in pre-test and post-test with questions that address the content worked on in the VLE.

To use the MA-AVA, it is necessary to perform three steps: (i) planning the evaluation, (ii) using the VLE and the five evaluation instruments and (iii) analyzing the results.

This stage includes knowing all the VLE contents to be evaluated, customizing the user characterization profile, adjusting the questionnaire on the perception of motivation, user experience, and learning, and preparing the pre-test and post-test. Both tests must have the same level of knowledge and equivalence in the questions and not be identical. Besides, a schedule of activities for the use of VLE and the application of the MA-AVA evaluation should be proposed.

The stage of using the VLE and evaluation using the MA-AVA begins with the application of the user characterization questionnaire, which must be built taking into account the VLE to be evaluated and the performance of the pre-test to verify the level from the students. After this activity, it is necessary to explain

to the students the functionalities of the virtual environment, and how the class will be with this VLE. After use, the post-test must be applied.

4. Model Application

The first step in applying the MA-AVA model was the choices of educational software and a theme. In this case, the researcher and the teacher chose the Educ-MAS-GA environment and the discipline of Analytical Geometry.

The second stage defined the hypotheses of the study, which will be proven or refused from the pilot test: the virtual environment promotes learning, motivating students, and offering a pleasant experience.

The Educ-MAS-GA environment (Sousa, 2012) offers contents for learning analytical geometry and addresses contents related to conics. The VLE offers didactic materials available with four levels of a Circumference Module and four levels of a Parabola Module. The key aspect of choosing the Educ-MAS-GA was the possibility of providing feedback to the user on its performance.

4.1. *Planning the pilot test*

Two meetings were held with the discipline's teacher to adjust the timing of the pilot test, set dates, and identify how many classes would participate.

The study would be carried out in three meetings of 2, 3, and 2 hours, respectively. The first would apply the characterization questionnaire, the pre-test, and a quick explanation of Educ-MAS-GA. In the second, students would use Educ-MAS-GA and, in the third, the post-test. The theme of this study is the Parabola that has a complete module in the Educ-MAS-GA environment. All the test questionnaires (pre and post) were defined for the study.

Each test had ten questions on the Parabola theme, which were classified by difficulty levels. The score of the questions varied from 1, for the first 8, which had a lower level of difficulty, and 4 points for the last two questions, subdivided into interdependent items.

4.2. *Applying the pilot test*

The professor used the software and the evaluation model in his teaching practice, with two classes of Engineering undergraduate course of a Public University in Rio de Janeiro. At the first meeting, the students who were willing to participate in the research signed a free consent, reinforcing the confidentiality of the data. After completing the consent form, students received the characterization questionnaire. The students had questions concerning/about the specific of VLE. The term VLE is not familiar to the students, and most of them did not know its meaning. However, all doubts were answered, and we reinforced that the most relevant issue was that they must fill the questionnaire with their real opinion. The first class (Class A) was composed of 16 students, and the second (Class B) had 15 students.

At the end of the characterization questionnaire, the pre-test was applied, making it clear that if they did not know how to solve a question, it could be left blank. The pre-test contained basic questions, fundamental for learning the topic about Parabola.

Both classes used Educ-MAS-GA in the second meeting, which took place in a Computer Laboratory.

Students were individually on a computer and had about 3 hours to use Educ-MAS-GA. The students used all the time available to complete the Parabola module. In the third meeting, the post-test was applied, and the students also answered the questionnaire on the perception of the use of Educ-MAS-GA. Only 15 students attended this last step.

5. Results and Discussions

This section presents the pilot test with Educ-MAS-GA in two parts. The first describes the learning evaluation results in the pre and post-tests; and the second considers student's perceptions about motivation, user experience, and learning perception, as defined in MA-AVA.

5.1. Learning Evaluation

From analyzing the percentage of correct answers in the pre and post-test, an improvement in the post-test performance of students is observed, with an increase of correct answers in the questions of higher levels of difficulty, as shown in Figure 2.

For validating this dimension, we applied the Student's t-test (Wholin et al., 2012) for paired samples. Figure 3 shows the means, standard deviation, variance, and sample size (N) for each group. From using the t-test with a 95% confidence interval, the result obtained determines that it is possible to reject the hypothesis that the averages of the pre and post-tests are equal since $t = 3.407$ and the t interval for hypothesis accepting would be 0,5822 to 2,649. The result of the post-test showed a mean and standard deviation slightly higher than the pre-test, proving the progress of the evaluated students.
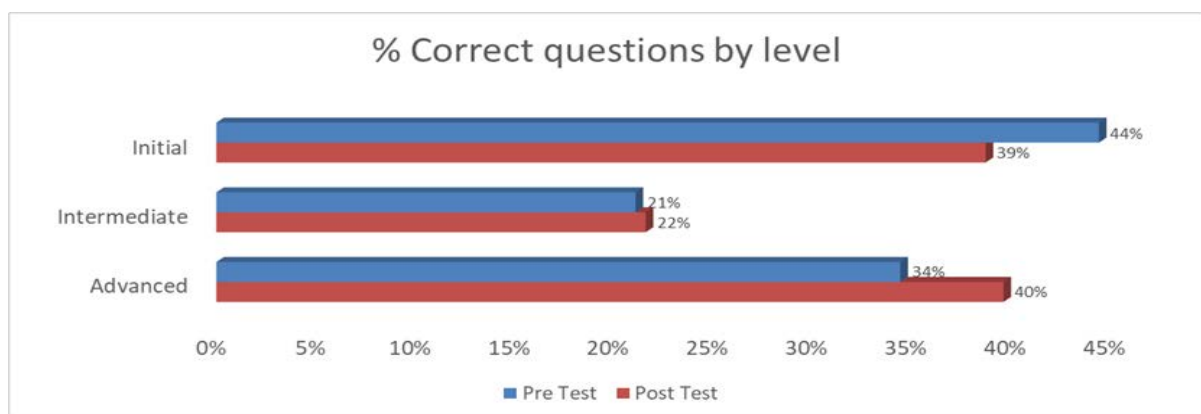
Figure 2. Percentage of correct answers by levels of difficulty of the questions in the Pre and Post Test

Type	N	Mean	Standard Deviation	p-value
Pre-test	13	6,92	1,85	<0,005
Post-Test	13	8,54	2,37	<0,005
Diference Pre-Post		1,62	1,71	
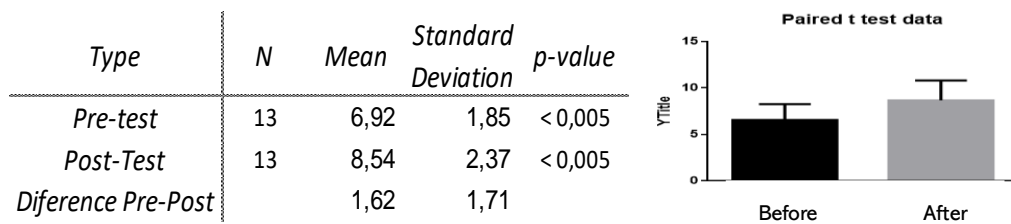
Figure 3. t-test results for classes A and B

5.2 Evaluation of Student Perception

Table 4 summarizes the Tables 1, 2, and 3 from the students' answers to the questions that are related to the perception of motivation, user experience, and learning in the use of VLE.

Table 4. Summary of students' perceptions of Educ-MAS-GA

Perception of the VLE experience	Motivation	The students considered Educ-MAS-GA as a learning motivator. The presentation strategy was considered quite relevant and varied (form, content, and activities). The opportunity to apply the learned subject matter in practice, as well as its understanding, had a lower evaluation than the other dimensions of the motivation subscale.
	User experience	In general, Educ-MAS GA provided a regular experience, with emphasis on the challenge and competence dimensions, which had a more significant evaluation. The challenge item was the best evaluated by the students, showing that Educ-MAS GA opens perspectives to make traditional classes less monotonous.
	Learning	The perception is that Educ-MAS GA contributed to learning in the discipline. All items were well evaluated and showed that the learning did occur.

In addition to the components of attention, motivation and user experience, the learning objectives were also assessed through a self-evaluation of students. The results of the students learning objectives means were checked using the Student's t test for paired samples and presented a p-value less than 0.001. All nine objectives had an increase when compared to the average grades before and after using Educ-MAS GA (Figure 4).
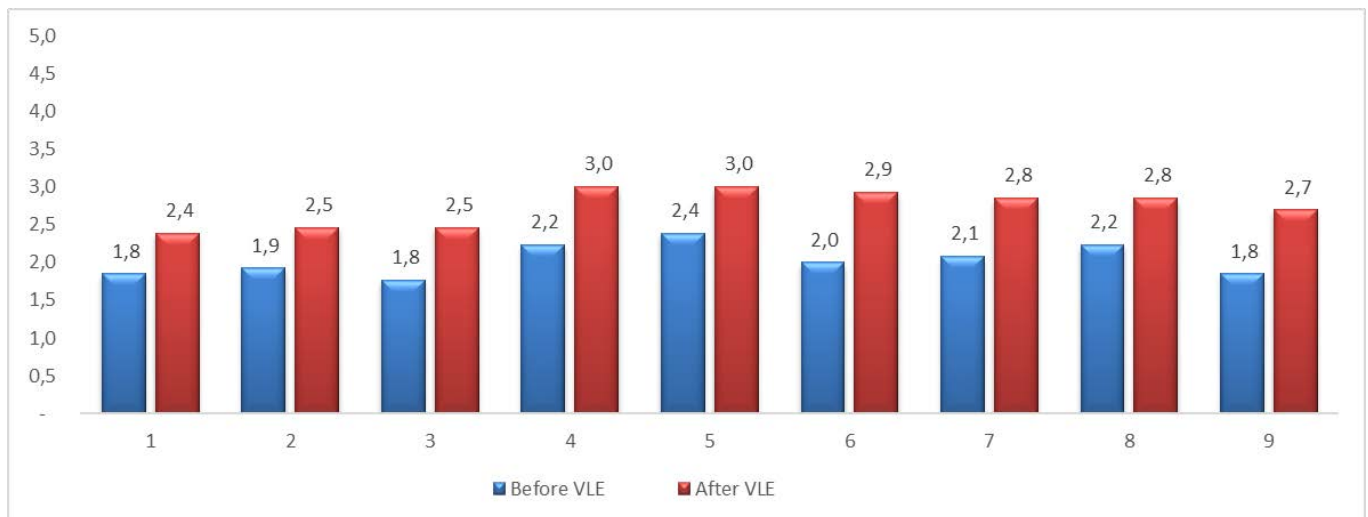
Legend: Learning Objectives

1 *Remember:* My understanding of Conics
2 *Understand* : My understanding of Conics
3 *Apply:* My understanding of Conics

4 *Remember:* Notion of Parabola
5 *Understand:* Notion of Parabola
6 *Apply:* Notion of Parabola

7 *Remember:* Graphical representation of the Parabola and its variations
8 *Understand:* Graphical representation of the Parabola and its variations
9 *Apply:* Graphical representation of the Parabola and its variations

Figure 4. Results from Learning Objective evaluation in the VLE

Figure 5 shows the results of the 13 students who participated in all stages of the study. The pre and post-test scores were normalized to be between 0 and 5.

When analyzing the results of the students' perception combined with the grades from the pre and post-tests, it is possible to notice that some results of learning perception dimension do not match the gain from the tests, with emphasis on the students 4, 6 and 9.

When analyzing case by case, some divergences between the result obtained and the given answers are evident. For example, the student represented in the graph in Figure 5 as number 8 had the value of learning perception of 3, which means that he felt he had learned the content. However, the results of his pre- and post-tests showed no gains. The opposite also occurs, as can be seen in student number 3, who has an average of 2 in relation to the perception of learning but has an excellent result in the post-test. This indicates that student's perception does not always correspond to the results of the evaluation tests.

As analyzed in section 5.1, in statistical terms, the average increases in grades in the post-test concerning the pre-test was expressive, and this can be observed in Figure 5.

The analysis of the results and comments from the participants generated some relevant observations. At the end of the second meeting, some students provided feedback on Educ-MAS-GA, and they pointed out that the completion of the Parabola module was exhaustive. This issue is related to the strategies for presenting the content. In this sense, according to Markova, Glazkova & Zaborova (2016) the faculty members need to recognize that e-learning and virtual learning environments require design expertise, considering the skills stimulated in each interaction. Thus, as the content of Educ-MAS-GA is in initial tests with end-users, the question of pedagogical strategies needs to be further explored.
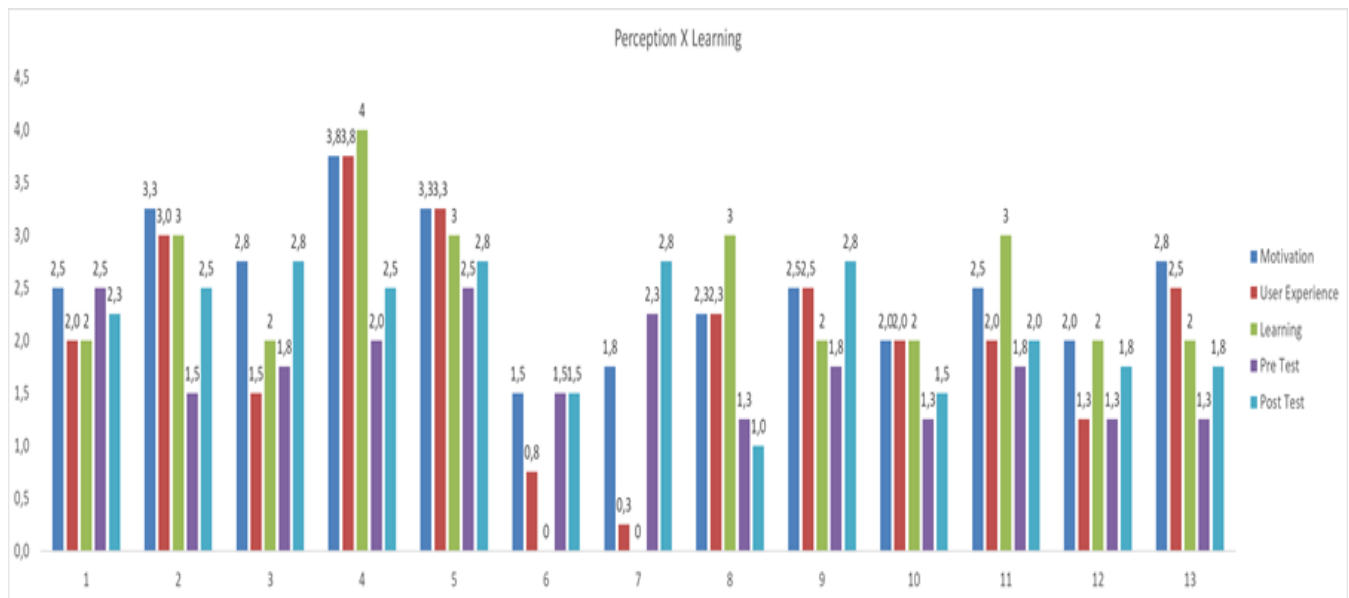
Figure 5. Perception and Learning Evaluation

An aspect noticed in this experiment was the low participation of students. However, because the experiment result would not add grades to the discipline of Analytical Geometry, many students were not motivated to participate.

6. CONCLUSION

Virtual learning environments can turn the teaching and learning process more attractive, allowing the integration of theory and practice of different disciplines. Therefore, it is necessary to evaluate such environments to understand whether there are gains in terms of knowledge, especially for the student. On the other hand, several papers discuss student engagement in the use of virtual learning systems and on the quality of activities available in AVA's (Agredo-Delgado, 2019, Aldredge, 2019), which are fundamental aspects to maintain students engaged in activities proposed by the environment. In this context, this paper presented the development of an evaluation model of learning in virtual environments, the MA-AVA, and developed a pilot test to identify positive points and weaknesses of the proposed model. The evaluation instrument considered two approaches, one based on students' perception of learning process and the other that explores the increase in students' knowledge, captured by pre and post-tests.

The first module assesses the students' perception considering three subcomponents: student motivation, user experience in the environment, and learning perception. This model was inspired by Savi's proposal (2011), which integrates aspects proposed by Kirkpatrick (1996), Keller's ARCS model (2009), and the Bloom taxonomy (Bloom, 1956, Moddy and Sindre, 2003). As Savi's model is quite long, with the evaluation of many dimensions, we tried to simplify the list of items to be evaluated to eliminate some questions and stimulate the users' commitment to the evaluation instrument. We also introduced the Kirkpatrick Level 2 (1996) that establishes the learning gain evaluation of training.

The student information was included in the model to determine the profile of classes or students, such as average age, levels of knowledge of the themes, and years of study. This information can be relevant for

the teacher to analyze the performance of the class, making some interrelation to these characteristics.

To evaluate the model, a pilot test was developed with two undergraduate classes from a public university in the discipline of Analytical Geometry. The teacher used the Educ-MAS-GA virtual environment to work on the Parabola concept in a laboratory class. The environment already contains some geometry courses ready to be used (Sousa, 2012). The professor participated in the structure of the experiment and the construction of the pre and post-test instruments. This was essential for the proposed questions to be aligned to the content worked on.

The evaluation process was structured and defined according to the model. There were 3 stages, one of which was a pre-test, the other used the Educ-MAS-GA environment, followed by one that was applied to the post-test and filling in the instruments of learning perception. From the data collection, it was possible to evaluate the MA-AVA model concerning its objectives and the hypothesis that based this study.

The experiment results suggest that students were motivated to use VLE, especially to diversify traditional learning methods. The number of correct answers in the post-test is statistically higher than the correct answers in the pre-test, indicating some level of improvement in learning.

Although the sample is small, the results of the two evaluated dimensions indicate the confirmation of the hypothesis: the virtual environment contributes to learning, motivating students, and being able to provide a pleasant experience.

However, as threats to the validity of the research, we highlight the low number of students who participated in the pilot tests, and the limited number of classes. As future works, we expect to develop other experiments, with more days of classes, more content to be worked on, and more students.

We would also like to highlight that virtual environments such as Educ-MAS-GA need to be further studied and filled with content, especially at this time of pandemic, when students of different educational levels in Brazil have little access to communication networks. This system can be used locally, providing support for the learning of various topics.

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Stock Management and Control in a Local Shop of Animal Products

Ravena de Mello Rodrigues

Institute of Science and Technology (ICT), Federal Fluminense University, Brazil.

Phone: +55 22 2764-9081

Address: Recife Street, Jardim Bela Vista, Rio das Ostras –Rio de Janeiro

Zip Code: 28895-532

Ricardo Luiz Fernandes Bella

Institute of Science and Technology (ICT), Federal Fluminense University, Brazil.

Phone: +55 22 2764-9081

Address: Recife Street, Jardim Bela Vista, Rio das Ostras –Rio de Janeiro

Zip Code: 28895-532

Douglas Vieira Barboza

Laboratory of Technology, Business Management and Environment (LATEC), Federal Fluminense University, Brazil.

Phone: +55 21 2629-5727

Address: 156, Passo da Pátria Street - room 324, São Domingos, Niterói –Rio de Janeiro

Zip Code: 28895-532

Maria Helena Teixeira da Silva

Institute of Science and Technology (ICT), Federal Fluminense University, Brazil.

Phone: +55 22 2764-9081

Address: Recife Street, Jardim Bela Vista, Rio das Ostras –Rio de Janeiro

Zip Code: 28895-532

Abstract

Due to globalization, the achievement of competitiveness has become fundamental to the organizations that try to be leaner each day, reducing costs, and thus allowing other investments. Thereby, stocks are achieving each day more importance due to its relevance in the company economic stability. A great management allows products never miss in stock and a great management also avoids excess in leftovers. In this project, the importance of stock management carries the objective of optimizing the investments over stocks and of decreasing losses caused by obsolescence in a retail micro company that sells goods for animals. For that purpose, the ABC Classification has been applied in which the main products referred to demand and profits were identified. The supply policy adopted for those products was the Economic Lot Size, calculating the safety stock and the resupply point. It was possible to calculate order costs, maintenance and material through collected data during meetings with the company owners and this way it was possible to realize that the economic buying batch applicability would generate savings relating to the current company model. In addition to the decreasing of the risk of losing items and keeping the safety

stock in order to face the demand fluctuations.

Keywords: Services management; ABC analysis; Inventory; Economic improvement; Safety Stock.

1. Introduction

With the competitiveness of the market increasing, companies seek to stand out for the quality of their products, but competition also forces entrepreneurs to work with low prices. Thus, the major obstacle for companies is to reduce their costs and improve their reliability simultaneously. For this, organizations seek techniques for cost management and process optimization, considering the computerization of inventory management in the search for competitiveness [1].

In addition to competing with large national companies, Brazilian micro and small companies (MPE) began to face international competition in the 1990s with the opening of Brazilian markets, thus compromising their survival [2]. For this reason, it is vital to rationalize the use of time and resources with the potential to increase profit margins, better satisfy customers and optimize the performance of their activities [3].

Stock management is a common theme in the market and fundamental to business health, because can help micro-companies to be steady and, when this is not done efficiently, leaves the enterprise exposed to not supply your costumer demand, generating opportunities for competitors [4].

The relevance of this work is due to the fact that the company object of the study has no knowledge of management practices, and consequently does not use them, as a relevant part of micro-companies.

Due to the absence of management practices, they present several problems, such as loss of capital and compromised profitability, since the company has high levels of inventories that generate losses of products due to obsolescence and losses in sales due to the absence of other products, in addition to the dissatisfaction of customers [5].

The present project aims to propose the implementation of stock management tools in order to improve the resupply policy in a pet food retail micro-company, reducing losses and optimizing investments in stocks. However, it is not for this study to analyze all products in the store, being restricted only to 15kg dog food bags, which will be identified through the ABC classification, as they are the products with the greatest financial impact and because they occupy a larger volume in the stock from the company.

In the structural aspect, the article is divided into five parts: in a first, contextualization and the final objectives of the approach proposed in this study are exposed. In a second part, the methodology used is presented and the understanding of the enterprise where the study was carried out is provided. The third shows the examination and documentation of the application of the method on the pet food retail company. The fourth part discusses the results presented in the previous step, highlighting those that presented themselves as of greater relevance and proposing to use management tools. And in a last stage, the achievement of the goals pursued in the objective of the study is concluded.

2. Material and Methods

This is applied research, exploratory, classified as qualitative and quantitative, and which used the case study in a retail company to study in detail the causes of a determined problem.

2.1 Methodology

The method of this research is formed by a bibliographic research and a case study. The bibliographic research aims to identify and organize the concepts related to the chosen theme based on relevant works [6].

Given that this research is a case study, it should be noted that, this research method ranges from the logic of its planning to the description of data collection and analysis procedures and also the development of the theory, this being an essential part of the project. To design the research, the author highlights four questions for its conduct: "What problems to study?"; "What data is important?"; "What data will be collected?"; and "How to analyze them?" [7].

The research took place in six stages: Kick-off meeting; planning visits throughout the project; collecting and analyzing data related to the store's stock and preparing a proposal for improving the product storage process.

The Kick-off Meeting was held on the first visit, in March 2019, in order to talk with the company owner about the possibility of carrying out an academic study in his store, which was restricted to visits with previous scheduling. Still at this stage, information was collected on the history of the company and its functioning, in order to elaborate the context of the research and also define the objective and the research problem.

On the second visit, a schedule was established with the entrepreneur, in order to decide the best days and times so as not to compromise the operation of the store and enable data collection with ease. In this way, 10 visits were scheduled over 5 months at 2 pm.

Data collection was carried out by means of documents, by direct observation of the company's storage system and through interviews with the store owner and employees using a question script in order to optimize the time and responses of employees. All interviews were recorded.

The time to place and receive an order was observed, which were observed and timed by the researcher in three different days and the systematic of resupply and storage of the store in order to understand its operation, since the company does not have a defined system, and capture possible gaps and then carry out a study and propose solutions.

Regarding the replacement of the items, the period and quantities of goods replaced and the size of the purchase lots were determined. And in relation to storage, it was seen how the stock is organized, where the items are allocated when they arrive at the store and who is responsible for their storage.

Customer service was observed in order to investigate whether there is a recurring lack of products in the store for consumers. At the end of the observations, reports and records with photos were made in order to keep all the information observed.

After data collection, results analysis was carried out to identify the quantity of products in stock, the products to be prioritized based on profitability and demand, and to analyze the stock replenishment policy. The Physical Inventory and ABC Classification tools were used.

The Physical Inventory has the objective of counting the goods in stock [8], and was used because the owner informed during the interview that he was not aware of the quantities of products stocked.

After the inventory, the products were classified according to the logic of the ABC curve, which shows that

not all items are of equal importance, with more significant items that should be prioritized according to demand, profit and sales price [9].

After completing the data analysis, the economic lot buying model was applied to the products prioritized in the ABC classification, in order to compare the results obtained with the current results of the company and propose the application of a replacement policy for the same.

Calculations were performed for: resupply cost and the annual inventory maintenance cost; safety stock; the resupply point; the maximum stock; and comparison between the total cost of the current model and the total cost of the economic purchase lot model.

As for the improvements, it was proposed to use and maintain the physical inventory spreadsheet, in order to optimize the control of product inputs and outputs, since the company does not do this management.

Along with this spreadsheet, the use of visual management was proposed, in order to allow the control of stock levels in the spreadsheet itself, where the column indicating the quantity in stock would signal the owner which action to take, according to the following colors: green, indicating that the stock is at the maximum level, yellow, in the safety stock, indicating the time to place the order with the supplier and red, indicating the minimum stock level [10].

Another possibility for continuous improvement that was analyzed was the application of the 5s tool to promote the reorganization of the stock and encourage the participation of employees in the application of the 5 senses: *Seiri* (classification), separating products by families; *Seiton* (Organization), group the products of the same family as well as identify them by means of labels; *Seiso* (cleaning), clean the stock and products; *Seiketsu* (standardization and health) [11], in addition to organizing and cleaning, carrying out possible repairs and maintenance on the stock structure; *Shitsuke* (self-discipline), consolidate the previous four senses through training with employees and application of the PDCA cycle.

2.1 Characterization of the enterprise

The present project is focused on a retail company located in the city of Niterói, state of Rio de Janeiro with the size of a micro company, according to Sebrae [12].

The company sells various types of animal products, such as dog food, cats, birds, rabbits and horses. There are also other products such as collars, houses for dogs and cats, cages, aquariums, riding accessories, among others. In addition, it offers bathing and grooming for pets and also has a delivery service for neighborhoods located close to the store. Currently, this company seeks to remain in the competitive market, as it has been facing a significant drop in sales of its products.

Its inauguration was in March 2014, when only the owner and his son worked, there is currently one employee, that is, 3 people work at the company in a total area of 90m² organized as follows: service area, where the products are exposed, bath and grooming area, owner's office, bathroom and stock. The company's layout is illustrated in Figure 1.
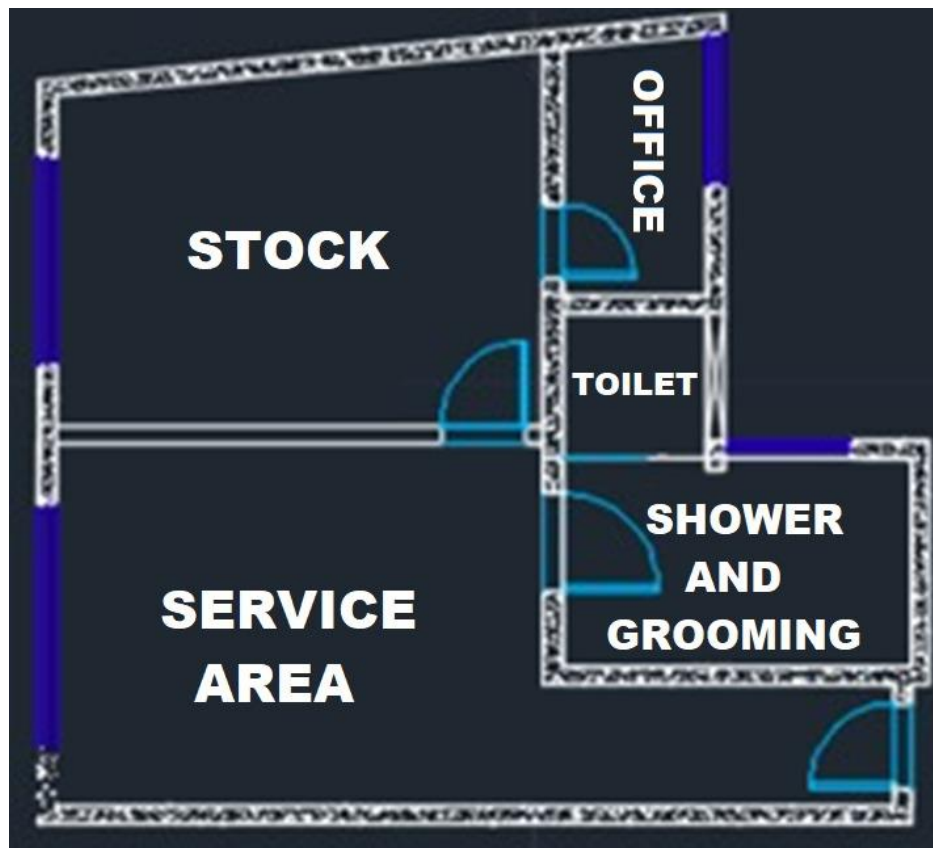
Figure 1. Organizational layout.
Source: Authors.

The company did not have a management system and therefore had problems in the storage process of its items due to the lack of organization and the quantity of products, which caused difficulties in the visibility and distribution of the items in the stock space, as there was no standard storage and shelves.

Other important information are: store opening hours and days, working hours, salary and number of employees, time for placing and receiving orders, responsible for ordering and checking orders, area of store rooms and the lead time of the supplier according to Table 1.

Table 1. Company characteristics.

Operating days	Monday to Friday
Opening hours	8:30h to 20h
Working hours	8 hours per day
Number of workers	3
Employee salary	1500 BRL
Salary of the owner's son	2800 BRL
Time to place an order	30 minutes
Time to receive / check the order	4 hours
Purchasing Manager	Owner's son
Conference officer	Owner's son
Supplier lead time	7 days
Company area	90 m^2

Source: Authors.

3. Examination

After the physical inventory of the company's stock, some items were prioritized for better development of the work according to the interview with the manager, where the 15kg dog food packages were defined as products to be quantified and analyzed, due to the greater impact in terms of of space.

So these were accounted for and spread out with the following information: Product name, total quantity in stock, expiration date and sales price, this information being collected by when carrying out the inventory in the stock.

When carrying out the inventory in stock, they were accounted for and spread out with the following information: Product name, total quantity in stock, expiration date and sales price. Demand history was also considered based on notes that the owner makes for his daily cash control from January 2019 to September 2019 (9 months), taking into account that the manager discards his notebook annually.

Because the manager does not know precisely which items generate the most profit for the company, it was decided to apply the ABC curve in order to identify such products. A resupply policy was proposed with the aim of assisting the owner on when and how much to buy with the use of *Kanban* cards, a system that makes it possible to monitor and control stocks in a simplified manner that ensures sufficient stock levels, without exaggeration and without lack, through the replacement of materials based on consumption and lead time [13].

The stock was divided into: Green zone, which indicates the maximum stock level, that is, the product does not need to be replaced or purchased; Yellow zone, which indicates the level of safety stock, that is, it is the point of ordering; Red zone, which indicates the minimum stock level or critical zone, that is, it indicates that the items present there are safe and need to be replaced, this card is used when there is a problem with the replenishment time [14].

The disorganization of the products prevented the exact quantity of each product from being known, generating unnecessary product purchases, losses of products due to expiration and thus losses of capital and customers. And because he does not know what is in stock, the owner could not draw up strategies for his company, because he does not have knowledge about what is his most strategic product, who is his critical supplier, when is the right time to resupply among other problems

The difference between the selling price and the cost price was calculated in order to calculate the profit per unit, and the sum of the profit of all the rations to know the total profit and to know the individual percentage of each product by dividing the profit per unit by the total profit of the products.

Once this was done, the products were ordered in descending order based on the percentage value of profit and thus the accumulated percentage of products was calculated and the ABC classification was performed based on the accumulated percentage according to the results presented in Table 2.

Table 2. ABC classification results

Classes	Quantity of products	Proportion of products	Proportion of Profit
A	6	14%	30%
B	16	24%	38%
C	43	64%	32%

Source: Authors.

It is possible to see that 14% of the products belong to class A, 24% belong to class B and 64% belong to class C and that adding the results of the proportions of values of Class A and Class B we have a profit margin of 68% , that is, 38% of the dog rations are responsible for 68% of the company's profit according to the delimitation. Based on the analysis of the ABC curve exposed in the Figure 2, it is perceived that due to the similarity of the data, it was not possible to reach the proportion of 80% of profits for 20% of products. Then, this same analysis was made for all other indicators in the table, that is, ABC classifications were made based on demand and sales price.
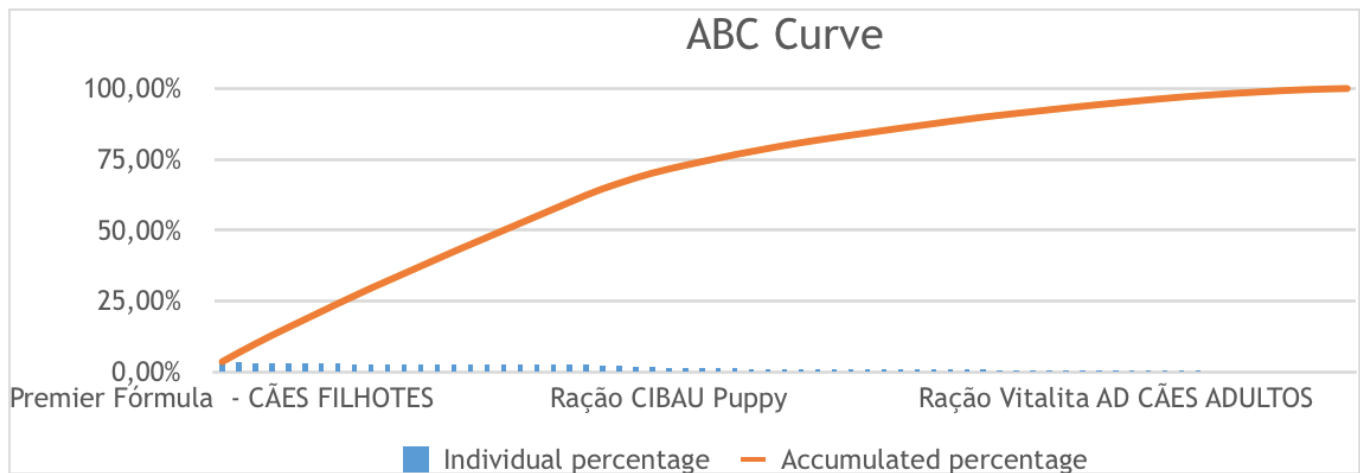
Figure 2. ABC Curve Graphic

Source: Authors

For the demand-based classification, the demands per unit were added up to the total demanded during the 9 months, being calculated the percentages per unit of product, that is, dividing the demand per unit by the total demand and later the accumulated percentages were calculated. Thus, the classification was also made regarding the sale price, using the same procedure that has its results summarized in Table 3 and Table 4.

Table 3. ABC classification results for demanda

Classes	Quantity of products	Proportion of products	Proportion of Demand
A	9	13%	20%
B	23	33%	39%
C	38	56%	41%

Source: Authors.

Table 4. ABC classification results for sales price

Classes	Quantity of products	Proportion of products	Proportion of Sales Price
A	7	10%	19%
B	22	32%	40%
C	40	60%	41%

Source: Authors.

The classification according to demand shows that 13% of the products belong to class A, 33% belong to class B and 56% belong to class C, and that adding the results of the proportions of values of Class A and Class B we have a percentage of demand of 59%, that is, 46% of the dog rations are responsible for 59% of the demand of rations.

While the sales price shows that 10% of the products belong to class A, 32% belong to class B and 60% belong to class C and that adding the results of the proportions of values of Class A and Class B we have a percentage of selling price of 42%, that is, 42% of the dog rations are responsible for 59% of the profit from the company's sales.

Priority was given to products that were repeated simultaneously, in Classes A and B, in the three analyzes, totaling 21 items that are shown in Table 5.

Table 5. Prioritized products

Premier Fórmula   - Cães filhotes
Royal Canin   Medium Adult
Royal Canin – Giant Puppy
Ração Royal Canin – Maxi Junior
Ração Royal Canin – Maxi Adult
Ração Royal Canin Canine Veterinary Diet Skin Care Small Dog
Ração Royal Canin Canine Veterinary Diet Urinary S/O Cães
Premier Ambientes Internos   - Cães Adultos
Royal Canin Medium Adult 7+
Ração Royal Canin Veterinary Gastro Intestinal – Cães Adultos
Ração Royal Canin Canine Veterinary Diet Renal Special para Cães
Royal Canin Renal Veterinary Diet Cães
Ração Royal Canin Veterinary Hepatic – Cães Adultos
Premier Seleção Natural Batata Doce – Cães Adultos
Premier Seleção Natural Frango – Cães Adultos Raças Pequenas
Premier Raças Específicas Frango – Pitbull Adultos
Premier Seleção Natural Frango – Cães Adultos Raças Pequenas
Ração Royal Canin Veterinary Obesity – Cães Adultos
Royal Canin Mini Adult
Royal Canin Mini Indoor Adult
Ração Royal Canin Canine Veterinary Diet Urinary S/O Cães

Source: Authors

It was observed through this analysis that, unlike what was imagined by the management, the Premier brand rations were the most significant, and Royal Canin has the greatest impact for the company. Since, among the 21 products prioritized 88% of Royal Canin's variations are offered by the company and 66% of Premier rations. Another analysis was regarding the number of brands sold by the store. Currently, the company has 14 feed brands, but only 2 brands were considered representative

During the interviews, the owner informed that there is no criterion for carrying out the replenishment of products, with orders being made according to his experience, within a 30-day interval, that is, at the beginning of each month, the products that are requested are visually out of stock in the store.

There is no minimum and maximum amount of animal feed per order and the time for delivery of orders is 7 days and all transport costs for delivery are attributed to the supplier.

It is noticeable that there is no need to restrict the number of orders, as there is no shipping cost for the company and the lead time of the supplier is relatively short, allowing the batch size of each product to be small and, therefore, to be carried out more orders throughout the month.

Thus, it was necessary to carry out a study to optimize the policy of resupply of the products that were prioritized, for which the economic lot size, the safety stock and the reorder point for each prioritized item were calculated.

4.　Proposition of Management Tools

With the objective to maintain the organization of information about the company's stock, a spreadsheet for stock control was proposed, as explained in Table 6.

Table 6. Example spreadsheet to control stocks

Inventory Control Worksheet					
Name	Sale Price	Cost Price	Demand	Quantity in stock	Validity

Source: Authors

Through the spreadsheet it is possible to keep the stock information organized and control the quantity of materials and their expiration dates. With its operation in two stages: a first to register name, sales price and cost, quantity in stock and validity of products; and a second, updating the quantities of registered products as they are sold, as well as their demand.

It was proposed to check the physical inventory spreadsheet every six months and recommended the periodic inventory for the company, validating the information from the inventory carried out in the present study, which found during its check six products with an expiration date for the next 3 months. Therefore, it was proposed that these products be exposed with a discount for sale and the action was carried out as a record in Figure 3.

Figure 3.   Registration of the promotional action

Source: Authors

The calculation of the economic lot size (ELZ) for the 21 products chosen was made from equation (1) based on data from interviews and observations of: resupply cost (RC); product demand in the period (D); the annual maintenance cost (aC)

$$ELZ = \sqrt{\frac{2*D*RC}{aC}}(1)$$

The calculation of the ressuply cost was based on the following data: salary of the employee (S) responsible for ordering the rations, which is equal to R $ 2,800.00, number of hours worked (NHW) in one month, which is equal to 192 hours. For the calculation of the time (t) that the employee spends to place orders, the follow-up was performed and the requisition time for three orders was timed to calculate the average times, as shown in Table 7.

Table 7. Order requisition time

Month	Time (Minutes)
July	30
August	28
September	31
Average	29,7

Source: Authors.

Thus, on average, the time (t) that the employee spends to place an order is 30 minutes, that is, half an hour, and this value should be applied to Equation 2, which represents the RC calculation.

$$RC = \frac{S}{NHW}t \ \ (2)$$

Applying the values to the equation, the value of 7.29 BRL per order was reached. And based on the same reasoning, the cost of receipt is calculated, since the same employee responsible for buying and receiving orders has the same salary and number of hours worked. To calculate the receipt time, the receipt time of three orders was timed and the average of the times was calculated, as can be seen in Table 8.

Table 8. Order receipt time

Month	Time (Minutes)	Time (Hours)
July	230	3,833
August	270	4,5
September	290	4,833
Average		4,4

Source: Authors.

On average, the time (t) the employee spends to receive an order is 4 hours and 25 minutes. The equation for calculating this cost is the same equation used for calculating the requisition cost, with which the amount of 64.16 BRL per order is reached. And adding the requisition and receipt costs, the resupply cost is 71.45 BRL per order.

The annual demand was obtained through the notes of the owner of the inputs and outputs of the products during the study period and can be seen in table 9.

Table 9. Demand for prioritized products

Prioritized Products	Annual demand (bags)
Premier Fórmula - Cães filhotes	180
Royal Canin Medium Adult	142
Royal Canin - Giant Puppy	142
Ração Royal Canin - Maxi Junior	142
Ração Royal Canin - Maxi Adult	142
Ração Royal Canin Canine Veterinary Diet Skin Care Small Dog	142
Ração Royal Canin Canine Veterinary Diet Urinary S/O Cães	142
Premier Ambientes Internos - Cães Adultos	180
Royal Canin Medium Adult 7+	142
Ração Royal Canin Veterinary Gastro Intestinal - Cães Adultos	142
Ração Royal Canin Canine Veterinary Diet Renal Special para Cães	142
Royal Canin Renal Veterinary Diet Cães	142
Ração Royal Canin Veterinary Hepatic - Cães Adultos	142
Premier Seleção Natural Batata Doce - Cães Adultos	180
Premier Seleção Natural Frango - Cães Adultos Raças Pequenas	180

Premier Raças Específicas Frango - Pitbull Adultos	180
Premier Seleção Natural Frango - Cães Adultos Raças Pequenas	180
Ração Royal Canin Veterinary Obesity - Cães Adultos	180
Royal Canin Mini Adult	142
Royal Canin Mini Indoor Adult	142
Ração Royal Canin Canine Veterinary Diet Urinary S/O Cães	142

Source: Authors

To calculate the annual cost of stock maintaining, the following were considered: capital opportunity costs based on the cost of products in stock at the company's opportunity rate, considering a fixed income fund with an average yield of 7% per year where the owner applies; and deterioration costs based on the 100% effective obsolescence cost and one year validity [16].

The calculation of the capital opportunity cost for each prioritized product, which is relevant for the company to know the loss of capital invested and paralyzed in stock, is shown in table 10.

Table 10. Calculation of obsolescence cost

Prioritized Products	Cost Price (BRL)	Opportunity rate (BRL)	Opportunity cost (BRL)
Premier Fórmula - Cães filhotes	109.90		7.69
Royal Canin Medium Adult	189.90		13.29
Royal Canin - Giant Puppy	194.90		13.64
Ração Royal Canin - Maxi Junior	159.90		11.19
Ração Royal Canin - Maxi Adult	159.90		11.19
Ração Royal Canin Canine Veterinary Diet Skin Care Small Dog	159,.90		11.19
Ração Royal Canin Canine Veterinary Diet Urinary S/O Cães	159.90		11.19
Premier Ambientes Internos - Cães Adultos	89.90		6.29
Royal Canin Medium Adult 7+	194.90	7%	13.64
Ração Royal Canin Veterinary Gastro Intestinal - Cães Adultos	159.90		11.19
Ração Royal Canin Canine Veterinary Diet Renal Special para Cães	159.90		11.19
Royal Canin Renal Veterinary Diet Cães	159.90		11.19
Ração Royal Canin Veterinary Hepatic - Cães Adultos	159.90		11.19
Premier Seleção Natural Batata Doce - Cães Adultos	89.90		6.29
Premier Seleção Natural Frango - Cães Adultos Raças Pequenas	89.90		6.29
Premier Raças Específicas Frango - Pitbull Adultos	89.90		6.29
Premier Seleção Natural Frango - Cães Adultos Raças	89.90		6.29

Pequenas			
Ração Royal Canin Veterinary Obesity - Cães Adultos	159.90		11.19
Royal Canin Mini Adult	155.90		10.91
Royal Canin Mini Indoor Adult	149.90		10.49
Ração Royal Canin Canine Veterinary Diet Urinary S/O Cães	159.90		11.19

Source: Authors

Table 11 shows the calculation made by multiplying the cost of effective obsolescence by the cost price of the prioritized products.

Table 11. Calculation of obsolescence cost

Prioritizes products	Cost Price (BRL)	Validity (months)	Cost of effective deterioration	Deterioration Cost (BRL)
Premier Fórmula - Cães filhotes	109,90	12		109,90
Royal Canin Medium Adult	189,90	12		189,90
Royal Canin - Giant Puppy	194,90	12		194,90
Ração Royal Canin - Maxi Junior	159,90	12		159,90
Ração Royal Canin - Maxi Adult	159,90	12		159,90
Ração Royal Canin Canine Veterinary Diet Skin Care Small Dog	159,90	12		159,90
Ração Royal Canin Canine Veterinary Diet Urinary S/O Cães	159,90	12		159,90
Premier Ambientes Internos - Cães Adultos	89,90	12		89,90
Royal Canin Medium Adult 7+	194,90	12		194,90
Ração Royal Canin Veterinary Gastro Intestinal - Cães Adultos	159,90	12	100%	159,90
Ração Royal Canin Canine Veterinary Diet Renal Special para Cães	159,90	12		159,90
Royal Canin Renal Veterinary Diet Cães	159,90	12		159,90
Ração Royal Canin Veterinary Hepatic - Cães Adultos	159,90	12		159,90
Premier Seleção Natural Batata Doce - Cães Adultos	89,90	12		89,90
Premier Seleção Natural Frango - Cães Adultos Raças Pequenas	89,90	12		89,90
Premier Raças Específicas Frango - Pitbull Adultos	89,90	12		89,90

Premier Seleção Natural Frango - Cães Adultos Raças Pequenas	89,90	12	89,90
Ração Royal Canin Veterinary Obesity - Cães Adultos	159,90	12	159,90
Royal Canin Mini Adult	155,90	12	155,90
Royal Canin Mini Indoor Adult	149,90	12	149,90
Ração Royal Canin Canine Veterinary Diet Urinary S/O Cães	159,90	12	159,90

Source: Authors

From the values presented, it was possible to arrive at the value of the annual cost of stock maintaining (aC) by adding the opportunity cost of capital with the cost of deterioration, according to Table 12.

Table 12. Annual stock maintenance cost

Produtos Priorizados	Custo de Oportunidade (BRL)	Custo de deteriorização (BRL)	Custo anual de manutenção (Ca) (BRL)
Premier Fórmula - Cães filhotes	7.69	109.90	117.59
Royal Canin Medium Adult	13.29	189.90	203.19
Royal Canin - Giant Puppy	13.64	194.90	208.54
Ração Royal Canin - Maxi Junior	11.19	159.90	171.09
Ração Royal Canin - Maxi Adult	11.19	159.90	171.09
Ração Royal Canin Canine Veterinary Diet Skin Care Small Dog	11.19	159.90	171.09
Ração Royal Canin Canine Veterinary Diet Urinary S/O Cães	11.19	159,90	171.09
Premier Ambientes Internos - Cães Adultos	6.29	89.90	96.19
Royal Canin Medium Adult 7+	13.64	194.90	208.54
Ração Royal Canin Veterinary Gastro Intestinal - Cães Adultos	11.19	159.90	171.09
Ração Royal Canin Canine Veterinary Diet Renal Special para Cães	11.19	159.90	171.09
Royal Canin Renal Veterinary Diet Cães	11.19	159.90	171.09
Ração Royal Canin Veterinary Hepatic - Cães Adultos	11.19	159.90	171.09
Premier Seleção Natural Batata Doce - Cães Adultos	6.29	89.90	96.19
Premier Seleção Natural Frango - Cães Adultos Raças Pequenas	6.29	89.90	96.19
Premier Raças Específicas Frango - Pitbull Adultos	6.29	89.90	96.19
Premier Seleção Natural Frango - Cães Adultos	6.29	89.90	96.19

Raças Pequenas			
Ração Royal Canin Veterinary Obesity - Cães Adultos	11.19	159.90	171.09
Royal Canin Mini Adult	10.91	155.90	166.81
Royal Canin Mini Indoor Adult	10.49	149.90	160.39
Ração Royal Canin Canine Veterinary Diet Urinary S/O Cães	11.19	159.90	171.09

Source: Authors

With the results of calculations of resupply costs, annual maintenance costs and demand data, it was possible to calculate the economic lot size of the priority feeds as shown in Table 13.

Table 13. Calculation of economic lot size

Prioritized Products	Resupply Cost (RC) (per order) (BRL)	Demand (D) (annual)	Maintenance Cost (aC) (annual)	Economic Lot Size (ELZ)
Premier Fórmula - Cães filhotes		180	117.59	15
Royal Canin Medium Adult		142	203.19	10
Royal Canin - Giant Puppy		142	208.54	10
Ração Royal Canin - Maxi Junior		142	171.09	11
Ração Royal Canin - Maxi Adult		142	171.09	11
Ração Royal Canin Canine Veterinary Diet Skin Care Small Dog		142	171.09	11
Ração Royal Canin Canine Veterinary Diet Urinary S/O Cães		142	171.09	11
Premier Ambientes Internos - Cães Adultos	71.45	180	96.19	16
Royal Canin Medium Adult 7+		142	208.54	10
Ração Royal Canin Veterinary Gastro Intestinal - Cães Adultos		142	171.09	11
Ração Royal Canin Canine Veterinary Diet Renal Special para Cães		142	171.09	11
Royal Canin Renal Veterinary Diet Cães		142	171.09	11
Ração Royal Canin Veterinary Hepatic - Cães Adultos		142	171.09	11
Premier Seleção Natural Batata Doce - Cães Adultos		180	96,19	16
Premier Seleção Natural Frango - Cães Adultos Raças Pequenas		180	9619	16

Premier Raças Específicas Frango - Pitbull Adultos	180	96.19	16
Premier Seleção Natural Frango - Cães Adultos Raças Pequenas	180	96.19	16
Ração Royal Canin Veterinary Obesity - Cães Adultos	180	171.09	12
Royal Canin Mini Adult	142	166.81	11
Royal Canin Mini Indoor Adult	142	160.39	11
Ração Royal Canin Canine Veterinary Diet Urinary S/O Cães	142	171.09	11

Source: Authors

After calculating the quantities of feed bags that must be purchased in each order so that the total annual cost is minimized, the time to place an order was also calculated through the safety stock (SS) and the resupply point (Rp). For the calculation of SS, was used the equation 3, where D is Demand and L is the supplier's Lead-time.

$$SS = D * L \quad (3)$$

Thus, the safety stock of each product was calculated as shown in Table 14.

Table 14. Calculation of safety stock

Prioritized Products	Average daily demand	*Lead time* (days)	Safety Stock
Premier Fórmula - Cães filhotes	0,5		4
Royal Canin Medium Adult	0,4		3
Royal Canin - Giant Puppy	0,4		3
Ração Royal Canin - Maxi Junior	0,4		3
Ração Royal Canin - Maxi Adult	0,4		3
Ração Royal Canin Canine Veterinary Diet Skin Care Small Dog	0,4		3
Ração Royal Canin Canine Veterinary Diet Urinary S/O Cães	0,4	7	3
Premier Ambientes Internos - Cães Adultos	0,5		4
Royal Canin Medium Adult 7+	0,4		3
Ração Royal Canin Veterinary Gastro Intestinal - Cães Adultos	0,4		3
Ração Royal Canin Canine Veterinary Diet Renal Special para Cães	0,4		3

Royal Canin Renal Veterinary Diet Cães	0,4	3
Ração Royal Canin Veterinary Hepatic - Cães Adultos	0,4	3
Premier Seleção Natural Batata Doce - Cães Adultos	0,5	4
Premier Seleção Natural Frango - Cães Adultos Raças Pequenas	0,5	4
Premier Raças Específicas Frango - Pitbull Adultos	0,5	4
Premier Seleção Natural Frango - Cães Adultos Raças Pequenas	0,5	4
Ração Royal Canin Veterinary Obesity - Cães Adultos	0,5	4
Royal Canin Mini Adult	0,4	3
Royal Canin Mini Indoor Adult	0,4	3
Ração Royal Canin Canine Veterinary Diet Urinary S/O Cães	0,4	3

Source: Authors

To calculate the replacement point, the supplier's lead time and monthly demand were multiplied and subsequently added to the safety stock according to equation 4.

$$Rp = (L.D) + SS \quad (4)$$

The results can be seen in Table 15.

Table 15.   Calculation of replacement point

Prioritized Products	Monthly demand	*Lead time* (month)	Safety Stock	Lead time x Montly demanda	Replacement Point
Premier Fórmula - Cães filhotes	15		4	4	8
Royal Canin Medium Adult	12		3	3	6
Royal Canin - Giant Puppy	12		3	3	6
Ração Royal Canin - Maxi Junior	12		3	3	6
Ração Royal Canin - Maxi Adult	12		3	3	6
Ração Royal Canin Canine Veterinary Diet Skin Care Small Dog	12	0,25	3	3	6
Ração Royal Canin Canine Veterinary Diet Urinary S/O Cães	12		3	3	6
Premier Ambientes Internos - Cães Adultos	15		4	4	8
Royal Canin Medium Adult 7+	12		3	3	6
Ração Royal Canin Veterinary Gastro Intestinal -	12		3	3	6

Cães Adultos					
Ração Royal Canin Canine Veterinary Diet Renal Special para Cães	12		3	3	6
Royal Canin Renal Veterinary Diet Cães	12		3	3	6
Ração Royal Canin Veterinary Hepatic - Cães Adultos	12		3	3	6
Premier Seleção Natural Batata Doce - Cães Adultos	15		4	4	8
Premier Seleção Natural Frango - Cães Adultos Raças Pequenas	15		4	4	8
Premier Raças Específicas Frango - Pitbull Adultos	15		4	4	8
Premier Seleção Natural Frango - Cães Adultos Raças Pequenas	15		4	4	8
Ração Royal Canin Veterinary Obesity - Cães Adultos	15		4	4	8
Royal Canin Mini Adult	12		3	3	6
Royal Canin Mini Indoor Adult	12		3	3	6
Ração Royal Canin Canine Veterinary Diet Urinary S/O Cães	12		3	3	6

Source: Authors

To calculate the maximum stock the ELZ and the Rp were added, and with them the values of the maximum stock and the current stock of the company, reaching the value of the excess stock that the company maintains, as shown in Table 16.

Table 16. Calculation of maximum stock

Prioritized Products	Replacement Poin	Economic Lot Size (ELZ)	Maximum Stock	Current Stock	Excess Stock
Premier Fórmula - Cães filhotes	8	15	22	70	48
Royal Canin Medium Adult	6	10	16	40	24
Royal Canin - Giant Puppy	6	10	16	35	19
Ração Royal Canin - Maxi Junior	6	11	17	22	5
Ração Royal Canin - Maxi Adult	6	11	17	23	6
Ração Royal Canin Canine Veterinary Diet Skin Care Small Dog	6	11	17	20	3
Ração Royal Canin Canine Veterinary Diet Urinary S/O Cães	6	11	17	40	23

Premier Ambientes Internos - Cães Adultos	8	16	24	36	12
Royal Canin Medium Adult 7+	6	10	16	37	21
Ração Royal Canin Veterinary Gastro Intestinal - Cães Adultos	6	11	17	55	38
Ração Royal Canin Canine Veterinary Diet Renal Special para Cães	6	11	17	58	41
Royal Canin Renal Veterinary Diet Cães	6	11	17	50	33
Ração Royal Canin Veterinary Hepatic - Cães Adultos	6	11	17	54	37
Premier Seleção Natural Batata Doce - Cães Adultos	8	16	24	51	27
Premier Seleção Natural Frango - Cães Adultos Raças Pequenas	8	16	24	30	6
Premier Raças Específicas Frango - Pitbull Adultos	8	16	24	29	5
Premier Seleção Natural Frango - Cães Adultos Raças Pequenas	8	16	24	27	3
Ração Royal Canin Veterinary Obesity - Cães Adultos	8	12	20	30	10
Royal Canin Mini Adult	6	11	17	30	13
Royal Canin Mini Indoor Adult	6	11	17	32	15
Ração Royal Canin Canine Veterinary Diet Urinary S/O Cães	6	11	17	34	17

Source: Authors

It was confirmed that the company maintains high levels of inventories, has been wasting capital and space. From which a comparative analysis was made between the company's current stock investment and the investment proposed by ELZ according to Table 17.

Table 17. Analysis of the amounts invested in stock

Prioritized Products	Maximum Stock Value (BRL)	Current Stock Value (BRL)	Cost reduction (BRL)
Premier Fórmula - Cães filhotes	2,449.65	7,693.00	5,243.35
Royal Canin Medium Adult	3,021.29	7,596.00	4,574.71
Royal Canin - Giant Puppy	3,075.69	6,821.50	3,745.81
Ração Royal Canin - Maxi Junior	2,687.45	3,517.80	830.35
Ração Royal Canin - Maxi Adult	2,687.45	3,677.70	990.25
Ração Royal Canin Canine Veterinary Diet Skin Care	2,687.45	3,198.00	510.55

Small Dog			
Ração Royal Canin Canine Veterinary Diet Urinary S/O Cães	2,687.45	6,396.00	3,708.55
Premier Ambientes Internos - Cães Adultos	2,144.33	3,236.40	1,092.07
Royal Canin Medium Adult 7+	3,075.69	7,211.30	4,135.61
Ração Royal Canin Veterinary Gastro Intestinal - Cães Adultos	2,687.45	8,794.50	6,107.05
Ração Royal Canin Canine Veterinary Diet Renal Special para Cães	2,687.45	9,274.20	6,586.75
Royal Canin Renal Veterinary Diet Cães	2,687.45	7,995.00	5,307.55
Ração Royal Canin Veterinary Hepatic - Cães Adultos	2,687.45	8,634.60	5,947.15
Premier Seleção Natural Batata Doce - Cães Adultos	2,144.33	4,584.90	2,440.57
Premier Seleção Natural Frango - Cães Adultos Raças Pequenas	2,144.33	2,697.00	552.67
Premier Raças Específicas Frango - Pitbull Adultos	2,144.33	2,607.10	462.77
Premier Seleção Natural Frango - Cães Adultos Raças Pequenas	2,144.33	2,427.30	282.97
Ração Royal Canin Veterinary Obesity - Cães Adultos	3,159.83	4,797.00	1,637.17
Royal Canin Mini Adult	2,641.87	4,677.00	2,035.13
Royal Canin Mini Indoor Adult	2,572.95	4,796.80	2,223.85
Ração Royal Canin Canine Veterinary Diet Urinary S/O Cães	2,687.45	5,436.60	2,749.15
TOTAL	54,905.67	116,069.70	**61,164.03**

Source: Authors

With the values in Table 16, it can be seen that the use of the Economic Lot Size generated savings of 61,164.03 BRL, based on the company's current inventory levels. It is worth mentioning that this economy refers only to the 21 items prioritized by the ABC Classification. This savings would be even greater if the study included all the products in the store.

4.1 Organization and Resupply systematic

Aiming to control the company's stock in a simplified way and based on the calculation of the safety stock, a visual management of the stock levels was proposed to optimize its control, so that everyone can identify the point of resupply of the products.

A stock divided into three zones was proposed:

- Green zone: The stock does not need replenishment, as it is at the maximum stock level;
- Yellow zone: the stock is at the point of ordering, that is, at the safety stock level; and
- Red zone: the safety stock is being consumed, that is, the situation is critical and the items need to be replaced urgently.

Based on the calculations made of the safety stock and the resupply point together with the product planning

and information, it will be possible to use visual management in this same organization. With the maintenance of the information of product inputs and outputs, visual management can be applied in the spreadsheet itself, so that the cells composed of the quantities of products stored are programmed to change their color according to the stock level, that is, remaining green when the stock level is maximum, yellow when the level reaches the safety stock and red when the safety stock is being consumed.

Knowing that the order point will be when the cells are yellow, the manager will know when to place an order and which products to purchase, optimizing their investments and building a resupply systematic with the daily control of product inputs and outputs in an automated spreadsheet.

4.2 5s Program

The use of the program is justified, as some negative points were noted during the research, such as: Absence of systematic storage of products; Dirty stock; Products without identification; Absence of cabinets, shelves and divisions; and Difficulty viewing products.

The application of the 5s will be divided into two stages: presentation meeting and application of the 5 senses. In the first, all workers will be brought together to introduce them to the 5s program, its importance to the company, stimulate commitment and generate an action plan for its application with 5 steps that will be exposed in the store to be more effective.

The next step and its 5 steps will be the application of each of the senses. Seiri (classification) being the first, in which responsible for this sense would be responsible for separating the products by families.

The second sense is Seiton (organization), in which the person in charge will have the function of storing the items of the same family in a specific place and identifying them by means of labels. It was proposed that the organization be made by adopting shelving with shelves to optimize space and based on the FIFO (first in first out) operation, ensuring that products stored for the longest time are dispatched beforehand, avoiding risks of deterioration and obsolescence. In addition, allocating the products with the highest demand close to the out of stock and the products with the lowest demand at the end of the stock, avoiding further movement and optimizing replacement time.

In the third sense, Seiso (cleaning), the person in charge will clean the stocked products, the entire stock area and the products in the service area. In Seiketsu (standardization and health), the responsibility is of the owner, who must carry out an assessment of his facilities in order to verify the need for renovations or repairs, the functioning of the lighting lamps and if any risks of product fall

The latter sense is responsible for the consolidation of all other senses, being linked to self-discipline, Shitsuke is the reflection of all planning, training, application of all other senses and the discipline of the owner and his employees to maintain the adopted 5S standard , and it is proposed that organizational supervision be carried out throughout the end of the month.

5. Conclusion

In view of the relevance of the application of inventory management models, the contribution of this project was noticeable, as it was possible to conclude that in the case study stock, there was excessive waste, which proves to have a lean stock is less expensive, improves performance consequently makes the company

more competitive in the market. Soon, the research objective was achieved by using an economical lot size model, in order to propose a new supply policy for the company.

With regard to academic contributions, this research contains some tools that can be used for inventory management and process improvements, serving as a background for other cases, so it is important to be collaborating as a reference model for both the environment and academic and society.

It is recommended that studies be carried out with all the other products of the same branch that were not covered in the present study and develop mathematical models that verify the best replacement policy according to the basic stock characteristics, case studies should be developed in other organizations in this market sector and multiple cases are compared aiming that the results for companies in the sector can be even better..

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Comparative Study of Innovation Ecosystems Inducing Success of Startups in The World (Cutting 2000-2017)

Janaína Galdino de Barros

Programa de Pós-Graduação em Ciência da Propriedade Intelectual

Universidade Federal de Sergipe, Brazil

Ana Eleonora Almeida Paixão

Programa de Pós-Graduação em Ciência da Propriedade Intelectual

Universidade Federal de Sergipe, Brazil

Abstract

Global Innovation Ecosystems are the result of creating drive-driven locations driven by their local entrepreneurial and innovative characteristics. This article aims to bring to light important information from three of the largest successful start-up ecosystems in the world. As a goal, this article aims to draw a comparison between the Startup-inducing global innovation ecosystems. The adopted methodology had a descriptive classification and a qualitative method. The study was made through a chronological cut - 2000 to 2017 - disseminating information about Silicon Valley ecosystems - USA; Tel Aviv - Israel and Beijing China. As a result, it was found that even some actions and activities seen in these ecosystems can be performed, but it is necessary to take into consideration the local characteristics and their abilities for the ecosystem to succeed.

Keywords: Culture and Innovation, Ecosystem, Entrepreneurial, Innovation

1. INTRODUCTION

1.1 Local Development

With the advent of the World Wide Web, business relations have become much more intense

and competitive worldwide. Entrepreneurship gained prominence and Startups began to create new mechanisms for innovation. But what are Startups? According to Blank (2014), Startups are not simply smaller versions of large companies and run business models in which customers, their problems and the necessary resources of the product are all "known". In striking contrast, Startups operate in the "search" mode, looking for a recurring and profitable business model. This objective requires dramatically different rules of action, involving scripts, a list of skills and tools that minimize risks and optimize the chances of success **(**BLANK & DORF, 2014).

Therefore, Startups are small businesses that must be scalable and that, necessarily, their entrepreneurs need to work in uncertain environments, covering "calculated" risks. Only in this way, the Startup model can take a scalable leap towards innovation.

The objective of this article was to carry out a comparative study between the world-leading innovation ecosystems that induce Startups. The methodology was descriptive and qualitative. As basic premises, we discuss the ecosystems of Silicon Valley - USA; Tel Aviv - Israel and Beijing - China for understanding that these ecosystems differ from each other, but arrive at a common point, that of local innovation. With the comparative procedures, ideas and paths favorable to the ecosystem were carried out in the processes of innovation and sustainability. It starts from the premise that this study is unprecedented, given the contemporary discussions of the theme.

In order to understand the comparative study, it is necessary that we understand the concept of innovation ecosystems. According to ETZKOWITZ AND LEYDESDORFF, 2000, "Ecosystems have been considered as networks of relationships in which information and talent flow, through systems of co-creation of sustained value" (ETZKOWITZ AND LEYDESDORFF, 2000). Jishnu, Gilhotra and Mishra (2011) and Russell et al. (2011) say that "innovation ecosystem refers to the interorganizational, political, economic, environmental and technological systems of innovation, in which the catalysis, support and support for business growth occurs". WESSNER, 2007 states that "Innovation ecosystems are made up of a set of individuals, communities, organizations, material resources, standards and policies through universities, government, research institutes, laboratories, small and large companies and the financial markets in a given region. These actors work collectively in order to allow knowledge flows, supporting technological development and generating innovation for the market.

The innovation ecosystems have the capacity to dialogue with organizations, whether public or private, class associations, the community in general and its actors, with the aim of prospecting, in loco, an incentive in the entrepreneurial culture than that region may have the best to offer to the world society. It is based on the assumption that ecosystems should be thought from the characteristics of the locality, improving and optimizing the product and / or service coming from the location. With that, the referred ecosystem will tend to become stronger and more structured, capable of taking a leap towards local development and innovation.

1.2 Silicon Valley Ecosystem

Silicon Valley is the region with the best structure in terms of innovation ecosystem in the world, which is geographically installed in the United States, in the San Francisco Bay area, where several high-tech companies that work with electrical circuits are installed, concatenating the region called as Silicon Valley. Its history is the star of the success in which it has become an ecosystem based on technology and disruptive innovation.

According to Geology for investors (2014), which is a discussion site on data mining, it is said that: In 1846, California had 700 foreigners and 300,000 indigenous people. In 1849, at the height of the gold rush, 40,000 miners had arrived in the region. At the time, the simple fact of reaching California was already a challenge: the routes that led to the North American west coast were very dangerous and the cause of death from diseases such as cholera was not difficult.

In another passage, in the year 1938, Professor Frederick Termman of Stanford University, encouraged two former students to undertake. These two students revolutionized the world, creating the Hewlett-Packard

Company - HP with just $ 500 in their pockets, at the beginning of their activities. Its two students, William Hewlett and David Packard started the most famous company in California in terms of innovation to date. Another important point in this ecosystem's race for global innovation was the Ames Aeronautical Laboratory - located in Silicon Valley. This was one of the laboratories created by NASA to work with the space industry.

The Hippie movement, extremely important in 1967, is the biggest characteristic of relatively young entrepreneurs, but with an extremely calm head. In Silicon Valley it is easier to find people wearing waistcoats, jeans and traveling on scooters that, necessarily, men and women dressed in formal clothes. It is believed that, because the Hippie movement was born at that time, there are people and entrepreneurs so calm in that ecosystem. Normand, 2014 infers that a few years later, in 1971, the success of the region's semiconductor industry had become known. As a consequence, in a story about her, journalist Don Hoefler named the site Silicon Valley. The logic behind the name was simple: San Francisco Bay is located in what is geographically a valley and silicon is one of the main chemical elements in semiconductor production (NORMAND, 2014).

Therefore, the entire strategy for structuring Silicon Valley was based on the positioning and innovative tactics of an ecosystem designed to be sustainable and disruptive. It is based on the premise that values based on and sustained to give "wings", which made the nascent or developed companies in the ecosystem to solidify, to the point of having a worldwide impact on the society of the globe with their extremely innovative products and services and bringing benefits never seen until its release to society.

According to discussions about this ecosystem, the contextualization of successful models like the Silicon Valley can even be copied, taking into account the regulatory mechanisms, the necessary qualities of the local market, its plans to encourage financing, as well as the acceleration of business. that will come, later, to the structuring of the ecosystem and an enormous desire to disseminate a culture based on and focused on the dissemination of entrepreneurship.

According to the text "How to create and develop ecosystems: the entrepreneurship acceleration cycle" Rasia (s.d) states that there are four component steps to create an ecosystem based on the innovation and feedback of entrepreneurship shown in Table 1:

The four steps and subcomponents of this cycle			
1 **GREAT DREAM**	**2** **GROWTH**	**3** **COMMITMENT**	**4** **REINVESTMENT**
New entrepeneurs seek to build scalable companies in local areas due to:	Entrepreneurs are able to grow their businesses ande reach scales based on:	Successful entrepreneurs remain in the region where they started and engage in new businesses due to:	Successful entrepreneurs reinvest in a new generation through:
Quality of social life.	Access to cystiners Access to financing	Quality of local life	Angel and working capital investment
Desire of grownt	Access to talent Your entrepreneurial skills	Investment Desire	Orientation Spinoffs Business

Source: Rasia (s/d) adapted

These four steps in the process of components of a cycle (1- Big dream; 2 - Growth; 3 - Commitment and 4 - Reinvestment) provided the basis for the creation of Silicon Valley and must be followed by other ecosystems, always respecting the individualities provided for in the places. Structuring ecosystems may or may not work. However, it is necessary to take into account the entrepreneurial culture, the inputs - products and services - to which such a location is more apt to develop and make available to society. It is based on the premise that local specificities should be studied and structured so that the model mentioned can be applicable to localities that wish to have a solid ecosystem and that prospect local innovation. According to the following data, in Fig 1, investment information in Silicon Valley has been increasing considerably, which shows that the ecosystem continues to grow over the years.
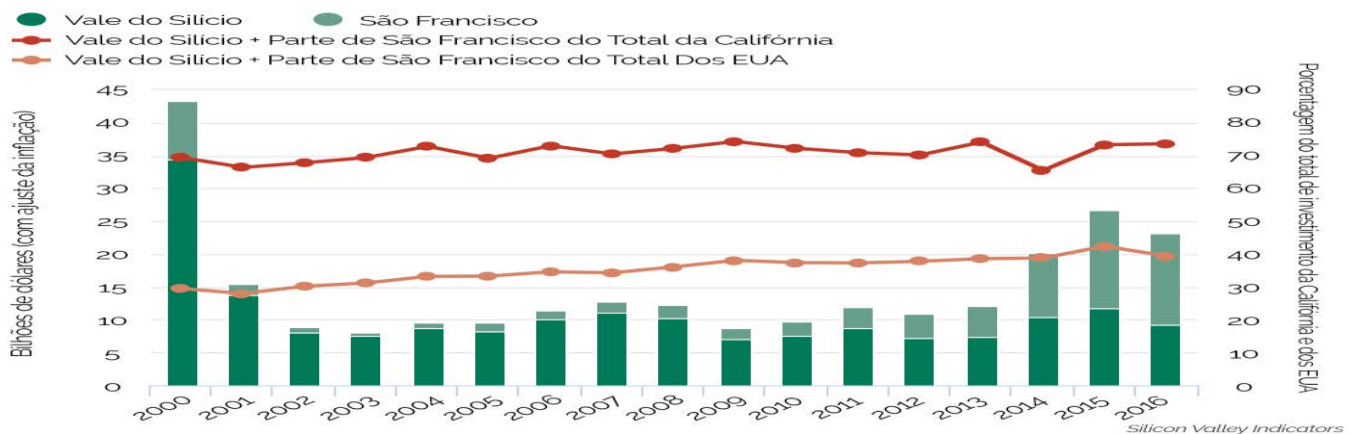
Figure 1 – Investment in Silicon Valley

Source: Silicon Valley Indicators, (s/d)

The figure shows the exact cut of the increase in investments from innovation in Silicon Valley. That is, from the beginning of its activities to the present day, Silicon Valley has been receiving considerable figures in terms of investment in Startup and innovative ideas. It is up to the rest of the world, interested in building their innovation ecosystems, to study their localities, their habitats and cultural processes, in order to identify which products / services are geographically excellent and to try to execute, in the best possible way, the business identified.

According to GSER (2017), "In the years 2016 to 2017, more than 47 thousand new jobs were created, 29% of which correspond to jobs in the technology area. Also, the region has produced 80 unicorns (Startup whose revenue has reached millions) since 2003". Undoubtedly, a successful ecosystem, based on entrepreneurial culture and the positioning of universities thinking about producing theory linked to business, should serve as an example to prospect activities capable of being promoted worldwide.

1.3 Israel's ecosystem - Tel Aviv

Located in a country that is constantly in a geopolitical war, the city of Tel Aviv, Israel boasts strategic and disruptive innovations, despite being one of the smallest cities in the world that have the most successful Startups, which makes the town bear the name of "Middle East Silicon Valley". Tel Aviv's history mixes with that of its country. Israel is a relatively small country and is going through a war that has lasted for many decades. "Its population has, on average, 8.5 million inhabitants, containing more Startup per capita than any other country: About 1 for every 2000 Israelis" **(**COGO, 2018, p. 77). In addition, the country has

the 3rd largest number of companies registered on the Nasdaq - which is an index of the market for common shares and similar securities listed on the stock market. Together with the Dow Jones Average and the S & P 500 it is one of the three most followed indices in the US stock markets (COGO, 2018), just behind the United States and China. Israel's nickname is Startup nation because it has several companies with this characteristic and because it has in its society the characteristic for changes and the culture of starting to innovate from the beginning. What should be taken into account in this article is the peculiar characteristic of that country. Perhaps the ability to start from scratch and the culture based on the eternal start had a direct impact on what has become Israeli Silicon Valley. The History of Israel gives rise to a situation of struggle, with a population that suffers from the constant geopolitical war, but that practically doubled in size in the first two years of its existence, growing by more than 1 \ 3 during the next seven years (COGO, 2018).

One of the important characteristics of this country is that Israel has always had a lot of hostility towards neighboring countries, being forced to export to distant markets, consequently, forced to have experiences with large markets and with high costs. This characteristic of Israel made the country realize that, necessarily, it would need to work directly with innovation. Another feature that we think is important for Israel to become a country geared towards innovation was its military arsenal. According to COGO (2018), maturity was reached briefly because society has experienced an incredible mix of incisive experiences since the end of high school, that is, men and women are forced to enlist in military life and undergo experiences within the process. This is also believed to be a distinctive feature of the Israeli population. And yet, according to COGO, 2018, The third main factor that profoundly influences Israel's success is given by immigration. "Immigrants are not averse to starting over. They are, by definition, risk takers".

It is believed that, due to these three basic characteristics of the Israeli people, the country has taken a turn towards the area of innovation, capable of standing out before the great world nations. It starts from the premise that the country has taken a significant leap, with peculiar characteristics and a driving force (public policies) based on Research and Development; a profound synergy between academia and industry; incentive to corporate internationalization programs, in addition to a wide participation of the state in a risk spreadsheet. All of this led to solidification, capable of boosting this country as an Asian precursor in terms of innovation. It has one of the highest densities of nascent companies in the world (COGO, 2018), that is, the city of Tel Aviv remains literally within an innovation bubble, prospecting various areas of IT and making disruptions in the world. It starts from the premise that a city so small and with so many negative impacts on the economy, due to the constant geopolitical war, as well as the lack of natural resources, managed to overcome all these negative points and became one of the largest cities with a high concentration of nascent companies in the world. The best answer for Tel Aviv to become the Asian Innovation Valley is, precisely, its militaristic culture, collectivism, the proximity of businessmen to Israeli universities and the ability to keep connected a robust ecosystem of suppliers, consumers, mentors, talents engineering and also venture capital with the immense capacity to connect in an efficient and optimized way, to the point that a country so small and so in need of different public policies had the capacity to excel in terms of innovation and considerable concentration of entrepreneurs and their Startups.

We'll see the cultural paradigm break with respect to filings for Israeli patent applications in the chart below.

Pedidos de Patente (2017)

- United States — 56,624.00
- China — 48,882.00
- Brazil — 28,667.00
- Israel — 6,425.00
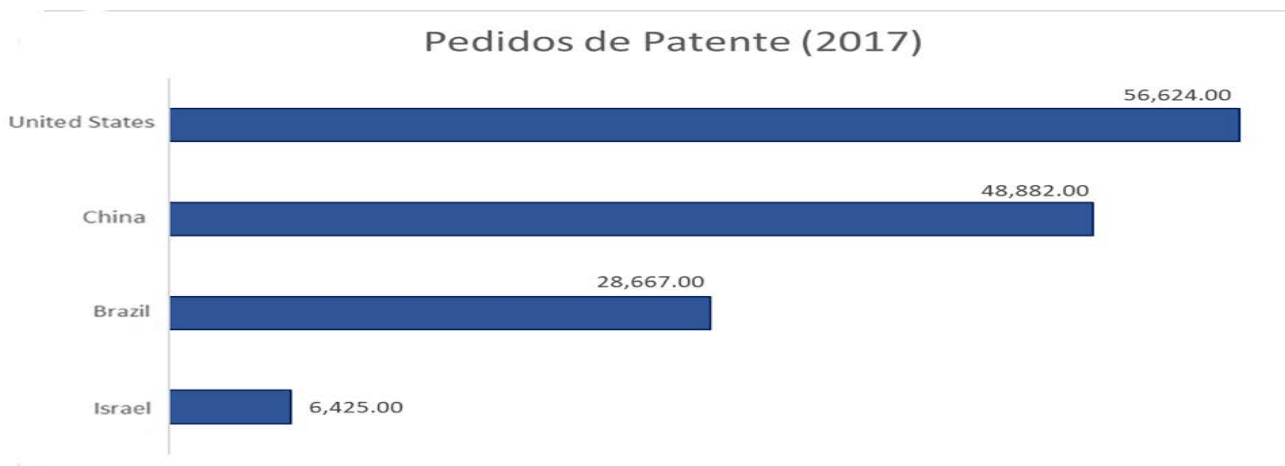
Figure 2 – Filing of Israeli Patent Applications

Source: Israel Patent Office, INPI, WIPO

As small as Israel's patent applications may still be, it is clear that the culture is geared towards entrepreneurship and impact innovation.

1.4 Beijing-China ecosystem

China has gone through several world difficulties and only in this century has it been arousing interest in the innovation race. The People's Republic of China is a socialist country and the most populous in the world. About almost 1/5 of the world population resides in China. The country has the 2nd largest economy in the world, second only to the United States. The People's Republic of   China is divided into 23 provinces and has the largest land border in the world, with almost 22 thousand km2. Its economy is based on the import of manufactured goods and the export of technological products, with a favorable trade balance.

Regarding the Chinese evolution, there is a very big paradigm break when the country ceases to be an exporter of pirated products and turns, primarily, to a country capable of developing products / processes and programs supported by world innovation. In this context of changes in how to deal with industrialization and technology, China has established two policies for the development of science and technology: The Five-Year Plan (2011-2015) and the National Plan (2006-2020). The Five Year Plan brought a total of US $ 1.7 trillion to several technological sectors that are very strategic for the economy (including: renewable energy, biotechnology, efficient and ecological technologies, electric cars and a new generation of Information Technology). The National Plan, in the medium and long term, aims to face what is perhaps the greatest challenge of Chinese technological advances, which is to improve the sector's innovation capacity (QUEIROZ, s \ d).

It was observed that, with the result of the policies of the *Quinquennia*l and National plans, there was an increase in the incentive of expenses with Research and Development, a jump of the order of 41 billion dollars in 2000 to 344 billion in 2014, totaling eight times more investments in R&D in the fourteen-year period. China practically tied with the USA in terms of investments in R & D & I in 2019, as shown in the fig below:
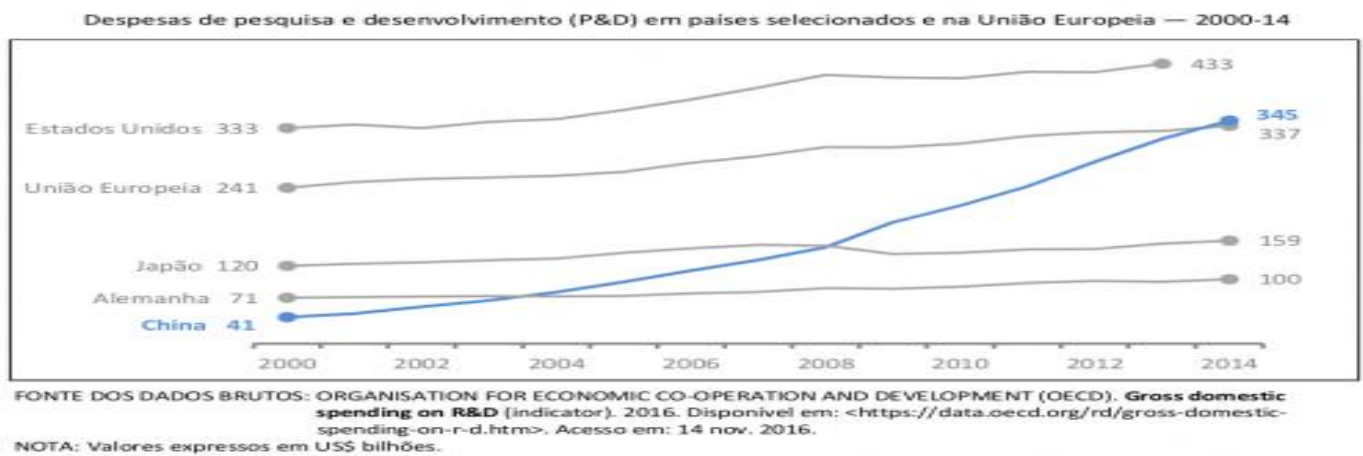
Figure 3 – Research and Development Expenditure in selected countries and in the European Union from 2000 to 2014

Source: Organization For Economic Co-peration and Development (OCDE),2016

Fig 4 shows that China exceeded, in 2019, the number of Startups that are able to multiply their earnings, the so-called Unicorns produced in that country.
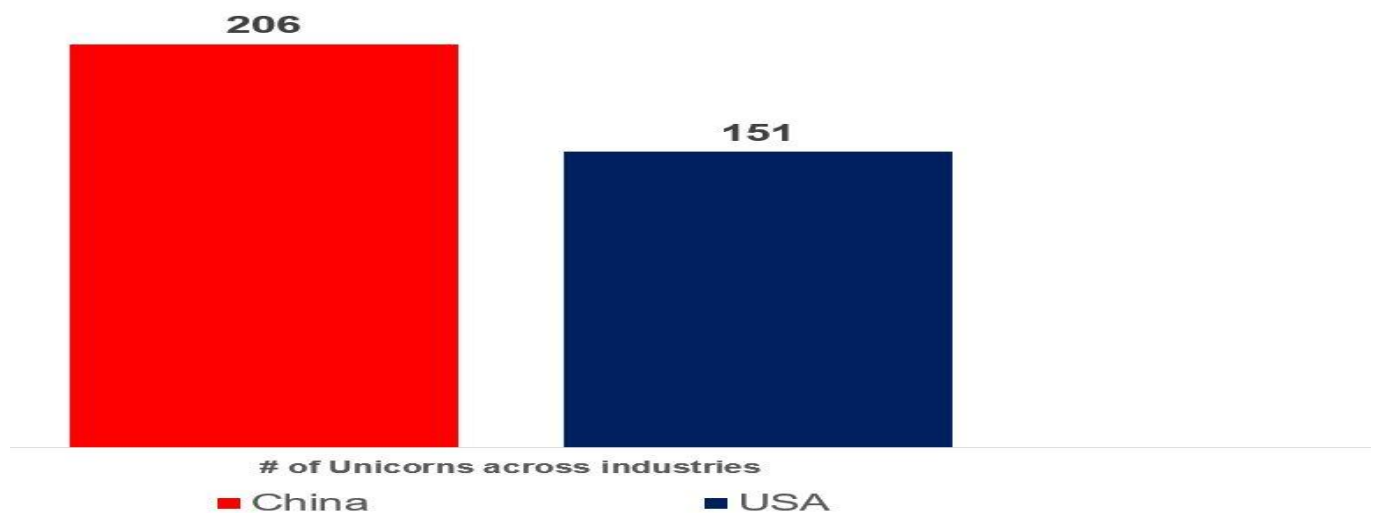
Figure 3 – Number of Unicorns in Chine and The United States

Source: China Unicorns, 2019

The identification of the graph shows us that, in 2019, China already surpassed the United States in number of Unicorns. For this reason, this country began to emerge in the area of technological innovation, seeking the development of several products and services directly linked to technological disruptions. In addition to the entire technological arsenal and the paradigm shift in working towards global innovation, research data from the International Accounting firm KPMG found that China and the United States together have the greatest technological innovation potentials in the world. This study originated from a survey based on data from a total of 800 world leaders who work directly with technology, including Startups and Fortune 500 executives, which is a ranking of the 500 largest corporations worldwide compiled and published by the magazine Fortune. Another important characteristic of the country is its major leader, President Xi

Jinping, who categorically stated the following explanation: "For a strong China, for a Chinese people with quality of life, great vigor is needed in the field of science and technology (…) With new times come new circumstances and new tasks, forcing us to have, in the field of innovation in science and technology, new concepts, new plans and new strategies, so that we can achieve our two goals for the centenary and accomplish the revival of the Chinese dream: accelerating innovation in all sectors and seizing the decisive opportunity for global competitiveness. This is our starting point for building a country strong in science and technology." (STARTUPSE, 2018).

According to the information from the country's leader, there is a great cultural and structural revolution that culminates in Chinese S & T & I, capable of providing unimaginable subsidies and, consequently, proposing new mechanisms for restarting the People's Republic of China with regard to the disruptive technology and innovation. It is up to the Chinese government to implement all public policies, capable of subsidizing all paths that favor the creation of business Startups based on increments and disruptive innovation. There are already some projects underway in the People's Republic of China in the field of Startup with the ability to change the way we use the Wi-Fi connection. The Asian dragon is developing Li-Fi, a new type of internet connection that is much better than Wi-Fi - It is a light connection, which uses visible LED light to transfer data with greater speed than Wi-Fi, which is based on radio waves. The connection will be based on emissive carbon dots in all colors (F-CDs, in the acronym in English) that allow to develop a faster wireless communication channel. A test carried out in 2015 by the Chinese government ministry showed that Li-Fi can reach a speed of 50 gigabytes per second (with it, a movie download, for example, can be done in just 0.3 seconds). However, it is stipulated that Li-Fi will only be available six years from now (STARTUPSE, 2018). In addition to this new way of accessing the World Wide Web, we will also have the insertion of the Internet of Things in the traditional Chinese cutlery / sticks, let's see: The traditional "sticks" for Chinese food have become sensors to detect if everything is right with the food - After suffering a problem with contaminated soils, the Chinese decided to use the Internet of Things in the service of health. It is also possible to detect the calories, acidity and even the temperature of the food (STARTUPSE, 2018).

The city of Beijing, capital of China, has been making significant leaps in terms of innovation and intellectual property. According to the World Intellectual Property Organization - WIPO — founded in March 1998, in response to the demand for knowledge and skills in training, teaching and research in Intellectual Property (PI), it states that China has generated "About 3.17 million of global patent applications, being executed in 2017, which corresponds to an increase of almost 6% per year "In other words, according to statements by the general director of WIPO, Francis Gurry, the demand derived from innovation linked to Intellectual Property has significantly increased the global economic growth rate, bringing an increasingly competitive component of commercial activities. Also according to WIPO (2017), in just a few decades, China built an intellectual property system, encouraged national innovation, joined the world's intellectual property leaders - and is now driving global growth in registrations. For this, it is known that China, more specifically, the city of Beijing has been pioneering and bringing an innovative arsenal to the world, capable of competing equally with the world power in terms of innovation, the United States. It is assumed that this competition will bring good results to the world in terms of science,

technology, innovation, research and development and intellectual property, the latter already emerging as a differential in the world confluence between the two world powers.

2. METHODOLOGICAL PROCEDURES

The method used is descriptive, carried out in a qualitative way, seeking updated information and stories, in some journalistic texts, articles and e-books on the innovation ecosystems studied here in 2019: Silicon Valley, in the United States, Tel Aviv in Israel and Beijing in China. It is known that, in the qualitative research, mechanisms of an empathic nature are constructed, the reasons are traced and the actors that propose to optimize the object of the study are identified. Its approach can only be used to understand specific and delimit able phenomena, more for its degree of internal complexity than for its quantitative expression.

As for the classification of the research, the descriptive one was chosen, which (...) aims at the characteristics of a certain population or phenomenon or, at the same time, the establishment of relationships between variables. There will be countless studies that can be classified under this title and one of its most significant characteristics is the use of standardized data collection techniques, such as the questionnaire and systemic observation **(**GIL, 2002).

It is based on the premise that the survey of ecosystem information proposed here drew a world map of a good part of innovative and entrepreneurial initiatives worldwide, capable of helping other ecosystems to shape themselves, always aiming at models of economic sustainability and innovation.

3. RESULTS AND DISCUSSION

With the onset of the global crisis, local innovation ecosystems were increasingly on the rise. The cities that proposed development supported by their ecosystems are the ones that have the most competitive advantages in terms of innovation, prospecting an increasingly competitive and innovative world, bringing resolutions to the various global problems thought, planned and executed within the innovation ecosystems. As a general objective, the article made a comparative study between the main innovation ecosystems in the world (United States, China and Israel) inducing Startups and the result is surprising when discussing the global ecosystem.

With regard to Silicon Valley, the ecosystem is already a success, bringing to its surroundings a significant increase in jobs - in the years 2016 to 2017, only due to its culture based on innovation and the development of entrepreneurial culture. The region has held the largest production of unicorns in the world since 2003, in addition to harnessing the theory of American universities to business.

With regard to the city of Tel Aviv - which has Israel as its country, it is therefore peculiar. With a very small population, the city managed to make significant leaps in terms of innovation with three basic characteristics: a) Country with several natural and war problems, having to adapt to exports to distant countries on account of the authority with neighboring countries; b) All Israeli citizens, regardless of gender, enlist in the army and c) Permanent immigration in that country, that is, those who arrive are not afraid to start everything from scratch, bringing a striking characteristic of the entrepreneurial subject, which is having the ability to make mistakes and start all over again. Israel and Tel Aviv mix in everything,

with their very peculiar characteristics and solidification capable of bringing to such a small country an arsenal with so many innovations and technological products and processes. Regarding the Republic of China and the city of Beijing, what can be seen as results is an ecosystem based on the disruptive processes of Artificial Intelligence, Internet of Things and a new way to access the world wide web. It is now up to the Republic of China to continue seeking results through the information already reiterated by its chief, President *Xi Jimping,* who says that China should be strong based on the propagated culture of Science and Technology. It is worth mentioning that China has been making extremely significant leaps in terms of Research, Development and Innovation. What can be concluded from this previous study is that, in most cases, the ecosystem has its own characteristics of the locality and only the entrepreneurial subjects are able to perceive all the peculiarities that are guided and marked by the locality, the local culture and the actions imposed by the countries treated here. In accordance with the objective presented here, a comparative chart follows regarding the entrepreneurial characteristics of the studied World Innovation Ecosystems:

Ecosystem But Innovations Worldwide	Ecosystem Characteristics	Pro-activity of Eco systems	Tratatives for innovative solutions
USA	• Culture of starting innovative projects containing few resources; • Calmness and tranquility with the theme of entrepreneurship: Hippie Movement; • Success of the semiconductor industry, originating the Silicon Valley;	• Creation of the Ames; • Aeronautical Laboratory; • Elaboration of the 4 steps of the ecosystem cycle.	• Increased investment in Silicon Valley; • 151 Unicorns accounted until 2019.
ISRAEL	• Entrepreneurship culture based on IP; • Enlistment in the army of all Israeli citizens; • Citizens start everything from scratch.	• 1 startup for every 2000 Israelis.	• Adaptation with distant countries due to austerity with neighboring
CHINA	• Paradigm break: From pirated products to products/processes and programs based on global innovation.	• The Largest number of Unicorns in the world; • Tie with USA in P&D&I	• Li-fi/ sticks for Chinese food.

Table 4: Comparison of Ecosystems

Source: own authorship

4 CONCLUSIONS

This comparative study of the world's leading startup success inducing ecosystems brought up information, which is important for future studies, such as inducing local culture, willingness on the part of local society to undertake, strategically think about the local ecosystem and make it happen, within geographic and global parameters, in addition to bringing solutions based on culture, proactivity and characteristics of these ecosystems. It is assumed that future analyzes can be made by these and other ecosystems, in order to bring up important information that minimizes the unsustainability of organizing an innovation ecosystem.

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Measuring Brazilian Inequality Using the Gender Inequality Index

Bruna A. Branchi

Dept. of Economics, Pontifícia Universidade Católica de Campinas
Campinas (SP), Brazil.

Talita Bozon Penteado

Dept. of International Relations, Pontifícia Universidade Católica de Campinas
Campinas (SP), Brazil.

Abstract

Gender inequality is a common feature shared by all countries, in different degrees. Its importance is evident in the United Nations 2030 Agenda. The Sustainable Development Goal (SDG) number 5 is mainly dedicated to it. However, for its multidimensional features, different SDGs include it among their targets, the third (health), fourth (education), and tenth (labor) goals in particular. A composite index better describes multiple disparities. In this paper, the Gender Inequality Index (GII), presented in the 2010 Human Development Report, is discussed and then calculated for the Brazilian Federation Units. Its dimensions, health, empowerment, and economic activity cover three crucial dimensions of gender inequality. The GII contributes to evaluate how inequality lowers human development among countries and within a country, as presented in this study. Even though its complex methodology, it is an important tool for policy guidance.

Keywords: Gender Gap; Inequality; Composite Index; Human Development; Sustainable Development Goals.

1. Introduction

The United Nations 2030 Agenda states the need to pursue sustainable development to "leave no one behind". "Among the most disadvantaged are women and girls who face the compounded effects of gender-based and other forms of discrimination" (UNWomen, 2019a, p. 4). The result is a combination of deprivation form access to health care and education to decent work and active participation in decision-making. Therefore the study of women inequality must be multidimensional.

"Over the past 25 years, progress has been made towards gender equality. Still, gaps remain" (UNWomen, 2019a, p. 11).

The "leave no one behind" strategy requires reliable data and clear indicators. Easily interpretable indexes are welcomed to inform the decision-making process.

Given that women suffer from multiple dimension gaps, a composite index can be appropriate tools.

There are many methods to measure gender disparities (Schüler, 2006; Soares, 2013). In this paper, the focus is on the contribution of the United Nations Development Program (UNDP) to this task. Following the successful experience with the Human Development Index (HDI), the UNDP presented in the 1995 Human Development Report two new composite indexes: the Gender-related Development Index (GDI)

and the Gender Empowerment Measure (GEM). They were thought to overcome some limitation of the HDI associated with gender inequality, that is the reduction in human development due to multiple inequalities between women and men. As written in the 1995 Report, "If development is meant to widen opportunities for all people, the continuing exclusion of women from many opportunities of life totally warps the process of development" (UNDP, 1995, p. iii).

The GDI shares the same set of variables with the HDI, which are longevity, educational attainment, and income, but it focuses on gender disparities. Differently, the GEM is based on three distinct variables: female participation in political decision-making, female access to professional opportunities, and female earning power.

Whereas the HDI "measures the average achievement of a country in basic human capabilities" (UNDP, 1995, p. 73), GDI estimates penalties resulting from gender disparities and GEM evaluates if each group can actively take part in economic and political life, as well as in the decision-making process. In other words, the former focuses on the extension of capabilities, and the latter concentrates on the use of such capabilities.

Despite the GDI e GEM having had a relevant impact on academic research, as the first composite indexes designed to reflects gender gaps (Schüler, 2006), fifteen years later, the UNDP proposed a new index: the Gender Inequality Index (GII) (UNDP, 2010). The new measure was welcomed since it was overcoming some problems presented by GEM and GDI. The GII characteristics and contributions to the gender inequality debate are the object of the next section. In the sequence, following the conventional methodology, the GII was calculated to describe the gender disparities among the Brazilian States. The paper ends with some considerations based on the experiment of applying the GII within a country.

2. Gender gaps and the Gender Inequality Index

Gender equality greatly benefits from a balanced participation of women and men in education, labor market, and decision-making positions. In Brazil, women educational progress has not yet resulted in better labor market participation and income for women (Oxfam, 2017; Alves, 2016; Arretche, 2015; Comin, 2015). This is probably the result of the social distribution of paid and unpaid work where the former was traditionally attributed to men and the second to women. Despite social changes, the gender gap persists due to the absence of accessible and quality care services for most people. This problem affects harder the poorest and the youngest. Early childbearing is, therefore, not only a health problem but has relevant economic and social impacts.

The multiple sources of disparities between women and men show the need for a multidimensional inequality index. According to Gaye et al. (2010), the GII aims to measure the impact of gender inequality on a country's human development potential. It is designed to measure gender disparities over three dimensions: reproductive health, empowerment, and economic activity. This choice reflects the relevance of education and economic independence on female opportunities. Therefore, human development is strongly influenced by education and economic autonomy. Reproductive health can also benefit from basic and advanced education.

The reproductive health dimension is based on two indicators: the maternal mortality ratio and the adolescent fertility rate. Health care and basic education are reliable instruments for preventing reproductive health problems, with impacts in both short and long time for reducing the gender gaps. Education is seen as a fundamental tool to enhance women position. It helps reproductive health by directly improving the capacity to use new information on health and nutrition, and indirectly promoting children learning.

Two indicators are used to measure the empowerment dimension: the secondary educational attainment and the share of parliamentary seats held by women and men. Again, better-educated people are more likely to actively participate in the decision-making process, in both public and private arenas since education contributes to knowledge and self-confidence.

Finally, the economic activity dimension is evaluated through the labor force participation rate, differently from the income variable extensively used in inequality indexes. Education is still a relevant tool for better working opportunities. Therefore, looking at the variables proposed to build the GII, promoting women's education is shared among the three dimensions and it seems to be the main instrument to promote equality. To GII "captures the inequality between women and men and is sensitive to changes in the association between indicators (Gaye et al., 2010, p.14). As defined by Seth (2009), it is an association-sensitive welfare index. The association sensitivity feature means that the index is responsive to those changes that turn out rewarding one group over the other, in all dimensions at the same time. The GII is calculated as a general mean of general means of different orders. In other words, it is a harmonic mean, calculated across gender groups, of a geometrical mean, calculated across dimensions.

The GII ranges from 0, meaning there is no gender inequality across dimensions, to 1, total gender inequality across dimensions.

Given the multiple dimensions of gender inequality and the holistic approach to development that differentiates the 2030 Agenda, the GII can contribute to supervise four of the 17 Sustainable Development Goals (SDG) (UNDP, 2015). They are:

- SDG 3 "Ensure healthy lives and promote well-being for all at all ages", mostly target 1;
- SDG 4 "Ensure inclusive and equitable quality education and promote lifelong learning opportunities to all", primarily targets 1 and 2;
- SDG 5 "Achieve gender equality and empower all women and girls", mainly targets 5 and 6;
- SDG 10 "Reduce inequality within and among countries", especially the second target.

The GII is quite easily interpretable, attending the communication purpose. Nevertheless, it presents two main weaknesses. The first drawback is its more than usually complicated methodology, especially compared to the quite simple HDI aggregation process (geometrical mean) (Permanyer, 2013). The second is associated with an important feature a composite index must share, especially to guide policymaking: the decomposition property. The GII does not attend such a feature; that is, it does not identify the contribution of each dimension to the overall result.

3. An application of the Gender Inequality Index

This section presents the application of the GII to Brazilian data. After describing the methodology and

data selection, the results are examined.

3.1 Method

The quite complicated functional form is easily explained following the five steps suggested by the technical note of the 2019 Human Development Report (UNDP, 2019b).

<u>First step</u>: Defining the extreme values.

The use of a geometric mean requires that no indicator has a zero value. In the absence of parliamentary seats occupied by women, the minimum value is set to 0.1%. For the "Maternal mortality rate", maximum and minimum values were set to 1,000 and 10, respectively.

<u>Second step</u>: Aggregation across dimensions for each gender group, using the geometric mean.

(1)   Female group: $G_F = \sqrt[3]{\left(\frac{10}{MMR} \cdot \frac{1}{AFR}\right)^{1/2} (PR_F \cdot SE_F)^{1/2} \cdot LFP_F}$

(2)   Male group: $G_M = \sqrt[3]{1 \cdot (PR_M \cdot SE_M)^{1/2} \cdot LFP_M}$

where: MMR = Maternal Mortality Ratio

   AFR = Adolescent Fertility Rate

   PR = Parliamentary Representations, female and male

   SE = Secondary Education, female and male

   LFP = Labour Force Participation, female and male

<u>Third step</u>: Aggregation across groups, using the harmonic mean.

According to Gaye et al. (2010), the harmonic mean was chosen to build the equality distribution index since it accounts for eventual overlap across dimensions.

(3) $HARM(G_F, G_M) = \left[\frac{(G_F)^{-1}+(G_M)^{-1}}{2}\right]^{-1}$

<u>Fourth step</u>: Calculating the geometric mean of the arithmetic means for each dimension.

Consequently, each dimension in this aggregation gets the same weight.

   a) The arithmetic means for each one of the three dimensions are:

(4) $\overline{HEALTH} = \left(\sqrt[2]{\frac{10}{MMR} \cdot \frac{1}{AFR}} + 1\right)/2$

(5) $\overline{EMPOWERMENT} = \left(\sqrt[2]{(PR_F \cdot SE_F)} + \sqrt[2]{(PR_F \cdot SE_F)}\right)/2$

(6) $\overline{LABOUR} = \frac{LFP_F+LFP_M}{2}$

   b) The geometric mean of the three dimensions arithmetic means is calculated as

(7) $G_{\bar{F},\bar{M}} = \sqrt[3]{\overline{HEALTH} \cdot \overline{EMPOWERMENT} \cdot \overline{LABOUR}}$

<u>Fifth step</u>: Calculating the Gender Inequality Index

(8) $$\mathbf{GII} = 1 - \frac{HARM(G_F, G_M)}{G_{\overline{F}, \overline{M}}}$$

As mentioned above, the GII ranges from a minimum of zero, meaning no gender inequality, to the maximum of one, meaning total gender inequality across dimensions.

3.2 Data selection

Table 1 recaps the variables employed in this study, along with their definitions and official sources. For the chosen geographical units, the preferential data source is the 2010 Demographic Census. An additional database is the National Health Care System (DataSUS) for indicators related to the Reproductive Health dimension. The Parliamentary Representation data refers to the 2012 federal election.

Table 1. Variables and Data source, Brazil.

Dimension	Variable	Definition	Source
Reproductive Health	Maternal Mortality Ratio (MMR)	Ratio of maternal deaths to the number of live births (x 100,000)	DATA SUS. **Taxa de Mortalidade Materna.** Rede Interagencial de Informações para a Saúde- Ministério da Saúde. Avaliable at:http://tabnet.datasus.gov.br/cgi/idb2000/fqc06.htm. OBSERVATÓRIO DA CRIANÇA E DO ADOLESCENTE. **Razão da Mortalidade Materna (para cada 100 mil nascidos vivos).** Available at: https://observatoriocrianca.org.br/cenario-infancia/temas/saude-materna-neonatal/586-razao-da-mortalidade-materna-para-100-mil-nascidos-vivos?filters=1,187
	Adolescent Fertility Rate (AFR)	The number of births to women ages 15–19 per 1,000 women in the same age group.	MS/SVS/DASIS. **Sistema de Informações sobre Nascidos Vivos-SINASC. Available at**: http://tabnet.datasus.gov.br/cgi/deftohtm.exe?sinasc/cnv/nvuf.def. PNUD; FUNDAÇÃO JOÃO PINHEIRO; IPEA. **Atlas do desenvolvimento humano desagregador por cor, sexo e domicílio, censos 2000 e 2010.** Available at: http://atlasbrasil.org.br/2013/pt/download/
Empowerment	Secondary Education, female and male (SE)	The ratio of population age 18 or more with high school diploma to people in the same age group.	PNUD; FUNDAÇÃO JOÃO PINHEIRO; IPEA. **Atlas do desenvolvimento humano desagregador por cor, sexo e domicílio, censos 2000 e 2010.** Available at: http://atlasbrasil.org.br/2013/pt/download/
	Parliamentary Representations, female and male (PR)	Proportion of Federal Deputies by sex.	TSE. **Estatísticas eleitorais 2014**. Available at: https://odsbrasil.gov.br/objetivo5/indicador551
Economic activity	Labour Force Participation, female and male (LFP)	The ratio of persons ages 15 or more in the labour force to people in the same age group. The labour force is the sum of persons employed and unemployed.	PNUD; FUNDAÇÃO JOÃO PINHEIRO; IPEA**. Atlas do desenvolvimento humano desagregador por cor, sexo e domicílio, censos 2000 e 2010.** Available at: http://atlasbrasil.org.br/2013/pt/download/

Source: The authors.

3.3 Results

Before calculating the GII, a close analysis of each variable is needed, given the multidimensional nature of the problem under investigation.

Differences in the Maternal Mortality Ratio observed within a country depend on the disparities in the provision and quality of maternal care. They are positively related to social and economic vulnerability (Pacagnella et al., 2018). The first target of SDG 3 aims to reduce, by 2030, "the global maternal mortality ratio to less than 70 per 100 000 live births" (UNDP, 2015). In Brazil, the MMR has decreased in the last decades, but it is still above or too close to the target in almost 1/3 of its Federal Units, mainly in the North and Northeast regions, the least developed area (Table 2).

The second indicator of reproductive health, Adolescent Fertility Rate, shows a similar regional pattern. Several studies suggest that the teenage fertility rate is negatively related to education (Wodon et al. 2018). On one side, the fertility rate among teenagers tends to decrease with more years of schooling. On the other, adolescent pregnancy often leads to school dropouts with severe negative impacts on female empowerment and labor opportunities.

Table 2. Variables and values for the GII, Brazilian States.

Brazilian States	Reproductive Health		Empowerment				Economic Activity	
	MMR	AFR	SE (female)	SE (male)	PR (female)	PR (male)	LFP (female)	LFP (male)
Rondônia	64.10	38.96	35.87	27.34	0.13	0.88	0.55	0.78
Acre	53.90	54.06	37.23	28.92	0.17	0.83	0.52	0.70
Amazonas	64.60	50.57	40.15	35.16	0.08	0.92	0.52	0.71
Roraima	37.70	50.02	47.69	37.80	0.08	0.92	0.56	0.71
Pará	68.20	48.18	32.97	25.30	0.17	0.83	0.47	0.72
Amapá	40.30	50.49	48.05	40.54	0.29	0.71	0.56	0.74
Tocantins	53.30	44.82	42.61	31.78	0.17	0.83	0.52	0.73
Maranhão	72.40	45.23	32.16	24.48	0.17	0.83	0.45	0.67
Piauí	100.10	36.80	31.09	22.32	0.23	0.77	0.46	0.68
Ceará	69.40	31.57	34.92	28.90	0.13	0.87	0.46	0.69
Rio Grande do Norte	66.00	33.57	37.11	30.11	0.13	0.88	0.46	0.70
Paraíba	47.60	33.81	32.49	25.71	0.17	0.83	0.45	0.70
Pernambuco	51.60	35.62	34.89	28.97	0.08	0.92	0.47	0.70
Alagoas	45.70	40.86	28.85	23.53	0.07	0.93	0.44	0.69
Sergipe	70.40	34.14	34.96	28.58	0.25	0.75	0.50	0.72
Bahia	70.00	34.44	35.15	27.21	0.17	0.83	0.52	0.72
Minas Gerais	33.80	25.52	37.91	32.00	0.05	0.95	0.55	0.75
Espírito Santo	64.40	30.37	41.05	36.17	0.13	0.87	0.57	0.77
Rio de Janeiro	80.80	30.03	45.98	45.06	0.19	0.81	0.52	0.73
São Paulo	36.80	27.20	45.59	44.07	0.11	0.89	0.57	0.76
Paraná	38.30	32.12	40.07	36.87	0.07	0.93	0.59	0.79
Santa Catarina	36.00	26.56	41.52	39.25	0.10	0.90	0.63	0.80
Rio Grande do Sul	66.20	25.50	39.63	35.66	0.15	0.85	0.59	0.77
Mato Grosso do Sul	68.60	40.67	39.86	34.12	0.08	0.92	0.57	0.79
Mato Grosso	58.50	38.93	40.07	31.29	0.08	0.92	0.56	0.79
Goiás	57.90	32.07	41.21	33.61	0.05	0.95	0.58	0.80
Federal District	43.70	27.10	57.71	54.78	0.17	0.83	0.64	0.79

Note: For each variable, the best result is emphasized in green, while red highlights the worst value.

Source: The authors.

In Brazil, women always rate better than men in educational attainment. However, the female group records an alarmingly low rate in political representation reaching, in the best case, less than 30% of the parliamentary seats. Results from the economic activity dimension are also quite negative for women: their

highest labor force participation rate is 64%, less than the worst rate for men (67%). It seems that the educational progress recorded over the last decades did not yet fully translated into equal economic and political opportunities for Brazilian women.

The coefficient of variation, a standardized measure of dispersion in a table of frequency, shows the highest variability for the female Parliamentary Representation indicator (Table 2). The more homogeneous indicator appears to be the male Labour Force Participation.

Following the methodological steps previously presented, the GII computed ranges from 0.312, recorded by the Federal District, where women scored better than men in education and labor force participation, to 0.432, for the Amazonas State. Figure 1 shows the GII values and their spatial distribution among the Brazilian states.

States	GII
Amazonas	0.432
Mato Grosso do Sul	0.421
Goiás	0.421
Alagoas	0.405
Mato Grosso	0.402
Pernambuco	0.395
Pará	0.393
Maranhão	0.392
Rondônia	0.385
Rio Grande do Norte	0.384
Piauí	0.381
Ceará	0.381
Roraima	0.380
Acre	0.378
Rio de Janeiro	0.370
Paraná	0.369
Espírito Santo	0.366
Tocantins	0.363
Minas Gerais	0.363
Bahia	0.362
Rio Grande do Sul	0.348
Sergipe	0.348
Paraíba	0.344
São Paulo	0.333
Santa Catarina	0.329
Amapá	0.321
Federal District	0.312

Figure 1. GII for the Brazilian States.
Source: The authors. Maps produced with *Philcarto*: http://philcarto.free.fr

Data were divided into four groups, which appear in Figure 1 with different colors, from light yellow to red, following the increasing values of the GII, that is more gender inequality. Three main clusters can be identified, while the States with the lower inequality (the light-yellow ones) are scattered all over the country.

Since GII measures the welfare loss due to gender inequality, the expected inverse relation between GII and HDI is confirmed by their correlation coefficient (-0.443) and depicted in Figure 2 by the green line. The scatter plot colors follow the same pattern of Figure 1.

In Figure 2, three Federal Units deserve special attention: the state of Amazonas and the Federal District for their GII values are the lowest and the highest, respectively, and the state of Alagoas. The Federal

District is the only geographical unit that holds the best results in both GII and HDI. Its peculiarity, being a federal district, can be the leading explanation of such a result. On the other extreme of the distribution, Alagoas, a Northeastern state with the lowest HDI among the Brazilian States, shows one of the worse GII values, confirming that gender inequality plays an essential role in reducing human development.
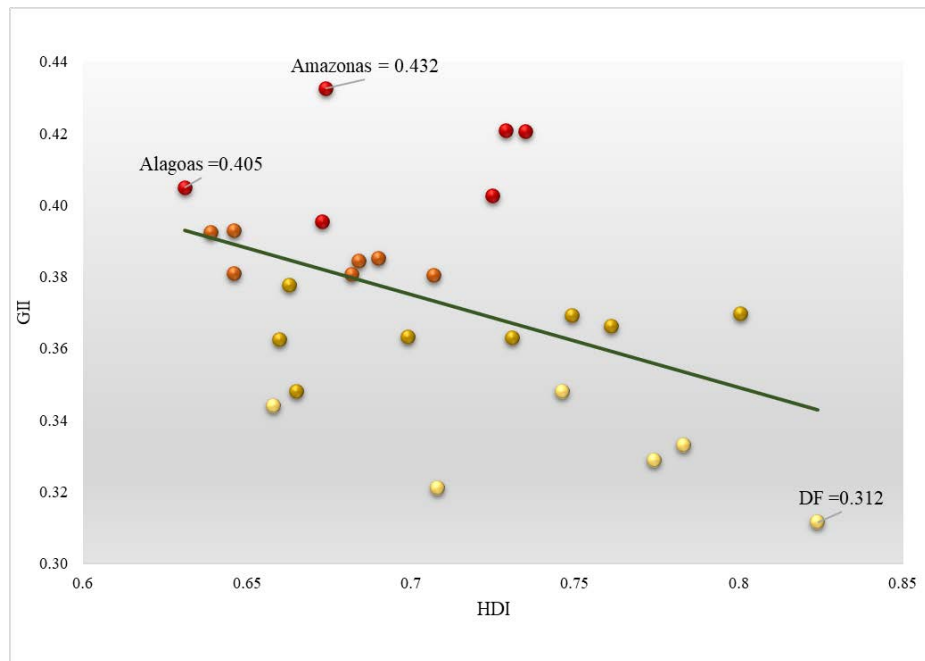
Figure 2. Scatter Plot for the GII and HDI, Brazilian States.
Source: The authors.

4. Conclusion

Multiple disparities define gender inequality. The GII, as a composite index, helps to better understanding how inequality contributes to lowering human development among countries and within a country, as presented in this study. Its dimensions, health, empowerment, and economic activity cover three crucial facets of gender inequality. The interaction among these three elements identifies education as a relevant instrument to lessen gender gaps. As seen in the Brazilian case, where women score better than men in educational attainment but far worse in the other dimensions, education is a precondition to reduce gender disparities. However, much more must be done. For example, policies that foster an equal division of unpaid work between men and women by providing care services accessible and for all, or that promote female participation in political elections effectively.

The GII as a composite index does an excellent job of summarizing gender inequality, but it does not facilitate the understanding of such a complex problem. Lacking the decomposable property, the GII potential to provide policy guidance diminishes. In this view, it is less efficient than the former Gender-related Development Index. On the other side, the GII includes variables to often forgotten in gender inequality indexes.

Finally, as shown in the GII results, gender inequality is a compound of many disparities. Moving toward an equal society is still a political goal which undoubtedly benefits from excellent and reliable indicators

and index.

5. Acknowledgement

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Personal Financial Literacy among University Students studying Engineering

Sirli Mändmaa

Tallinn University of Technology (TalTech), Estonia

E-mail: sirli.mandmaa@taltech.ee

Abstract

Nowadays financial literacy is essential as in a society much of the financial responsibility has shifted from governments to the individual. The findings of earlier studies show that university students are not knowledgeable about personal finance and their financial skills needs improvement. This study analyzed the survey results of 536 university students to assess the financial literacy, the impact of educational and demo-graphical characteristics to the participants' financial literacy, and the students' financial opinions and choices. Results of regression analyze showed that statistically significant impact to the financial literacy had factors: academic discipline, level of education, gender, nationality, age and the choices to have a current account, a debit card, and investment services. Students studied in the Faculty of Civil Engineering compared to others, had higher knowledge in finance, especially female students. These results of study give the direction for future research and enable to enhance financial education.

Keywords: Personal financial literacy, financial education, higher education students, engineering studies, gender differences

1. Introduction

According to the definition used by Organization for Economic Co-operation and Development (OECD), financial literacy is a combination of awareness, knowledge, skill, attitude, and behavior necessary to make sound financial decisions and ultimately achieve individual financial wellbeing (OECD, 2012).

The financial literacy definition used in an international study to assess the financial literacy of young people, PISA 2012, was following: "Financial literacy is knowledge and understanding of financial concepts and risks, and the skills, motivation and confidence to apply such knowledge and understanding in order to make effective decisions across a range of financial contexts, to improve the financial well-being of individuals and society, and to enable participation in economic life." (OECD, 2014, p. 33).

To improve financial literacy there is essential to enhance personal financial education. "Financial education is the process by which financial consumers/ investors improve their understanding of financial products and concepts and, through information, instruction and/or objective advice, develop the skills and confidence to become aware of (financial) risks and opportunities, to make informed choices, to know where to go for help, and to take other effective actions to improve their financial well-being and protection "(OECD, 2006, p. 118).

To elaborate personal financial education there is need to continue research as there is a range of factors that we do not know yet or whose effect we cannot assess. There are examples where good knowledge was not able to result in reasonable behavior. For instance, in OECD International Network on Financial Education pilot study undertaken in 14 countries Estonians ranked in the second group in financial knowledge and last in behavior - exhibited significantly lower levels of behavior than all other countries, except Albania. (OECD, 2012)

Previous studies among adults (Faktum & Ariko, 2010; Kann, 2010) have shown that Estonians elementary level of financial literacy is not a problem, because it is compensated by the conservative behavior of the money matters. Problems arise when there is a need for using long term financial services and calculations. Study results from 2015 show that the financial literacy level of the Estonian population indicates an upward trend. People's perception of interest and its calculation, as well as investment awareness, have improved over the previous five years and there have been a steady increase of number of families, who account their incomes and expenses, i.e. draw up a household budget (2010 33%, 2012 39% and 2015 44% of participants). (Saar Poll, 2015)

The financial literacy test, PISA 2012, was taken in 18 countries and economies. In Estonia 1088 students took the test and achieved a mean score of 529 points, which was significantly above the OECD mean (500 points) score (OECD, 2014). The disturbing fact in results was the gap, between the groups with different languages spoken at home, as students' who spoken Estonian at home had the mean score 46 points higher, than students' whose home spoken language was another language (OECD, 2014).

Earlier studies analyzing the financial literacy of students at Estonian universities showed that the level of financial literacy of students was low and that the interest of students in long-term planning was not remarkably high. 51.0% of respondents had low financial literacy and only 3.4% planned their finances for several years. (Mändmaa, 2019a) University students studying science or mathematics-oriented subjects had more financial knowledge, especially male students. The lowest level of the financial literacy mean score (52%) was of students studying in field of Construction. (Mändmaa, 2019b)

As financial education should be meet the needs and financial literacy level of the target audience, it is important to explore more deeply what and how affects the financial knowledge, and what kind of influence have the knowledge to students' personal finance issues and decisions.

This study had two purposes: First, examine the financial literacy and its relationships with financial opinions and choices (i.e. views on personal finance issues and financial decision making) made by students' who studying engineering sciences in Estonia; Second, to explore the impact of socio demographic characteristics to the participants' financial literacy, opinions and choices.

The main goal of this study was to examine personal financial literacy, opinions and choices among university students' who studying engineering sciences to give the results what will enable to identify needs and gaps in financial education for develop the area and well-being in society.

The paper is organized as follows. Section two considers the previous relevant contributions in literature, related to financial literacy and education. Section three describes the methodology and the sample that was used. Section four presents the results that were obtained, and finally section five concludes the paper.

2. Literature review

Wealthy people are more financially literate than poor people, and those with high education attainment are also more financially literate. (Lusardi, 2017)

Financial education should be regarded as a lifetime, on-going and continuous process, to take account of the increased complexity of markets, varying needs at different life stages, and increasingly complex information. (OECD, 2006)

The findings from an OECD International Network on Financial Education pilot study undertaken in 14 countries show that compound interest and diversification is lacking amongst sizable proportion of the population in every country. (OECD, 2012)

Researchers have examined the financial literacy and practice of various components of society. Several studies throughout the world have shown that females tend to display lower level on personal financial literacy than males, among adults (Lusardi & Mitchell, 2006; Fonseca, et al., 2010; Monticone, 2010), students (Chen and Volpe, 1998; Chen and Volpe, 2002; Atkinson et al 2006; OECD, 2012; Mändmaa, 2019a, b), and adolescents (Lusardi et al 2010). Goldsmith and Goldsmith (1997; 2006) suggested that females have lower level in financial literacy than males as their general interest in investment and personal finance is usually lower, and they are less confident in their ability to perform financial analysis. Chen and Volpe (2002) argued that enthusiasm and confidence may be the contributing factors that explain why men are more financially knowledgeable than women. They stated that Personal Finance is mostly number-oriented subject and not attractive to women, as women prefer courses with less mathematics and other number-oriented science. (Chen and Volpe, 2002)

Several researchers have noted that age makes an important influence in the level of financial literacy. For instance, Atkinson et al (2006) obtained results in the study of the United Kingdom population, that 26-year-old and older are in higher financial literacy levels than the younger. Similar results were obtained in the study among university students in Estonia (Mändmaa, 2019a). Chen and Volpe (1998) surveyed college students in US and noted that participants under the age of 30 are more likely to be less knowledgeable as compared with those of the age of 40 or older.

Various studies (Chen and Volpe, 1998; Mändmaa, 2019a,b; Pires and Quelhas, 2015) examined students financial knowledge revealed that students with an economic academic discipline or which individuals attending programs in business sciences tend to reveal a higher level of financial literacy. Lewis Mandell who was surveyed the Financial Literacy of Young American Adults, released his opinion:" Regardless of major, college students learn how to do research and solve problems. In a rapidly changing financial system, these two skills are more important to financial decision-making than understanding financial products, rules, and regulations. Knowing how to approach a problem and how to research it are key to making the best personal financial decisions." (2008, pp. 29) According to the results students who study science and engineering had the highest financial literacy scores and those who studied business or economics came next (Mandell, 2008).

The research among Portuguese students revealed that the existence of prior experience, as credit clients or the existence of saving habits increases the financial literacy of individuals. (Pires and Quelhas, 2015)

Financial literacy can have important implications for financial behavior. Previous research has found

that people with low financial literacy are more likely to have problems with debt (Lusardi and Tufano, 2009), less likely to participate in the stock market (van Rooij *et al*, 2007), less likely to accumulate wealth and manage wealth effectively (Hilgert *et al*, 2003; Stango and Zinman, 2007), and less likely to plan for retirement (Lusardi and Mitchell 2006, 2009).

The financial situation of today's youth in USA is characterized increasingly by high levels of debt, as between 1997 and 2007, average undergraduate student loan debt rose from \$9,250 to \$19,200 — a 58% increase after accounting for inflation (Reed, 2008). Cole, Paulson and Shastry showed that education improves credit scores, and dramatically reduces the probability of declaring bankruptcy, as well as significantly increases investment income and retirement savings (Cole *et al*, 2012).

Many young people wished they had more financial knowledge. In a 2009 survey on credit card use among undergraduate students in USA, 84% of students said they needed more education on financial management topics, 60% wanted to receive this education while in high school, and 40% as college freshmen (Sallie Mae, 2009) In survey among Estonian university students, 65% of the participants were interested to get more information about financial services and monetary affairs planning (Mändmaa, 2019a).

Understanding financial literacy among young people is thus of critical importance for policymakers in several areas; it can aid those who wish to devise effective financial education programs targeted at young people as well as those writing legislations to protect younger consumers (Lusardi et al, 2010).

3. Methodology

This study used a standardized survey method to determine participants' personal financial literacy. The questionnaire was designed to cover major aspects of personal finance, included knowledge on General Personal Finance, Saving, Borrowing, Investment and Insurance. In current study were used multiple-choice questions contained 10 questions on demographic data, 23 about personal finance knowledge and five concerning participants finance choices and opinions. The validity and clarity of the survey were previously evaluated by the group of master level students and by three individuals who were knowledgeable in personal finance topics.

The responses from each participant were used to calculate the mean and median percentage of correct scores, to measure the financial literacy levels and to analyze the results. Consistent with the existing literature (Chen and Volpe, 1998; Mändmaa, 2019a, b), the mean percentage of correct scores was grouped into three categories. The first category represents a relatively high level (more than 80%) of knowledge, the second a medium (60% to 79%) and the third represent a relatively low level (below 60%) of knowledge.

Previous research advised that levels of financial literacy vary among subgroups of students (Chen and Volpe, 1998, 2002; Mändmaa, 2019a, b). To provide evidence of the differences the Analysis of Variance (ANOVA) was used. The differences were further analyzed using logistic regression models. The participants were divided into two groups using the median percentage of correct answers of the sample. Students with scores higher than the sample median were classified as students with relatively higher (More) knowledge, coded as "1" and students with scores equal or below the median are classified as

those with relatively lower (Less) knowledge, coded as "0". The dichotomous variable, financial literacy level (More, Less), was used in logistic regression as the dependent variable, which was explained simultaneously by all the independent variables. To detect if the independent variables have different effect on students' financial literacy the logistic regression analysis conducted separately two times: for entire sample and for students studying Civil Engineering.

In current case the independent variables were age, academic discipline, level of education, gender, household size, nationality, work experience, currently available financial services (including the use of credit card), planning period for personal finance affairs, and interest about personal finance topics.

In this study, the logistic model took on the following functional form:

$$
\begin{aligned}
\log\left[p/(1-p)\right] = {} & B_0 + B_1(Age1) + B_2(Age2) + B_3(Age3) + B_4(Academic\ discipline) + B_5(Credit\ Card) \\
& + B_6\ (Gender) + B_7\ (Household1) + B_8\ (Household2) + B_9\ (Household3) + B_{10}\ (Household4) \\
& + B_{11}\ (Household5) + B_{12}\ (Interest) + B_{13}\ (Financial\ services\ 1) + B_{14}\ (Financial\ services\ 2) \\
& + B_{15}\ (Financial\ services\ 6) + B_{16}\ (Financial\ services\ 9) + B_{17}\ (Financial\ services\ 10) \\
& + B_{18}\ (Financial\ services\ 11) + B_{19}\ (Income1) + B_{20}\ (Income2) + B_{21}\ (Income3) \\
& + B_{22}\ (Income4) + B_{23}\ (Level\ of\ education1) + B_{24}\ (Level\ of\ education2) \\
& + B_{25}\ (Level\ of\ education3) + B_{26}\ (Nationality) + B_{27}\ (Planning) + B_{28}\ (Work1) + B_{29}\ (Work2) \\
& + B_{30}\ (Work3) + B_{31}\ (Work4) + e_i
\end{aligned}
$$

$$(1)$$

Where, p = the probability of a participant with relatively more knowledge about personal finance;

B= the coefficient. Coefficients B_1 to B_{31} represent the effect of each subgroup compared with the reference group.

To understand better and find the needs and gaps in financial education, the students' choices (financial planning and services using), opinions and self-assessment, were analyzed in addition. To describe the relationships between students' choices, financial literacy and socio-demographic background, the Cross-tabulations, Chi-square tests, descriptive statistics and analysis of variances (ANOVA) were used.

Based on earlier research results, the students from the Faculty of Civil Engineering mainly were chosen as subjects of this study. For the interests of results representativeness to all students, who studied in the Faculty of Civil Engineering in the academic year 2014/2015 was offered the opportunity to participate in the survey. To increase the number of participants, the poll was conducted at paper form during the lectures. As some lectures bring together students from several faculties, more answers were gathered, and these were used to make comparisons. The total sample size was 536 and 447 of them were students studying civil engineering. Among respondents studying civil engineering, the distribution of male and female students was similar with whole Faculty of Civil Engineering, with 60% and 64% males, and 40% and 36% females, respectively. The comparison by gender and levels of education is shown in Table 1. The description of sample is presented in Table 2.

Table 1 The distribution of students by educational levels and gender

Level of education	A. Faculty of Civil Engineering			B. Sample of students studying engineering		
	Total Count %	Male Count %	Female Count %	Total Count %	Male Count %	Female Count %
Bachelor studies	156 12,0	79 50,6	77 49,4	93 20,8	41 44,1	52 55,9
Master studies	288 22,2	150 52,1	138 47,9	93 20,8	58 62,4	35 37,6
Integrated Bachelor's and Master's Study	855 65,8	606 70,9	249 29,1	261 58,4	170 65,1	91 34,9
Total	1299 100,0	835 64,3	464 35,7	447 100,0	269 60,2	178 39,8

Source: Author's own preparation based on Statistics of the TTU Faculty of Civil Engineering (2015)

Notes: The data presented in the table part B are appropriate for generalization (Chi-square=12,910 significant at level 0,002).

Table 2 Characteristics of the sample

Characteristics	Faculty of Civil Engineering		Male participants		Female participants		Entire sample	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Total amount of observations	447	100	326	100	210	100	536	100
A. Education								
1. Academic discipline								
a) Civil Engineering	447	100	269	82.5	178	84.7	447	82.5
b) Other	0	0	57	17.5	32	15.3	89	17.5
2. Level of education								
a) Bachelor studies	93	20.8	96	29.5	81	38.3	177	33.0
b) Master studies	93	20.8	59	18.1	36	17.2	95	17.8
c) Integrated Bachelor's and Master's Study	258	57.7	168	51.5	92	44.0	260	48.5
d) Unanswered	3	0.7	3	0.9	1	0.5	4	0.7
B. Experience								
1. Age groups								
a) 18-22	259	57.9	198	60.7	142	67,6	340	63.4
b) 23-29	150	33.6	102	31.3	55	26,2	157	29.3
c) 30 and up	38	8.5	26	8.0	13	6,2	39	7.3
2. The work experience								
a) None	126	28.2	104	31.9	67	31.9	171	31.9
b) Less than 2 years	172	38.5	126	38.7	81	38.6	207	38.6
c) 2 to 5 years	78	17.4	43	13.2	40	19.0	83	15.5
d) More than 5 years	64	14.3	50	15.3	16	7.6	66	12.3
e) Unanswered	7	1.6	3	0.9	6	2.9	9	1.7
C. Demographic characteristics								
1. Nationality								
a) Non-Estonian	75	16.8	48	14.7	43	20.5	91	17.0
b) Estonian	372	83.2	278	85.3	167	79.5	445	83.0
2. Gender								
a) Male	269	60.2	326	100	0	0	326	60.8
b) Female	178	39.8	0	0	210	100	210	39.2
3. Household size								
a) Live alone	129	28.9	102	31.2	54	25.7	156	29.1
b) Live with husband/ wife	92	20.6	45	13.8	55	26.2	100	18.7
c) Live with husband/ wife and children	37	8.3	27	8.3	13	6.2	40	7.5
d) Live with parents/grandparents	146	32.7	126	38.7	64	30.5	190	35.4
e) Other	43	9.6	26	8.0	24	11.4	50	9.3
D. Income								
1. Personal monthly net income								
a) Do not want to answer	64	14.3	61	18.7	36	17.1	97	18.1
b) Under 300 EURO	176	39.4	129	39.6	90	42.9	219	40.9
c) 301- 750 EURO	113	25.3	70	21.5	52	24.8	122	22.8
d) 751 EURO and over	94	21.0	66	20.2	32	15.2	98	18.2
E. Background								
1. Educational level of parents - existence of higher education								
a) Mother	278	62.2	207	63.5	120	57.1	327	61.0
b) Father	207	46.3	166	50.9	88	41.9	254	47.4
c) Stepparent	21	4.7	12	3.7	11	5.2	23	4.3
d) Grandparent	92	20.6	69	21.2	44	21.0	113	21.1
2. Number of books in childhood home								
a) Under 100	103	23.0	76	23.3	54	25.7	130	24.3
b) 101 – 500	243	54.4	176	54.0	112	53.3	288	53.7
c) More than 500	92	20.6	68	20.9	39	18.6	107	20.0
d) Unanswered	9	2.0	6	1.8	5	2.4	11	2,0

Notes: Author's own preparation based partly on Mändmaa, 2020.

4. Results and Analysis

To evaluate the level of financial literacy and analyze the factors that influencing students studying the engineering in higher education institution the survey was conducted. The questionnaire was filled in by 536 students. Most participants were Estonians (83%). In terms of gender, male participants accounted for about 61% and females   39%, of the sample. About 82% of the participants were from Faculty of Civil Engineering and 93% of participated students were under 30 years old. The collected data were analyzed by using the software Statistical Package for the Social Sciences (SPSS).

4.1 Differences in personal financial literacy

The survey responses are summarized, and differences of answers by gender and by level of financial literacy are presented in Table 3. Lower financial literacy scores mainly concerned topics of insurance and interest formation. In total, survey results showed that participants' financial literacy was at Medium level.

Compared the results of all respondents and respondents from the faculty of Civil Engineering, the results of the Civil Engineering faculty were significantly better. There was only one question of the 23 (question about the impact of inflation), where the responses average score was 1.3% lower. On average, female students answered to the 69.1% of questions correctly, while score of students studying civil engineering was 72.5% and male students had the correct answers for the 66.5% and 70.8% of questions, respectively.

Table 3 Mean percentages of correct responses by gender and result of ANOVA

Brief description of the questions	Level of Personal Financial Literacy									Total %
	Low Below 60%			Medium 60-79%			High Over 80%			
	M	F	F test	M	F	F test	M	F	F test	
I General Personal finance knowledge										
1. Personal financial literacy				73.9	70.0	0.983				72.4
				78.1	76.4	0.169				77.4
2. Asset liquidity	41.1	48.6	2.895							44.0
	43.9	51.7	2.633							47.0
3. Meaning of inflation				71.8	77.1	1.904				73.9
				76.2	79.2	0.551				77.4
4. Impact of inflation							79.4	83.3	1.250	81.0
							85.1	82.0	0.763	83.9
5. Understanding of loan interest							95.7	96.2	0.076	95.9
							96.7	97.7	0.456	97.1
6. Cost of apartment leasing				68.1	69.0	0.053				68.5
				74.0	73.0	0.049				73.6
7. Legal requirement for apartment lease				66.9	70.0	0.574				68.1
				68.4	73.6	1.387				70.5
8. Time value of money	59.5	50.9	3.811*							56.2
	61.7	53.9	2.675							58.6
9. Discount valuation							97.8	96.7	0.705	97.4
							98.9	97.2	1.747	98.2
Mean correct responses for the I section				72.7	73.5	0.332				73.0
				75.9	76.1	0.021				76.0
II Saving, borrowing, insurance and investments										
10. Appropriate saving place				76.1	76.7	0,025				76.3
							81.4	82.0	0.026	81.7
11. Annual percentage rate							89.3	90.5	0.203	89.7
							91.8	92.7	0.113	92.2
12. Compound interest				65.3	66.7	0.100				65.9
				71.0	73.6	0.356				72.0
13. Purchasing power assessment							83.1	88.6	3.016	85.3
							88.5	92.1	1.583	89.9
14. Monthly payments of mortgage				68.1	70.5	0.337				69.0
				76.6	78.1	0.138				77.2
15. Interest of loan	53.4	56.7	0.557							54.7
				60.0	65.2	1.283				62.0
16. Loan co-sing consequences				59.5	66.2	2.425				62.1
				64.7	68.5	0.710				66.2
17. The interest rate evaluation							89.0	91.0	0.551	89.7
							93.7	92.1	0.395	93.1
18. Understanding the content of insurance	35.6	38.6	0.489							36.7
	40.1	41.6	0.090							40.7
19. Homeowners' insurance	33.1	43.3	5.737*							37.1
	36.8	45.5	3.383							40.3
20. Revenue of different Interest calculation	46.9	49.5	0.343							47.9
	52.8	54.5	0.125							53.5
21. Risk diversification				78.5	80.9	0.459				79.5
							83.6	86.0	0.437	84.6
22. High risk-return							81.9	84.8	0.739	83.0
							87.0	88.8	0.312	87.7
23. Interest rates changes and treasury bond price	15.3	22.9	4.860*							18.3
	17.1	23.0	2.408							19.5
Mean correct responses for the II section				62.5	66.2	5.243*				63.9
				67.5	70.3	3.493				68.6
Mean correct responses for the entire survey				66.5	69.1	3.683*				67.5
				70.8	72.5	2.070				71.5
Median correct responses for the entire survey										69.6
										73.9

Notes: "M" - the average scores of male participants; "F" - the average scores of female participants; F test - value of F-Statistic; * significant at the 0.05 level.
The first row of each position represents the results of the entire sample and the second row shows the results of students from department of Civil Engineering.
Author's own preparation based partly on Mändmaa, 2020.

4.2 Analysis of Results by Subgroups of the Sample

The results in previous section displayed the differences in financial literacy about students' academic disciplines and gender, but the effects of other determining factors were not controlled. In this section the ANOVA was used to detect if factors from various subgroups had differences in effecting the levels of financial knowledge.

Table 4 Mean percentage of correct responses by characteristics of sample and results of ANOVA

	Characteristic	Total count	Total %	Civil engineering count	Civil engineering %
A.	**Education**				
	1. Academic discipline				
	a) Civil engineering	447	71.48	447	71.48
	b) Other***	89	47.53	-	-
	F Statistic		(281.893)**		
	2. Level of education				
	a) Bachelor studies	177	65.22	93	81.67
	b) Master studies	95	74.32	93	74.43
	c) Integrated Bachelor's and Master's Study	260	66.82	258	66.88
	d) Unanswered	4	47.83	3	59.42
	F Statistic		(10,066)**		(43.171)**
B.	**Experience**				
	1. Age groups				
	a) 18-22	340	66.73	259	72.97
	b) 23-29	157	67.79	150	68.40
	c) 30 and up	39	73.13	38	73.45
	F Statistic		(3.183)*		(6.783)**
	2. The work experience				
	a) None	171	65.27	126	71.84
	b) Less than 2 years	207	66.24	172	70.42
	c) 2 to 5 years	83	70.56	78	72.02
	d) More than 5 years	66	72.33	64	73.03
	e) Unanswered	9	66.67	7	70.81
	F Statistic		(3.693)**		(0.596)
C.	**Demographic characteristics**				
	1. Nationality				
	a) Estonian	445	68.26	372	72.28
	b) Non-Estonian	91	63.78	75	67.54
	F Statistic		(6.659)*		(8,805)**
	2. Gender				
	a) Male	326	66.50	269	70.78
	b) Female	210	69.07	178	72.54
	F Statistic		(3.683)		(2.070)
	3. Household size				
	a) Live alone	156	67.28	129	71.35
	b) Live with husband/ wife	100	69.74	92	71.41
	c) Live with husband/ wife and children	40	70.00	37	71.44
	d) Live with parents/grandparents	190	64.99	146	70.55
	e) Other	50	71.30	43	75.23
	F Statistic		(2.953)*		(1.132)
D.	**Income**				
	1. Personal monthly net income				
	a) Do not want to answer	97	62.03	64	69.90
	b) Under 300 EURO	219	66.86	176	71.61
	c) 301- 750 EURO	122	69.10	113	70.76
	d) 750 EURO and over	98	72.36	94	73.17
	F Statistic		(8.465)**		(1.008)
E.	**Background**				
	1. Level of education of the parents. Higher education exists				
	a) Mother (F Statistic)	327	68.31 (2,399)	278	71.91 (0,838)
	b) Father (F Statistic)	254	67,20 (0,191)	207	71.90 (0,410)
	c) Stepparent (F Statistic)	23	71.27 (1,478)	21	72.67 (0,192)
	d) Grandparent (F Statistic)	113	67.22 (0,051)	92	71.17 (0.068)
	2. Number of books in childhood home				
	a) Under 100	130	67.93	103	72.81
	b) 101 – 500	288	66.82	243	70.62
	c) More than 500	107	69.32	92	72.87
	d) Unanswered	11	65.84	9	65.22
	F Statistic		(1.002)		(1.850)

Notes: *significant at the 0.05 level; **significant at the 0.01 level or greater; *** Participants who were not study in field of Civil Engineering were grouped together under the name "Other".

4.3 Analysis of Results by participants' choices and opinions

Analysis of variance was used to detect if participants with different financial choices have different levels of knowledge. More detailed overview about participants' choices, made about currently available financial services is presented in Table 5.

Table 5 Results of ANOVA and mean percentage of financial literacy (FL) level in cases of differing financial choices

Students' financial choices	Civil Engineering department		Male		Female		Total	
	Count	FL level	Count	FL level	Count	FL level	Count	FL level
Currently available financial services								
Current Account								
a) Yes	392	72.9	272	69.4	180	70.4	452	69.8
b) No	55	61.4	54	52.0	30	61.1	84	55.3
F Statistic	(42.817)**		(68.789)**		(10.680)**		(73.395)**	
Debit Card								
a) Yes	368	73.9	262	69.3	163	70.7	425	69.8
b) No	79	64.6	64	55.1	47	63.4	111	58.6
F Statistic	(29.737)**		(49.933)**		(9.552)**		(52.907)**	
Term deposit								
a) Yes	62	70.3	43	67.7	29	68.1	72	67.9
b) No	385	71.7	283	66.3	181	69.2	464	67.4
F Statistic	(0,581)		(0.322)		(0.157)		(0.049)	
Saving Account								
a) Yes	100	72.9	76	67.8	43	70.5	119	68.8
b) No	347	71.1	250	66.1	167	68.7	417	67.1
F Statistic	(1.631)		(0.758)		(0.498)		(1.111)	
Student loan								
a) Yes	54	72.5	37	69.0	26	69.1	63	69.0
b) No	393	71.3	289	66.1	184	69.1	473	67.3
F Statistic	(0.567)		(1.076)		(0.000)		(0.705)	
Housing loan								
a) Yes	31	73.2	21	73.7	11	70.0	32	72.4
b) No	416	71.3	305	66.0	199	69.0	504	67.2
F Statistic	(0.615)		(4.948)*		(0.043)		(3.585)	
Other bank loan								
a) Yes	9	76.8	9	73.4	2	60.9	11	71.1
b) No	438	71.4	317	66.3	208	69.1	525	67.4
F Statistic	(1.612)		(1,869)		(0.632)		(0.646)	
Vehicle Lease								
a) Yes	25	75.3	18	73.2	10	71.3	28	72.5
b) No	422	71.2	308	66.1	200	69.0	508	67.2
F Statistic	(2.395)		(3.603)		(0.244)		(3.234)	
Insurance								
a) Yes	143	74.1	101	71.7	57	71.3	158	71.6
b) No	304	70.2	225	64.1	153	68.2	378	65.8
F Statistic	(9.240)**		(17.565)**		(1.856)		(16.578)**	
Investment Services								
a) Yes	40	77.6	23	74.1	18	79.7	41	76.6
b) No	407	70.9	303	65.9	192	68.1	495	66.7
F Statistic	(10.390)**		(6.092)*		(10.887)**		(16.273)**	
Pension fund shares								
a) Yes	138	74.6	92	72.5	62	71.3	154	72.0
b) No	309	70.1	234	64.1	148	68.1	382	65.7
F Statistic	(12.332)**		(20.828)**		(2.087)		(20.072)**	
Credit Card								
a) Yes	99	72.8	69	72.4	42	71.4	111	70.1
b) No	301	71.8	215	66.4	147	69.2	362	67.5
c) Yes, but not my own	38	69.0	34	66.0	13	64.9	47	65.7
d) Unanswered	9	57.5	8	46.2	8	61.4	16	53.8
F Statistic	(4.655)**		(5.677)**		(1.459)		(5.856)**	

Notes: *significant at the 0.05 level; **significant at the 0.01 level or greater.

Students' were asked their own opinion, does their financial literacy needs improvement, and the results showed that the higher level of financial literacy tend to relate to higher interest. By the ANOVA, the results were statistically significant, and about of full sample the generalizations could be made.

Table 6 Differences in financial literacy levels in case of differing opinions about improvement the financial knowledge

Students' opinions	Civil Engineering department		Male		Female		Total	
	Count	FL level	Count	FL level	Count	FL level	Count	FL level
Does your financial literacy level need improvement?								
a) Yes	374	71.9	274	67.3	166	70.2	440	68.4
b) No	33	70.6	21	64.0	22	64.8	43	64.4
c) Unanswered	40	67.8	31	60.9	22	64.6	53	62.4
F Statistic	(1.985)		(2.763)		(2,486)		(4.724)**	

Notes: **significant at the 0.01 level or greater.
FL - Financial Literacy

4.4 Students' financial planning habits

The ANOVA tests were used to find out if there were any differences in students' financial affair planning habits. The results showed that most preferable planning period was one months, as 39% of students in whole sample (41% of males and 36% of females) and 40% in Civil Engineering department sample (43% of males and 35% of females) picked this answer to the question: "How long in advance do you plan your financial affairs (the expected revenues, the necessary costs and predictable financial situation)?". Statistically significant tests results (for whole sample F=4,098 sig=0,000 and for Civil Engineering department sample F=3,452 sig=0,000) reveled that only 5% of students planned their financial affair on several years basis and less than 1% until retirement (was only male students' choice). The number of students', who do not saw the need to plan, was an average 6%. In terms of short-term planning, the higher financial literacy level generally related to a longer planning period, and lower financial literacy level was linked to noticeably shorter or missing planning habit.
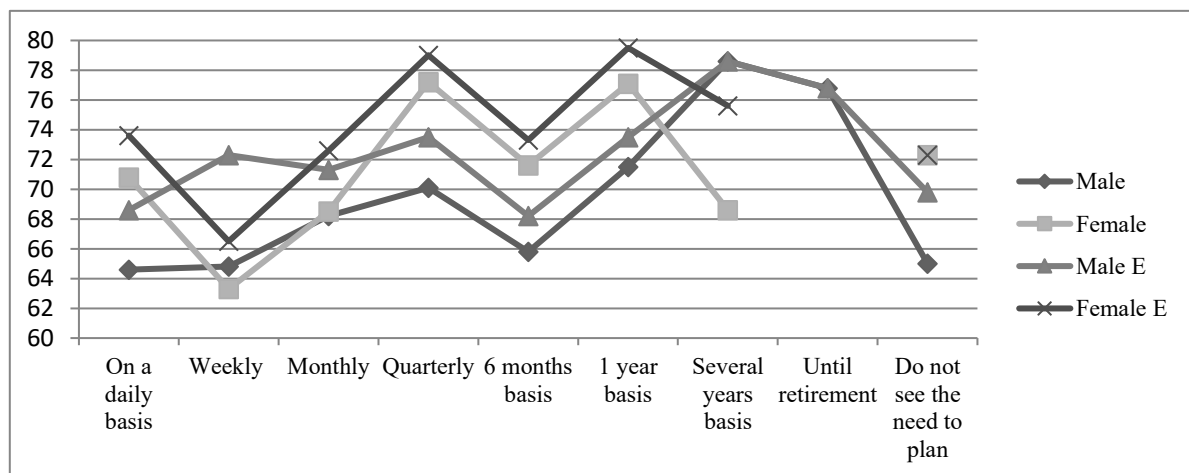

Figure 1 Students' financial affairs planning habits described through the financial literacy level and gender

Notes: Financial affairs planning habits of male and female students from Civil Engineering department are denoted Male E and Female E.

4.5 Relationships between self-assessment, confidence, and financial literacy

Students' assessment of their financial knowledge was not in line with the results of the financial literacy assessment conducted in the framework of the study. The overlap was only 38% for the whole sample (Table 7a) and 42% for the Civil Engineering department sample (Table 7b).

These results could be concluded that students' own knowledge's were overrated, as in full sample the 42% of students evaluated their knowledge to High level, but only 20 percent of those in the survey exceeded the High-level border, and the differences were similar (20%) in the Civil Engineering students' sample. By analyzing the Low-level results, the cap between self-assessment and results was small (5%) in sample of Civil Engineering department but in Full sample the difference was much bigger (18%).

225 students (97 female students i.e. 46% of females and 128 male students, i.e. 39% of males) who assessed their financial knowledge to the high level could be counted of self-confident, as well as these 55 students (17 female students and 38 male students) whose financial literacy level was low but they proposed the level as medium.

Table 7a Full sample, differences in assessments

Self-assessment about financial knowledge?		Financial literacy level			Total
		Low	Medium	High	
High	Count	41	125	59	225
	% within	18.2%	55.6%	26.2%	100.0%
	% within column	29.5%	42.8%	56.2 %	42.0%
Medium	Count	55	121	35	211
	% within	26.1%	57.3%	16.6%	100.0%
	% within column	39.6%	41.4%	33.3%	39.4%
Low	Count	23	20	2	45
	% within	51.1%	44.4%	4.4%	100.0%
	% within column	16.5%	6.9%	1.9%	8.4%
Hard to say	Count	20	26	9	55
	% within	36.4%	47.3%	16.3%	100.0%
	% within column	14.4%	8.9%	8.6%	10.2%
Total	Count	139	292	105	536
	% of Total	25.9%	54.5%	19.6%	100.0%
Note:		Chi-Square=12.847 significant at the 0.046 level			

Note: Based on Mändmaa, 2020.

Table 7b Civil Engineering department, differences in assessments

Self-assessment about financial knowledge?		Financial literacy level			Total
		Low	Medium	High	
High	Count	11	124	59	194
	% within	5.7%	63.9%	30.4%	100.0%
	% within column	20.8%	42.9%	56.2%	43.4%
Medium	Count	26	121	35	182
	% within	14.3%	66.5%	19.2%	100.0%
	% within column	49.1%	41.9%	33.3%	40.7%
Low	Count	9	18	2	29
	% within	31.0%	62.1%	6.9%	100.0%
	% within column	17.0%	6.2%	1.9%	6.5%
Hard to say	Count	7	26	9	42
	% within	16.7%	61.9%	21.4%	100.0%
	% within column	13.2%	9.0%	8.6%	9.4%
Total	Count	53	289	105	447
	% of Total	11.9%	64.7%	23.5%	100.0%
Note:		Chi-Square=26.011 significant at the 0.000 level			

4.6. Determining factors of personal financial literacy

In this section the statistically significant differences were analyzed further. The relationship between personal financial literacy and the participants' gender, education, age, nationality, income and some financial choices and opinion were examined.

The tested correlation among the independent variables was low, i.e. under 0.60 that indicate the multi-collinearity was not a problem in current analysis.

The Forward Stepwise method was chosen, and the regression analyses were run separately for two different samples. The statistically significant results of logistic regressions are reported in Tables 8a and 8b. As suggested by the Chi-square values, the models have high explanatory power. In addition, the overall fit of the models was assessed by its ability correctly classify observations. For the entire sample, 77.6% of the observations were correctly classified as compared with 56.7% change classification and for the Civil Engineering sample were correctly classified 75.2% of the observations compared with change classification 67.8%.

Based on the logistic regression analysis the results of Full sample (Table 8a) showed that students in Civil Engineering department (Acad. discipline 1) belong 50 times more likely to the group of more knowledgeable about financial literacy, than students from the others academical disciplines. The students in the Master studies (Level of education 2), were 7 times more likely to be with relatively higher knowledge about personal finance than those from Bachelor or Integrated studies.

The coefficient (B) of Gender (1), denote Male students and was negative. Consistent with findings of ANOVA, the result suggested those males were more likely to be less knowledgeable about personal finance than females. Using a small calculation (1/Exp(B)N=1/0.402=2.487) the result could be presented on the contrary, that is to say from female students perspective and to state that they were 2.5 times more likely to be more knowledgeable about personal finance than males did.

The coefficient (B) of Income (4), was also negative. That variable presented the situation when participant refused to answer the question about monthly net income. Based on the logistic regression results those participants were more likely to be less knowledgeable about personal finance than others who answered the question. The results were consistent with ANOVA results (Table 4). This concrete variable (Income 4) was more like behavioral factor as it did not give any answer about the influence of the amount of income.

ANOVA results (Table 5) of current study showed that financial services that had statistically significant effect were: Current Account, Debit Card, Housing loan (only in sample of Male students), Insurance, Investment Services, Pension fund shares and Credit Card. Based on the logistic regression results the financial services that had significant impact on participants financial literacy were Current Account (Financial services 1), Debit Card (Financial services 2) and Investment services (Financial services 10).

Table 8a Full sample. The logistic regression Model

	Step 1		Step 2		Step 3		Step 4		Step 5		Step 6		Step 7	
	B	ExpB	B	ExpB	B	ExpB	B	ExpB	B	ExpB	B	ExpB	B	ExpB
Acad. Discipline (1)	3.577**	35.771	3.553**	34.920	3.537**	34.350	3.980**	53.528	3.892**	49.020	3.874**	48.154	3.910**	49.909
Level of Education (2)			1.893**	6.637	1.949**	7.024	1.960**	7.099	2.011**	7.473	1.962**	7.114	1.933**	6.912
Financial services (1)					1.399**	4.052	1.352**	3.864	1.279**	3.595	1.177**	3.244	1.119**	3.061
Gender (1)							-0.876**	0.416	-0.942**	0.390	-0.902**	0.406	-0.911**	0,402
Financial services (10)									3.053**	21.188	3.003**	20.141	2.962**	19.345
Financial services (2)											0.551*	1.734	0.573*	1.774
Income (4)													-0.577*	0.562
Constant	-2.833**	0.059	-3.059**	0.047	-4.267**	0.014	-3.349**	0.035	-3.229**	0.040	-3.612**	0.027	-3.494**	0.030
-2 log Likelihood	569.583		536.039		516.239		499.907		478.191		474.229		470.299	
Chi-Square	163.770**		197.314**		217.113**		233.446**		255.162**		259.124**		263.054**	
Adjusted R^2	0.353		0.413		0.447		0.474		0.508		0.514		0.520	
Correct Classified	72.9		72.9		76.1		76.1		76.3		77.1		77.6	
Chance Classification	56.7													

Notes: *significant at the 0.05 level; **significant at the 0.01 level or greater.

Table 8b Sample of Civil Engineering department. The logistic regression Model

	Step 1		Step 2		Step 3		Step 4		Step 5	
	B	Exp(B)	B	Exp(B)	B	Exp(B)	B	Exp(B)	B	Exp(B)
Level of Education (3)	-1.852**	0.157	-1.816**	0163	-1.902**	0.149	-1.956**	0.141	-1.922**	0.146
Financial services (1)			1.336**	3.803	1.326 **	3.764	1.275**	3.579	1.231**	3.424
Nationality (1)					-0.867**	0.420	-0.879**	0.415	-0.832**	0.435
Age (2)							-0.691**	0.501	-0.667**	0.513
Financial services (2)									0.571*	1.769
Constant	1.976**	7.217	0.802*	2.230	1.026**	2.790	1.351**	3.862	0.887*	2.428
-2 log Likelihood	496.639		478.845		470.292		461.908		458.013	
Chi-Square	65.220**		83.014**		91.567**		99.952**		103.846**	
Adjusted R^2	0.190		0.237		0.259		0.280		0.290	
Correct Classified	67.8		71.8		74.5		72.0		75.2	
Chance Classification	67.8									

Notes: *significant at the 0.05 level; **significant at the 0.01 level or greater.

The findings of logistic regression analysis about the sample of Civil Engineering department (Table 8b) were statistically significant and compatible with results of ANOVA (Table 4). The result showed that the coefficient (B) of variables Level of Education (3), Age (2) and Nationality (1), was negative.   In current case the Level of Education (3), indicated that students at Integrated Studies were more likely to be less

knowledgeable about personal finance than students studding in Bachelor and Master Studies. Variable, Nationality (1), was indicating that non-Estonians were more likely to be less knowledgeable about personal finance than Estonians. The result could be presented from Estonians perspective and to state that is (1/Exp(B)N=1/0.435=2.298) 2.3 times more likely Estonian students belong to group with higher level of financial literacy than non-Estonians. The variable, Age (2), was suggesting that participants in age 23-29 were more likely to be in a lower level of financial literacy group than students from other age groups. Based on the logistic regression results the financial services that influencing participants financial literacy were Current Account and Debit Card (ANOVA results in Table 5).

5. Discussion and conclusion

The main goal of this study was to examine personal financial literacy, opinions and choices among university students' who studying engineering sciences to give the results what will enable to identify needs and gaps in financial education for develop the area and well-being in society.

Students' financial literacy was assessed by the answers of survey questionnaire. The study analyzed the results that were gathered from 536 university students in Tallinn University of Technology. The cross-tabulation, Chi-square, ANOVA test and Logistic Regression were used to analyze the responses.

Current study revealed that there are differences between male and female students' financial literacy, and students who studied Civil Engineering were more knowledgeable in personal finance than students in other academic disciplines.

The survey results showed that low level scores concerned topics of asset liquidity, insurance, and interest formation.

Regression analysis results suggested that students' financial literacy was mainly related to four groups of variables: Education (Academic discipline and Level of education); Demographic characteristics (Gender and Nationality); Experience (Age) and Financial Services (Current Account, Debit card and Investment Services).

The study results exhibited that Estonian students' financial literacy level was raised from a low (58.9%) (Mändmaa, 2019a, b) to a medium (67.5%) level. These results are in line with the results published by the research agency Saar Poll, that people's knowledge have improved over the previous five years and the financial literacy level of the Estonian population indicates an upward trend. (Saar Poll, 2015) A study on the same period among Portuguese students also shows a positive direction, i.e. a good level of financial literacy of students (Pires and Quelhas 2015). Contrary to these, the results of earlier studies among Turkish and US students demonstrated low levels of financial literacy (Chen and Volpe, 1998; Altintas, 2011).

Statistically significant results revealed that on average females' knowledge scores (69.1%) about personal finance were higher than males (66.5%). Previous study (Mändmaa, 2019b) among Estonian university students showed that men have a higher level of financial literacy than women. Atkinson et al. (2006), Goldsmith and Goldsmith (1997; 2006), Chen and Volpe (1998; 2002), Lusardi et al. (2010) and Monticone (2010) presented the same results. The result of the Australian students' financial literacy survey showed that gender does not affect the level of financial literacy (Wagland and Taylor, 2009), while Turkish students displayed similar results to current survey, i.e. female students had higher level (Altintas, 2011).

In current study statistically significant results of ANOVA (Table 4) showed, that older students had higher level of financial knowledge. The regression analysis (Table 8b) gave the outcome that age was influencing the students' financial literacy only in the sample of Civil Engineering department (financial literacy scores among age groups: 18-22 73.0%; 23-29 68.4%; 30 and up 73.4%). A remarkable change occurred in the level of financial literacy of the younger age group, which was significantly risen compared to the results of the previous survey (18-22 55.9%), presumably due to develops in personal financial education. Several researchers have noted earlier that the older students have higher financial literacy levels (Chen and Volpe, 1998; Atkinson et al., 2006; Mändmaa, 2019a). However, Wagland and Taylor (2009) in researching Australian students' financial literacy came to the result that age would not affect the level of financial literacy, which could be a sign of appropriate financial education.

Analyzing the effect of nationality to financial literacy, it turned out that Estonians had a higher level of financial literacy compared to non-Estonians (Table 4). The same results were obtained in financial literacy studies by Faktum and Ariko (2010), Mändmaa (2019a,b), and in PISA 2012 test (OECD, 2014). Based on the results of a survey conducted among Estonian students in 2012, it can be assumed that the reasons are lack of financial education (teaching materials) in the mother tongue. In 2012 survey, 65% of non-Estonians answered that they did not understand the demands/explanations given to them by financial institutions, and 84% of them thought that it would be helpful if the service providers spoke in clients mother tongue. (Mändmaa and Zhiguleva, 2013)

Participants' educational background had a significant impact on their financial knowledge. The results for the entire survey clearly showed that students from Civil Engineering department were more knowledgeable than students from other academic disciplines. On average, the engineering students answered correctly 71% of the survey questions while on other disciplines the score was 47% (Table 4). Mandell (2008) revealed by studying the US students that the level of financial literacy of students in scientific fields of study is high. Previous study (Mändmaa, 2019b) conducted among Estonian university students concluded that in science and mathematics-based areas the level of financial literacy was high. The highest scores got the students whose study field was Economy (females 67% and males 70%) and the Info technology came next (females 65% and males 70%). Mändmaa (2019b) reported in the same study that students studying Civil Engineering (in previous named Construction) had lowest level of financial literacy (mean score 52%; females 39% and males 56%). Current study showed the opposite results (mean score 71.5%; females 72.5% and males 70.8%). The differences could be explained first, by differences in samples, as in earlier study the educational level of respondents from the study field of Construction was lower (44% in Applied studies and 56% in Integrated i.e. previously named Combined studies). There were missing participants from Bachelor and Master Studies whose overall financial literacy scores were (overall scores: Bachelor 57.7%; Master 64.3%; Applied 57.7%; Integrated 53.7%) higher in previous study and in current study (Civil Engineering students mean scores: Bachelor 81.7%; Master 74.4%; Integrated 66.9%) as well. Secondly, the financial literacy levels could be affected positively by actively started financial education.

The results confirmed that students who used financial services had a higher level of financial literacy (Table 5). Based on earlier studies (Pires and Quelhas, 2015; Mändmaa, 2019b) available financial services have an impact on students' financial literacy level. The research among Portuguese students revealed that

the existence of prior experience, as credit clients or the existence of saving habits increases the financial literacy of individuals (Pires and Quelhas, 2015) Earlier study conducted among Estonian university students exhibited that financial services with statistically significant effect were: Debit Card, Bank loan, Investment Services and Insurance (Mändmaa, 2019b). Current study results showed that financial services with statistically significant effect were even more: Current Account, Debit Card, Housing loan, Insurance, Investment Services, Pension Fund Shares and Credit Card. Students studded in Civil Engineering department were significantly more active users of financial services than participants from other study fields (Table 4, financial literacy scores: Civil Engineering 71% and Other 47%).

Contrary to the results of various other studies that bring out the problems with debts (van Rooij et al. 2007; Reed, 2008; Lusardi and Tufano (2009), the borrowing is not very popular among Estonian students, as only 21% of participants have Credit Card, 12% Student loan, 6% Housing loan and 2% Other bank loan, and the loan users average financial literacy level is not low (respectively: 70%; 69%; 72% and 71%). The amount of loan users among students studying Civil Engineering was similar (Credit Card 22%,   Student loan 12%, Housing loan 7% and Other bank loan 2%).

Earlier studies expressed concerns in people's behavior, whether they accumulate and manage wealth effectively (Hilgert et al. 2003; Stango and Zinman, 2007) or whether they plan funding for retirement (Lusardi and Mitchell, 2006, 2009). Previous survey among Estonian students (Mändmaa, 2019b) showed that 7% of students hold the Investment Services, 25 % had Insurance services, and 56% of students have been thought about Retirement Funding. The finding of current study displayed positive movement (Table 5), as 8% of students own Investment Services, 29% Insurance services, 22% of participants owns Savings Account, and 29% owns Pension Fund Shares and the students studied the Civil Engineering showed even more activity as the 9% of students own Investment Services, 32% Insurance services,   31% owns Pension Fund Shares and 22% of participants own Savings Account.

Analyzing students' financial planning habits, the figures showed that in terms of short term planning the higher financial literacy level generally related to a longer planning period and lower financial literacy level links to very short or missing planning habit (Figure 1). The most preferable planning period for students was one months, as 39% of whole sample (41% of males and 36% of females) and 40% of participants from sample of Civil Engineering department (43% of males and 35% of females), picked that answer. Study revealed that only 5% of students planned their financial affair on several years' basis and less than 1% until retirement (was only male students' choice). The number of students', who do not saw the need to plan, was an average 6%. In previous study of university students, the statistically significant factor influencing the financial literacy level was financial affairs advance planning daily while the most popular planning period was one months and that without differences in responses of male or female students (Mändmaa, 2019b).

There are several researchers (Goldsmith and Goldsmith, 1997; Chen and Volpe, 2002) suggested that financial literacy tends to be affected by interest about financial topics. At previous study in Estonia 65% of the participants were interested. More curiosity had students with lower financial literacy level (below the median 57.14% level), Estonians, participants from youngest (18-21) age group and students studied in the field of Construction and Energetics. (Mändmaa, 2019b) In current survey the students were asked about their opinion, does their financial literacy needs improvement, i.e. do they have an interest to get additional

information about financial topics. The level of interest of male students was just 5% higher, based on fact that 79% of female students and 84% of male students reported that they have interest to improve their financial literacy. However, the results showed that the higher interest was related to higher financial literacy, and students studying Civil Engineering were interested most about personal financial topics (Table 6).

This study do not confirmed the results of previous studies (Goldsmith and Goldsmith, 1997; Chen and Volpe, 2002) that women have lower confidence in and less interest to personal finance than men do, as the results showed only small differences between females and males in self-assessment and interest. Findings about self-assessments from previous study among university students in Estonia showed that 8% of students rated their own financial knowledge to High level (in reality by responses 9%) and 32% of students assessed the knowledge to Low level (by responses 51%) (Mändmaa, 2019b). At previous research in Estonia have made the conclusion that if the self-assessment about financial knowledge is not high that means it is quite adequate (Faktum & Ariko, 2010). In current study 43% of students studying engineering and 42% of all participated students rated their financial knowledge as High while by study results the number of students whose responses exceeded the high-level border was accordingly 24% and 20%. Students who admitted their knowledge in the Low level, their amount among of students studying engineering was 7% and among all of participants 8%, while based on scores of correct answers the Low level had 12% and 26% of students, respectively. It could be concluded whereas the students' self-assessment was not quite adequate, and the knowledge was overrated as well as that Estonian students' self-confidence was risen noticeably in past years. The situation brings out concerns as too high self-confidence could lead to painful mistakes and points attention to the needs continue the surveys to improve curriculum with additional care. It is important to not let be influenced by the facts that students' financial literacy level has increased lately. There are still lots of open questions and risks.

Limits: The number of students from other faculties enrolled in this study was small, and students from the other universities were missing, which meant that comparisons were limited. For example, is the financial literacy of female students generally improving, or is it only in math-based academic disciplines? As questionnaire was anonymous, there was not possibility to contact whit respondents later and ask their needs in knowledge about Personal Finance, especially among students with lower scores.

These study results make the author to advice the educators in primary, secondary, and high schools: To pay serious attention to mathematics teaching. It would be good to add simpler mathematics courses that develop logic to university curricula as well. Mathematics based on logic certainly improves personal ability to create so-called bigger picture and make sound financial decisions – enhances financial literacy. For conclusion, there is good to point out the importance of personal financial knowledge by repeating the words of Professor Lusardi: "Financial literacy gives individuals the ability to make informed financial choices. Just as it was not possible to contribute to and thrive in an industrialized society without basic literacy - the ability to read and write - so it is not possible to successfully navigate today's world without being financially literate." (Lusardi, 2017, p. 1).

6. Acknowledgement

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Violent deaths and the path to judicialization of LGBTphobia in Brazil:

The (non) guarantee of protection of rights

Leandro Beiragrande da Costa, Yuri Bindá Leite, André Luiz Machado das Neves, Eduardo Barbosa de Menezes Guimarães

Universidade do Estado do Amazonas

Brazil

Abstract

This exploratory research was based on bibliographic and documentary sources and aimed to address the performance of the three branches regarding the criminalization of LGBTphobia. These people are stigmatized because of their sexual orientation and gender identity, since they differ from the heteronormativity still prevailing in society, which has led them to suffer more and more different types of violence, including physical, sexual, emotional, and psychological aggressions, to which they are constantly subjected. The lack of official data, beforehand, shows the real neglect of the public authority towards the rights and guarantees of this minority, in addition to the lack of effective public policies and non-investigation and non-judgment of crimes commonly poignant, which reveal true state violence. It was found that few actions by the executive branch go beyond the planning stage and that the endless discussions by the legislative can be described as true inertia, resulting in numerous quarrels in the judiciary branch, in which the LGBT community has achieved progress in denouncing human rights violations and in the relentless search for overcoming discrimination.

Keywords: Gender. Violence. Sexuality. Judicialization.

1. Introduction

The Inter-American Commission on Human Rights (IACHR), when addressing violence against lesbian, gay, bisexual, transvestite and transgender people (LGBT), stated that "a person's sexual orientation is independent of the sex assigned to him/her at birth and independent of his/her gender identity" (IACHR, 2015, p. 31). The Commission also validated the following definitions addressed in the Yogyakarta Principles, which are a set of principles that guide the application of the international human rights law regarding sexual orientation and gender identity:

> **Sexual orientation** is defined as "the ability of each person to feel a deeply emotional, affective, and sexual attraction to people of a different gender, or of the same gender, or more than one gender, as well as the ability to maintain intimate and sexual relationships with these people". (...) **gender identity** is "the internal and individual experience of gender as deeply felt by each person, which may or may not correspond to the sex assigned at birth, including the personal experience of the body (which may involve changes in body

appearance or function through medical, surgical or other means, as long as this is decided by the person) and other gender expressions, including dress, way of speaking, and conduct" (IACHR, 2015, p. 32 – **boldface added**).

However, although sexual diversity is recognized in official documents, it is observed that cultural, social, and historical aspects make the free expression of sexuality and gender unfeasible.

Borrilo (2010) mentions that the division of genders (male/female) and sexual desire (hetero/homo) serve to reproduce the social order based on a model of sexist (subordination between sexes) and heterosexist (hierarchy of sexualities) normality, and homophobia has the power to protect these borders. For this reason, homosexuals are no longer the only victims of homophobic violence, as it also affects people who perform genders seen as deviant.

This violence can be seen from the report data of the Gay Group of Bahia (GGB), which shows that 329 LGBT people were victims of violent deaths in Brazil, in 2019, accounting for 174 gays (52.8%), 118 transvestites and transsexuals (35.8%), 32 lesbians (9.7%). and 5 bisexuals (1.5%) (GGB, 2019).

Therefore, homophobia can be defined as a set of prejudiced, discriminatory and violent actions, based on hatred, justified by "fear, aversion, or irrational hatred towards homosexuals, and, by extension, towards all those who manifest sexual orientation or gender identity different from heteronormative patterns" (ABGLT, 2015, p. 21).

Among the characteristics of violence against LGBT people, the IACHR (2015, p. 37-40) points out the aggressor's desire to punish people who have attitudes he/she considers as deviant from the 'traditional' ones, aiming at 'public moral' maintenance. This can be observed from the following aspects: (1) the vulnerability of transsexual and transvestite women, who are excluded early from social life and, in their majority, murdered before 35 years old; (2) subjection to cruel and inhuman treatment, typical of torture, which 'punishes' through acts of sexual violence and seeks to dehumanize the victim; (3) violence resulting from hints of a sexual nature, which, in a heterosexual environment, would be acceptable as flirtation, but for the homosexual reality causes disgust that justifies the 'gay or trans panic' action; (4) categorization of violence as a way to promote 'social cleansing'; and (5) in certain contexts, acts of discrimination or violence motivated by prejudice toward LGBT people are related to the perception of the person by the aggressor.

Faced with this panorama, this study aimed to demonstrate the absence of the state, both concerning the recognition of these rights holders and the incipience of inclusive public policies in making perpetrators responsible for acts of discrimination, hatred speeches, and crimes against life.

2. The confrontation of violence against the LGBT population and the actions of the three branches

2.1 National Human Rights Program of the federal government

There were two World Conferences on Human Rights. The first one was held in Tehran, Iran, in 1968, with the participation of 68 countries, and the second one in Vienna, Austria, accounting for 171 countries. According to Cançado Trindade,

Both represent, in addition to global assessments of the matter evolution, decisive steps in the construction of a universal culture of human rights. The Tehran Conference resulted in the strengthening of the universality of human rights, especially by the emphatic assertion of their indivisibility. After the Vienna Conference, it was recognized that the subject under consideration concerns all human beings and permeates all spheres of human activity (CANÇADO TRINDADE, 1997, p. 178).

Nevertheless, it was at the second Conference that was expressly recommended (item 71 of the Vienna Declaration and Program of Action) the elaboration of a national action plan, "identifying measures, through which the State in question can better promote and protect the human rights" (ONU, 1993).

In this sense, on May 13, 1996, under President Fernando Henrique Cardoso, the Federal Government instituted the National Human Rights Program (PNDH), which affirms (Art. 1) that it is a "diagnosis of the situation of these rights in the country and measures for their defense and promotion, as in the Annex to this Decree" (BRASIL, 1996). However, discrimination based on sexual orientation was mentioned on only one occasion when dealing with a forecast, in the section on the "Proposals for Government Actions", specifically regarding "Human Rights, everybody's Rights", for the government to propose legislation prohibiting all types of discrimination and revoking existing discriminatory rules, in a short term (BRASIL, 1996, p. 20).

Six years later, in the last biennium of his second term, FHC launched a revised and improved version of the program, known as PNDH-2 (BRASIL, 2002), which included several recommendations from the IV National Conference on Human Rights, showing greater concern over LGBT people, after protests in relation to the previous version, regarding sexual orientation, equality, awareness, health, and work:

> 114. **Propose an amendment to the Federal Constitution to include the guarantee of the right to free sexual orientation and the prohibition of discrimination based on sexual orientation.** 115. Support the regulation of registered civil partnership between people of the same sex and the regulation of sex reassignment law and change of civil registration for transsexuals. 116. **Propose the penal legislation improvement regarding discrimination and violence motivated by sexual orientation.** 117. Exclude the term 'pederasty' from the Military Penal Code. **118. Include in the demographic censuses and official surveys data related to sexual orientation** (BRASIL, 2002, p. 8, **boldface added**).

The PNDH-3, published on December 21, 2009, in the penultimate year of the President Luiz Inácio Lula da Silva's second term, deepened and expanded the range of rights, in response to the numerous suggestions arising from popular participation in fifty Thematic Conferences held since 2003 (food security, education, health, racial equality, rights of women, children and adolescents, housing, environment, etc.) and to the conclusions of the XI National Conference on Human Rights (held in December 2008), preceded by an extensive consultative process through previous conferences ("Free

Conferences") and state and district conferences, which elected 1,200 delegates and nominated 800 observers and guests (Adorno, 2010, p. 13).

Much more detailed than the previous ones, the latter PNDH is structured in six guiding axes, subdivided into 25 guidelines, 82 strategic objectives, and 521 programmatic actions. With regard to the rights of the LGBT population, it was the most effective, although these rights have been distributed throughout the plan, the "Guideline 10: Guarantee of equality in diversity", "Guiding axes II: Development and Human Rights", and "Strategic objective V: Guarantee of respect for free sexual orientation and gender identity" stands out, comprising several actions, such as:

> a) Develop affirmative policies, which may promote a **culture of respect for free sexual orientation and gender identity**, favoring visibility, and social recognition. (...) d) Recognize and include in the public service information systems all family configurations constituted by lesbians, gays, bisexuals, transvestites, and transsexuals, based on the **deconstruction of heteronormativity**. (...) h) **Make a periodic monitoring report** on policies against discrimination toward the LGBT population, which includes, among other aspects, information on inclusion in the labor market, full-time health care, number of registered and investigated violations, recurrences of violations, and population, income, and marital data. (BRAZIL, 2009b, **boldface added**).

In this brief contextualization, it is observed that, over time, social mobilization, especially by organizations that felt excluded, contributed greatly to the improvement of programs that ensure (at least provided for in legislation) human rights.

However, it is worth mentioning that President Jair Messias Bolsonaro, at the end of his first year in office, revoked several decrees, wholly or partially, through Decree No. 10,087, of November 5, 2019, including Article 4 of the PNDH-3, which dealt with the plan's Monitoring Committee. This fact generated immediate national repercussion, leading the National Human Rights Council to issue Recommendation No. 27, of December 11, 2019, in order to request the readjustment of the Federal Government to the PNDH-3, the recreation of the Committee, support for the activities of human rights bodies, among other recommendations.

2.2. The criminalization of LGBTphobia in the National Congress: attempts to judicialize violence against LGBT

To address the legislative scenario regarding the criminalization of LGBTphobia, it is necessary to make a brief analysis of Bill No. 5003/2001, presented on August 7, 2001, by Federal Deputy Iara Bernardi (PT/SP), whose central objective was to determine "sanctions against discriminatory practices based on people's sexual orientation", as established in the syllabus.

On April 26, 2005, the then rapporteur Federal Deputy Luciano Zica (PT/SP) issued his opinion in the Justice and Citizenship Constitution Commission (CCJC), not only on the project in question but also on five others that were attached to it during its processing, as they deal with correlated matters, as shown in Table 1:

No. Bill (Date) – Author	Objective
Bill 5/2003 (2/18/2003) Iara Bernardi - PT/SP	Amends Law No. 7,716/89 and the Penal Code (art. 140, paragraph 3) to include punishment for discrimination or prejudice based on gender and sexual orientation
Bill 381/2003 (3/18/2003) Maurício Rabelo - Bill/TO	Amends Law No. 7,716/89 to include discrimination involving culture or cultural values as subject to legal punishment.
Bill 3143/2004 (3/16/2004) Laura Carneiro - PFL/RJ	Amends Law No. 7,716/89 to include crimes resulting from prejudice based on sex or sexual orientation.
Bill 3770/2004 (6/9/2004) Eduardo Valverde - PT/RO	Amends Law No. 8,213/91, 9,029/95, and 10,406/02 to promote and recognize sexual freedom of orientation, practice, manifestation, identity, and preference.
Bill 4243/2004 (10/7/2004) Edson Duarte - PV/BA	Amends Law No. 7,716/1989 to include the crime resulting from prejudice or discrimination based on sexual orientation.

Table 1 - Law projects attached to Bill No 5003/2001

In his opinion, the above-mentioned rapporteur rejected Bill No. 381/2003, considering the inclusion of punishment for discrimination as of difficult penal typification because of the culture as being a new criminal type, and Bill No 4243/2004, which sought to make non-bailable crimes resulting from discrimination or prejudice against race, color, ethnicity, religion, national origin, and sexual orientation.

On the other hand, Bill No. 5003/2001 and those annexed to it (Bill 3770/2004, Bill 0005/2003, and Bill 3143/2004) were approved by the rapporteur, on the merits, since he understood it was fully possible to assimilate their purposes.

The Bill in question went through five years and four months in the Chamber of Deputies when its substitute was sent to the Federal Senate on December 7, 2006.

In the Federal Senate, Bill 5003/2001 was renumbered to Chamber's Bill No. 122/2006, whose rapporteur was Senator Fátima Cleide (PT/RO). This Bill was submitted to seven public audiences until being submitted to be analyzed by the Social Affairs Commission (CAS), in which, after seven other instruction audiences, had a favorable opinion, on November 10, 2009.

The approved Bill maintains the "criminalization of homophobia (sexual orientation and gender identity) and male chauvinism (gender and sex)", "typifies discrimination and prejudice against the condition of elderly or disabled people as a crime", and replaces the term *national provenance* with *origin*, so that, "in addition to criminalizing xenophobia, this proposition meets the demands of various internal segments, such as those that are discriminated against because of their northeastern origin, for example" (BRASIL, 2009a, p. 12).

On December 10, 2013, after five more public hearings in the Commission on Human Rights and Participatory Legislation (CDH), the rapporteur, Senator Paulo Paim (PT/RS), presented the third substitute for Chamber's Bill 122/2006, which was never approved, in order to meet desires of religious groups:

> We also expanded expressions to resolve fears associated with offensive attitudes towards religious spaces, so that not only temples but also religious events are protected and may

> reject practices with which they have a doctrinal disagreement. (...) he met the request of religious sectors so that homophobia controversy could be avoided. (...) we combined in a single Law all kinds of prejudice so that no one could say we had made a special Law for sexual orientation, i.e., all those discriminated against will be met (BRASIL, 2013, p. 4-7).

After heated discussions in public audiences and commission sessions, as well as the presentation of several amendments to the text, the project ended up being automatically archived at the end of the 54th Legislature, under the terms of §1, Art. 332 of the Internal Rules of the Federal Senate, on December 26, 2014, since it had been in process for two legislatures, i.e., after eight years of processing in that legislative chamber.

In short, the National Congress discussed the matter for more than thirteen years, holding nineteen public audiences, and, after hearing all sectors of society, archived the Chamber's Bill No. 122/2006.

Senator Weverton (PDT/MA) performed a new attempt to criminalize discrimination and prejudice related to gender identity or sexual orientation, through Bill No. 672/2019, on February 12, 2019, curiously the day before the Federal Supreme Court has definitively and jointly analyzed the Injunction Order (IO) No. 4733/DF and Direct Unconstitutionality Action for Omission (DUAO) No. 26.

2.3 Criminalization of homotransphobia in the Supreme Court: judicial approval of violence against LGBT

The Collective Injunction Warrant No. 4733 was filed on May 10, 2012, by the Brazilian Association of Gays, Lesbians, and Transgenders - ABGLT, seeking

> to obtain specific criminalization of all forms of homophobia and transphobia, especially (but not exclusively) offenses (individual and collective), homicides, aggressions, and discrimination based on sexual orientation and/or gender identity, real or supposed, of the victim, because this (specific criminalization) is an assumption inherent to the citizenship of the LGBT population today (BRASIL, 2013d, p. 1).

Urged to provide information, the Federal Senate (FS), the Chamber of Deputies (CD), the Federal General Advocacy (FGA), and the Attorney General's Office (AGO) have expressed, in short, that: (1) the judicial way chosen was not appropriate, as there is no prejudice to the exercise of the right, which is a requirement determined in Art. 5, item LXXI, of the Federal Constitution, since the crimes committed due to sexual orientation would already be covered by the existing criminal typifications; (2) it did not deal with normative omission, given that Bill No. 122/2006 was already under discussion in the Federal Senate; and (3) what was intended was the edition of a specific criminal norm that, in respect to the principle of the legal reserve (Art. 22, I, FC), the Supreme Federal Court should not regulate it, even if provisionally.

On October 23, 2013, the then rapporteur, Minister Ricardo Lewandowski, issued a Monocratic Decision without knowing the injunction order, with the extinction of the fact without judgment on the merits, and Regimental Appeal was interposed by the interested party, on November 1, 2013.

As a new manifestation was required, the AGO changed its initial position, on July 25, 2014, to say that,

> With regard to the merits of the question, homophobia and transphobia constitute a **serious violation of fundamental rights, to which urgent and emphatic response is required by Criminal Law.** To that extent, it is not possible to prevent the collegiate examination from a question of constitutional basis and with enormous social relevance and topicality. The regulatory appeal deserves to be provided. There is a clear absence of a regulatory norm (...). **Discrimination and prejudice** against lesbians, gays, bisexuals, transvestites, and transsexuals particularly affects certain people and groups, which **taint the principle of equality, and involves a special situation of serious** physical, psychological and social **vulnerability**, for violating the right to security, this principle consists of important citizenship prerogatives (BRASIL, 2014, p. 4, boldface added).

Minister Edson Fachin was appointed to be the new rapporteur, on June 16, 2015, and, on June 14, 2016, he reconsidered the monocratic decision to comply with the injunction order in the case in question. The AGO, in turn, reiterated its last opinion, on September 13, 2016.

After analyzing the admission of entities such as *amicus curiae*, the eminent rapporteur dismissed Eduardo Banks Association and admitted the Dignity Group for the citizenship of gays, lesbians, and transgenders, on September 26, 2016, and later admitted the Federal Council of Psychology, on October 3, 2016, as well as the Brazilian Institute of Family Law - IBDFAM, on October 31, 2018.

On November 12, 2018, the above-mentioned rapporteur decided to postpone the trial, which was scheduled for two days later, at the request of the plaintiff, which was approved in Plenary, on February 13, 2019, since it was wanted a joint assessment with the Direct Unconstitutionality Action by Omission No. 26, scheduled for June 13, 2019.

The rapporteur, Minister Edson Fachin, in his vote, considers MI 4733 as valid, recognizes the unconstitutional delay of the legislative branch and applies Law 7716/89 with prospective effects until the National Congress legislated on it. Among the allegations, it was highlighted the moment he mentioned that

> **Sexuality is a dimension inherent to the dignity of the human person.** (...) Thus, even if it involves criminal matters, it is not possible to claim that the injunction should be limited to the mere recognition of the delay. (...) In other words, equality is demanding us, as interpreters of the Constitution, **to recognize the equal offensiveness of discriminatory treatment**, either to dispel the claim that Jews would not be victims of racism or to tolerate the apology to the hatred and discrimination derived from the free expression of sexuality (BRASIL, 2019d, p. 24-26, boldface added).

The decision made by the Plenary followed, by the majority, the terms of the rapporteur, "defeating, to a lesser extent, Ministers Ricardo Lewandowski and Dias Toffoli (President), and Minister Marco Aurélio, who considered the mandatory approach inadequate." (BRASIL, 2019c).

Another action, the Direct Action of Unconstitutionality for Omission (DAUO) in question, was requested by the Popular Socialist Party (PPS), on December 19, 2013, through its lawyer, Mr. Paulo Roberto Iotti Vecchiatti (OAB/SP No. 242.668) who, in ninety-eight pages, supports the following thesis, as mentioned at the beginning of the petition itself:

> [We have here] pure and simple **institutional ill will of the Brazilian Parliament** toward the specific criminalization, in order to make evident the unconstitutional delay of the Legislative in this specific case and to make it equally evident, even if this requires the action of this Court in in its **counter-majoritarian function** imposing on the National Congress the specific criminalization of *offenses (individual and collective), aggression and discrimination based on sexual orientation and/or gender identity, real or supposed, of the victim* to ensure that **citizenship** is not made physically unfeasible and/or not made unfeasible the **fundamental rights** to security (efficient protection) and free sexual orientation and free gender identity, since we have here typical **oppression of the minority by the despotism of the majority** in the parliament that refuses to implement this absolutely **necessary and mandatory** specific criminalization, resulting from constitutional imposition [in order: Art. 5, XLI, XLII, or LIV – prohibition of deficient protection]. (BRASIL, 2013c, p. 1, boldface added)

On December 19, 2013, the process was submitted to the rapporteur, Minister Celso de Mello, who was responsible for analyzing several applications for admission of institutions such as *amicus curiae* throughout the process, rejecting only the Eduardo Banks Association, on May 27, 2014, and accepting many others, as observed below.

- The Gay Group of Bahia (GGB), the Brazilian Association of Lesbians, Gays, Bisexuals, Transvestites and Transsexuals (ABGLT), and the Group of Lawyers for Sexual Diversity (GADvS), on February 9, 2015.
- The National Association of Evangelical Jurists (ANAJURE), on March 5, 2015, the "Mixed" Parliamentary Front for Family and Support to Life, on September 16, 2015.;
- The Dignity Group for Citizenship of Gays, Lesbians, and Transgenders, on November 23, 2015;
- The Brazilian Convention of Evangelical Churches "Irmãos Menonitas" (COBIM), on February 17, 2016;
- The Federal Council of Psychology and the Unified Socialist Workers' Party (PSTU), on August 5, 2016;
- The National Association of Transvestites and Transsexuals (ANTRA), on September 25, 2017;

- The Public Defender's Office of the Federal District, on October 29, 2018.

The FS and the CD offered answers, respectively, on November 6 and 12, 2014, in which the latter legislative chamber presented a statement of only two paragraphs, limiting itself to saying that Bill No. 5.003/2001 was approved and forwarded to another chamber. On the other hand, the FS limited itself to address the non-necessity to create a new criminal type to criminalize LGBTphobia, as the crimes against this population would already be covered by Criminal Law. Such pieces were strongly rejected by the plaintiff, on January 13, 2015.

The AGO manifested itself for the validity of the request, on June 15, 2015, and, after the manifestation of several *amicus curiae*, on November 19, 2018, it determined the request inclusion on the agenda together with MI 4733/DF, and the trial was scheduled for February 13, 2019.

The rapporteur, Minister Celso de Mello, in his extensive vote, considered the DAUO 26 as valid, with general effectiveness and binding effect, and recognized the delay of the legislative when declaring the existence of unconstitutional normative omission, applying with prospective effects Law 7,716/89 until that the National Congress legislated in this respect, highlighting the item

> (d) interpreting according to the Constitution, because of the constitutional incrimination warrants registered in items XLI and XLII of Art. 5 of the Political Charter, **to classify homophobia and transphobia, whatever their form of manifestation, into the different criminal types defined in Law No. 7,716/89, until autonomous legislation, edited by the National Congress**, befalls due to considering, in the terms of this vote, that homotransphobic practices are qualified as a kind of racism, in the dimension of social racism enshrined by the Supreme Federal Court in the plenary trial of HC 82.424/RS (Ellwanger case), as such **behaviors matter in acts of segregation that make members of the LGBT group inferior,** due to their sexual orientation or gender identity, and also because such behaviors of homotransphobia fit the concept of acts of discrimination and offense toward fundamental rights and freedoms of those who included in the vulnerable group in question; (BRASIL, 2019b, p. 154-155, boldface added).

The Plenary Decision, on June 13, 2019, followed by the majority the terms of the rapporteur, defeating "Ministers Ricardo Lewandowski and Dias Toffoli (Presidente), who judged the action as partially valid, and Minister Marco Aurélio, who judged it as unfounded" (BRASIL, 2019a). The following thesis was established, also by the majority, since Minister Marco Aurélio did not subscribe to it, and Ministers Roberto Barroso and Alexandre de Moraes did not justifiably participate:

> 1. Until there is a law issued by the National Congress designed to implement the criminalization warrants defined in items XLI and XLII, Art. 5, of the Constitution of the Republic, **homophobic and transphobic behaviors**, real or supposed, which involve hateful aversion to someone's sexual orientation or gender identity, **as they refer to expressions of racism, understood in its social dimension, they fit by the identity of**

reason and through typical adaptation, to the primary incrimination precepts defined in Law No. 7,716, of January 8, 1989, also constituting, in the hypothesis of intentional homicide, a circumstance that qualifies it, for configuring a nasty motive (Penal Code, Art. 121, § 2, I, "in fine");

2. The criminal repression against the practice of **homotransphobia does not reach, restrict or limit the exercise of religious freedom**, whatever the professed confessional denomination, ensuring its faithful and ministers (priests, pastors, rabbis, mullahs or Muslim clergy, and leaders or celebrants of Afro-Brazilian religions, among others) the right to preach and publicize, freely, by word, image or any other means, their thoughts and to express their convictions according to what is contained in their books and sacred codes, as well as teaching according to their doctrinal and/or theological orientation, being able to seek and win proselytes and practice acts of worship and the respective liturgy, regardless of the space, public or private, of their individual or collective performance, **as long as such manifestations do not constitute hate speech, such as those externalizations that incite discrimination, hostility or violence against people because of their sexual orientation or gender identity;**

3. **The concept of racism** understood in its social dimension, projects itself beyond strictly biological or phenotypic aspects, as it **results, as a manifestation of power, from the construction of a historical-cultural nature based on the objective of justifying inequality** and intended for ideological control, political domination, social subjugation, and denial of alterity, dignity, and humanity of those who, because they belong to a vulnerable group (LGBTI+) and do not belong to the state that holds a position of hegemony in a given social structure, are considered strange and different, degraded to the condition of marginals of the legal system, and are exposed, as a result of hateful inferiority and perverse stigmatization, to an unjust and harmful situation of exclusion from the general system of right protection, overruled by Minister Marco Aurélio, who did not subscribe to the proposed thesis (BRASIL, 2019a, p. 1-2, boldface added).

Faced with the silence of the legislators, the judges decided to equate crimes of homophobia and transphobia with racism crime, inscribed in Law No. 7716/1989, thus generating questions regarding the violation of the principles of legality, legal reserve, and separation of branches, since, for many scholars, the Judiciary, whose primary function is to apply the laws and give them the best interpretation, ended up innovating in criminal matters, without the necessary procedure.

The purpose of this article is not to justified or reject the validity of the decision issued by the Supreme Court, but cite juridical uproar demonstrates the complexity of the theme related to the criminalization of homotransphobia, so that, one year after the controversial decision to declare the legislative omission and supply it, the Congress has not yet legislated on it.

3. The (non) guarantee of protection of rights for LGBT people in Brazil

In this section, an effort will be made to expand the discussion on the effects of the judicialization of violence against LGBT, divided into two subsections. The first one named "theory" and the second one "practice".

3.1 In "theory": the existing legal and judicial protection

A recent study, published by the International Association of Lesbians, Gays, Bisexuals, Trans and Intersex (ILGA) (MENDOS, 2019, p. 237), indicates that nine member countries of the United Nations (5%), contain in their Constitutions expressed clauses for protection against discrimination based on sexual orientation, among them only Bolivia (Art. 14, II) and Ecuador (Art. 11, II) in South America. In addition to these countries, the list also includes South Africa (Africa), Mexico (Central America), Nepal (Asia), Malta, Portugal and Sweden (Europe), and Fiji (Oceania).

With regard to legal protections, protection against discrimination in the workplace, criminal liability for crimes motivated by the victim's sexual orientation and the prohibition of hate speech, violence or discrimination based on sexual orientation, the number of members of the UN and its percentage, concerning the total, are fifty-two (27%), seventy-four (38%), forty-two (22%), and thirty-nine (20%), respectively (MENDOS, 2019, p. 241, 251, 265, 271).

It is noteworthy that Brazil, in none of these points mentioned, appears as a country that ensures and/or protects the rights of the LGBT population. However, although there is no protection in Federal law, six states have, in their Constitutions, an explicit prohibition for this type of discrimination: Alagoas (art. 2.1; 2001), Federal District (art. 2.5; 1993), Mato Grosso (art. 10.3; 1989), Pará (art. 3.4; 2007), Santa Catarina (art. 4.4; 2002), and Sergipe (art. 3.2; 1989). Moreover, about 70% of the Brazilian population lives in jurisdictions where local laws provide for some level of protection and administrative penalties against discrimination based on sexual orientation (MENDOS, 2019, p. 238, 242), such as in the case of Amazonas State, where Law No. 3079, of August 2, 2006, provides for the combat of discrimination based on sexual orientation, the application of the resulting penalties, and other measures.

Furthermore, Resolution No. 001/99, of March 22, 1999, of the Federal Council of Psychology, forbids (art. 3) its professionals to favor the pathologization of homoerotic behaviors or practices or coerce their clients into unrequested treatments. This normative act resisted when tested in Complaint No. 31,818/DF, "filed by the Federal Council of Psychology (CFP), on September 12, 2018, against a decision by the 14th Federal Court of the Judicial Section of the Federal District, which, when declaring the sentence in popular action No. 1011189-79.2017.4.01.3400" (BRASIL, 2019e, p. 2). In this action, on December 6, 2019, the rapporteur, Minister Carmen Lúcia, decided,

> The popular action No. 1011189-79.2017.4.01.3400 consists of **a true direct action of unconstitutionality filed in a feigned manner in an incompetent court**. It is not even a case of calling back a popular action for judgment in this Supreme Court since there is **no legitimacy of popular authors** to bring a direct action of unconstitutionality. (...) I consider valid the claim to **revoke the claimed decision** and to determine the completion

and filing of the popular action when aggrieved the interlocutory appeal filed against the preliminary decision (BRASIL, 2019e, p. 19, boldface added).

Regarding the recognition of rights to the LGBT population, there is a significant role of the Brazilian Judiciary branch, confirming what Rifiotis (2015, p. 266) conceptualizes as judicialization of social relationships "the processes that are made visible through the expansion of the State action in areas of "social problems" as a mechanism for guaranteeing and promoting rights". Some cases are presented:

- Special Resource Superior Justice Tribunal (SJT) No. 889,852/RS [Minister-Rapporteur Luis Felipe Salomão] – Decision made on March 27, 2010: examined the specific case of the adoption of children by a partner who lived in same-sex union with another who had already adopted the same children. "The matter regarding the possibility of adopting minors by homosexual couples is necessarily linked to the need to verify what is the best solution for the protection of children's rights, as they are inseparable issues. (BRASIL, 2010, p. 1-2).
- Direct Action of Unconstitutionality No. 4277/DF (judged with ADPF No. 132/RJ) [Minister Ayres Brito] – Decision made on May 5, 2011: same rules and consequences for hetero and homoaffective stable union, with effective erga omnes and binding effect. "Family as a private institution that, voluntarily constituted of adults, maintains a necessary trichotomic relationship with the State and civil society. (...) equal subjective right to the formation of an autonomized family (BRASIL, 2011, p. 268).
- Resolution No. 175/2013 [National Council of Justice] – published on May 14, 2013: same-sex civil marriage. "Art. 1º - The competent authorities are forbidden to prohibit the qualification, celebration of civil marriage, or the conversion of the stable union into marriage, between people of the same sex" (BRASIL, 2013b).
- Extraordinary Resource SJT No. 846,102/PR [Minister-Rapporteur Cármen Lúcia] – Decision made on May 5, 2015: adoption by same-sex couples. "If same-sex unions are already recognized as a family entity, originating from an affective bond, deserving legal protection, there is no reason to limit adoption, creating obstacles does not provide for by the Law (BRASIL, 2015, p. 156-157).
- Direct Action of Unconstitutionality No. 4275/DF [Minister Marco Aurélio] – Decision made March 1, 2018: constitutes a fundamental subjective right to change the first name and gender classification in the civil registry of transgender people who declare themselves in this manner, in writing, "through administrative or judicial means, regardless of surgical procedure and third party reports, as this is a matter related to the fundamental right to the free development of personality." (BRASIL, 2018, p. 2).

The Brazilian Judiciary branch has become a kind of protector of the rights of those who, for having sex and gender different from the standard traditionally imposed and reproduced, are left at the margins of society, exposed to barbaric, atrocious and inhuman acts. Therefore, if these are inhumane acts, they affect the basis of all constitutional rights, the human dignity principle, thus legitimizing the Supreme

Court' role, which is the guardian and ensurer of the 1988 constitution, agreeing with the Inter-American Commission on Human Rights, which

> (...) considers that the recognition of the LGBTI people's rights is a fundamental factor to achieve equality, dignity, and non-discrimination, as well as to combat the violence against these people, aiming at building or reaching a more just society. (IACHR, 2018, p. 34, our translation).

3.2 In "practice": the alarming numbers of violence

The lack of official data, in itself, already constitutes a disregard for the affirmative policies of the LGBT population, disposed of by the PNUD (see section 2.1), and justifies the deficiencies in the protection of their rights, as addressed by the Inter-American Commission on Human Rights:

> 43. In the IACHR's opinion, the lack of effectiveness of several measures taken for States is mainly related to deficiencies in their conception, development, and implementation, as well as the lack of effective mechanisms for evaluation. This is because states do not have reliable qualitative and quantitative information that reflects the true dimension of discrimination suffered by LGBTI people in the hemisphere. (IACHR, 2018, p. 35, our translation).

The only data available on the official website of the Ministry of Women, Family and Human Rights, on violence against LGBT people, are based on complaints made by Dial 100 (Human Rights phone number). From the data obtained from complaints about violations to vulnerable groups (Table 2), it was possible to verify that the type of violation, related to institutional, physical, psychological and sexual violence, corresponded to 55% of complaints made on Dial 100, from 2011 to 2019. In addition, it is worth mentioning that, in this period, it was recorded the highest percentage (61%), in comparison with the total number of complaints (MMFDH, 2019, 2020).

Violation Type	2011	2012	2013	2014	2015	2016	2017	2018	2019	Period
Total "violence"	1431	3692	1992	1156	1243	1354	1656	1495	948	14967
Grand Total	2353	6136	3398	2143	2964	2907	2998	2879	1565	27343
LGBT Percentage	61%	60%	59%	54%	42%	47%	55%	52%	61%	55%

Table 1 – Denunciations of violence on Dial 100 and their representativeness compared to the total, per year.

Given the lack of official data, the Gay Group of Bahia (GGB) has an important role to fill this gap, since it publishes annually (under the coordination of Dr. Luiz Mott, its founder) reports of deaths of

homosexuals, based on news published by the media, information from victims' relatives and police records.

Figure 1 shows a comparative graph of violent deaths of LGBT, between 2011 and 2019, revealing a predominance of deaths of Gays, followed by Trans (GGB, 2011-2019).
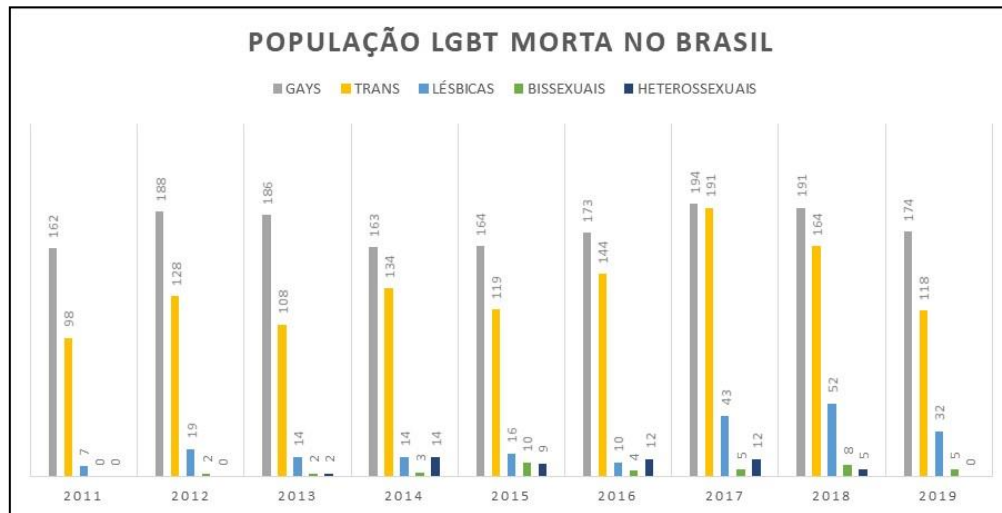

Figure 1 – Comparative graph of deaths of LGBT, per category, between 2011 and 2019

Table 3 shows that 2017 was the most lethal year for the group in question (445 deaths), followed by 2018 (420 deaths), and 2016 (343 deaths). During nine years, there were three thousand and ninety-nine violent deaths, resulting in an average of one violent death every 25 hours.

	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**TOTAL**
Crime/h	33	26	28	27	28	26	20	21	27	25
TOTAL	267	337	312	328	318	343	445	420	329	3099

Table 2 – Total death comparison and the crime/hour ratio, between 2011 and 2019

Regarding the decrease in the last two years, the 2019 Report shows there is not much to celebrate, because despite

> It is not the first time that in this historical series there has been a decrease in the number of deaths from one year to the next, with no reasonable forecast or sociological explanation. (...) [a] every 26 hours an LGBT+ is murdered or commits suicide as a victim of LGBTphobia, which indicates Brazil as the world champion in crimes against sexual minorities. According to international human rights agencies, far more homosexuals and transsexuals are killed in Brazil than in the 13 countries in the East and Africa, where there is the death penalty for such crime. (...) [It should also be noted] that the number of such deaths has increased uncontrollably in the last two decades: from 130 homicides on average, in 2000, to 260, in 2010, increasing to 398 in the last three years (GGB, 2019, p. 12-14).

4. Conclusion

This documentary research revealed that the executive branch when there was an apparently more "progressive" federal administration, at least formally, developed processes for the constitution of LGBT people as subjects of rights in Brazil. However, such purposes are not effective in practice, given the lack of specific public policies, since the LGBT agenda, since 2014, has been "emptied" in the last federal governments.

For its part, the legislative branch remained inert and silent even after thirteen years of dealing with the issue in both legislatures, refusing to answer to society in the face of the three thousand and ninety-nine murders, from 2001 to 2019. It is not the case of encouraging the proliferation of ineffective laws; however, a position was expected to guide a new path for the treatment of inequalities due to gender and sex, in the same way as it was performed for femicide. By keeping silent, the legislative branch consented to the violent deaths suffered by the LGBT population, or to the suicide of many who are unable to live with their internal and social conflicts. This issue, i.e., suicide among gays, lesbians, bisexuals and transsexual people, deserves a separate study, as it accounts for a significant number of deaths among young people.

It is worth mentioning that there was no easy way in the Judiciary, in which there were major discussions by sectors of society directly conflicting on the matter; however, unlike Congress, it manifested itself. This occurred in an affirmative sense to meet the desires of those who were interested in criminalizing LGBTphobic behaviors, as they involve hateful aversion to sexual orientation or the identity of someone who differs from heteronormativity, and because they correspond to expressions of racism in its social dimension.

In this sense, this paper was written, seeking to understand at what point the judicialization of social relationships can influence the decrease in the alarming numbers of violent LGBT deaths. Nevertheless, it was observed that the performance of the Judiciary, questioned by some people as exorbitant in their competences, is, in fact, the *ultimate ratio* for those who are trapped by the immobility of the Legislative and Executive branches in their main constitutional roles, which (does not) acting in this way, perpetuate numerous human rights violations.

Thus, it was concluded that the effort by LGBT movements, to criminalize acts of violence against people with any sexual orientation and/or gender identity, reveals the intention to give effectiveness to the fulfillment of their rights, since there is no progress in their recognition as subjects of right in other sectors of society, such as in education, which was involved by a dispute between religion and science.

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Innovation, intellectual property and technological transfer by inventors in Brazil

Carlos Tadeu Santana Tatum *(corresponding author)*

Federal University of Sergipe • Intellectual Property Science Program

tadeutatum@gmail.com • https://orcid.org/0000-0001-6822-3217

Suzana Leitão Russo

Federal University of Sergipe • Intellectual Property Science Program

Suzana.ufs@hotmail.com • http://orcid.org/0000-0001-9810-274X

Jonas Pedro Fabris

Federal University of Sergipe • Intellectual Property Science Program

jpfabris@hotmail.com

Maria Emília Camargo

Federal University of Sergipe • Intellectual Property Science Program

mariaemiliappga@gmail.com • http://orcid.org/0000-0002-3800-2832

Luis Felipe Dias Lopes

Federal University of Santa Maria • Administrative Sciences Department

lflopes67@yahoo.com.br • https://orcid.org/0000-0002-2438-0226

ABSTRACT

Innovation can be understood as a technological asset in relation to the protection of knowledge with regard to intellectual property, and a challenge for universities and companies regarding the transfer of technology, since there are numerous variables that influence even full monetization. It is important to reflect on all the energy expended in relation to the authors involved in this process, having as general aim to analyze the perception of researchers about the processes of protection of intellectual property and its security mechanisms, characteristics of innovation and technology transfer. A structured research was used as a methodology, using the survey method, applied to specialists, with hypotheses formulated, based on the literature review. The results mainly understand that there is a moderate correlation index in quantitative terms of graduate programs and number of patents, by region of Brazil, an awareness in agreement with the elements of protection of intellectual property. In global efforts among researchers, universities and companies, only about 5% of patents have reached the level of royalty generation, demonstrating that the other 95% are still available for potential exploitation for society.

Keywords: Technology, Triple-Helix, Patent.

o **Introduction**

Innovation is a process that involves the use, application and transformation of technical-scientific knowledge related to the production and commercialization of products or services with profit vision (HAUSER *et al.*,2015), and can be applied in processes and marketing (OECD, 2005), present with degrees of innovativeness at different levels (PINTO; THOMANN; VILLENEUNE, 2016), undergoing modifications due to decrements or increments to the object of innovation, or none of them, resulting from total disruptiveness (BAIYERE; HUKAL, 2020).

Each scientific research has an element of novelty and it is necessary to be aware about the importance of intellectual property protection (IP) regarding the new parts of the research, regardless of the degree of training of the researcher (SĂVESCU, 2020).

As for the aspects of intellectual property, innovation can be seen as a technological asset in the face of knowledge protection, verifying as a challenge the valuation in aspects of technological transfer between University-Company, since there is a complex number of variables and methods to be considered in the transformation of knowledge into *royalties* (CARVALHO *et al.*,2019; CHUKHRAY, MRYKHINA, 2020).

Negri (2018) commented that the greatest relevance to society regarding the appropriation of knowledge and the production of patents produced by universities to companies, is the avoidance of deposits of technologies that are not technically developed. And at this point, questions arise regarding the number of patents that are produced in a sample of Brazilian researchers-inventors, belonging to research groups, which are being developed in *network* with companies and other national and foreign inventors. As well as other questions, such as: What is the flow in technological transfer and royalties production? What are the perceptions about aspects of innovation, intellectual property and technological transfer for this group?

In seeking to answer these gaps, 84 specialists participated, involved in the areas of engineering and participants in technological processes of patenting in Brazil, consulted by *the survey* method, supported by the measurement of perceptions in the Likert gradual scale (1932) with sample calculation based on Fisher (1936).

Therefore, based on aspects of the knowledge economy in which there is detachment of energy and time from a thinking mass of researchers, it becomes relevant to understand the perceptions about the protection of intellectual property, possible security mechanisms protection, attributes of innovation and technological transfer, as well as to understand their participation in the framework of federal university institutions in Brazil and their respective graduate programs.

o **Theoretical framework**

This part aims at further deepening the theme, seeking to verify or structure constructs of the model, such as: protective elements (PE), sources of knowledge to innovation (HR), security mechanisms (MS), hybrid attributes to innovation (AH) and technological transfer (TT).

- Protective Elements (EP)

In the case study of Gonçalves and Tomaé (2020) at the Federal University of Paraná, in relation to the protection of knowledge applied to intellectual property, the authors identified that aspects such as the issue of secrecy, the search for technological information, confidentiality agreements, norms regarding publication and patenting, are not included in the guidelines for the protection of knowledge of that institution. They concluded that the absence of these guidelines may interfere in the sensitization of researchers to the protection of knowledge and innovation.

Another case study considered was that of mechanical engineering, from Romania, on the importance of promoting knowledge of IP in universities, but without current full application (SĂVESCU, 2020).

Oppenheim (2020) presented the role of copyright in the area of intellectual property, mentioning the strong influence it exerts on information to the student public, library professionals, and those who give lectures, write or use bibliographic resources, regardless of electronic or printed means, as well as the impact on those who serve the academic community, as funders and publishers.

Therefore, observing that researchers-inventors are professionals who must respect the copyright legal principles (BRASIL, 1998) and that when they carry out research aimed at technological innovation, they present the finalistic of technology transfer, they must respect the right to industrial property (BRASIL, 1996), so it is understood that:

EPa Every researcher or inventor generating innovations should know about the protection mechanisms.

In the between publishing or protecting, there is a third known as defensive publication, a modality that denotes the publication of an invention for the purpose of creating the state of the art, and thus preventing the granting of patents on this invention, despite the patent system itself being frequently used (HENKEL; PANGERL, 2008).

Shyam (2014) argued that defensive publications are effective means of defending intellectual publications, making the hypothesis available mainly in the public domain, and that although they are most often used in pure sciences, technology and engineering, this form of protection can be more effective in the medical field. This is because it is common for senior professionals to develop surgical techniques for years and not to publish, for various reasons, however come another professional and publish, taking credit for having done the publication first. In addition, the author commented that the defensive publication, even if it is of hypotheses, ideas and opinions, allows the improvement of the original idea, but safeguarding intellectual property and protecting the rights of the original thinker.

The excess of activity with research, demands in laboratories and teaching often lead to a lack of time for the teacher/inventor to be involved in issues related to the production of technology, as it proves to be one of the requirements that shift the focus on patenting in universities (AGUILLERA, 2013).

By basing the authors who defend the publication, although incipient, with the defensive publication technique or observing that the main purpose of the researcher is the production of knowledge, one can lead to believe that:

Epb To achieve the best protection in innovation I can publish my research without concern for Intellectual Property, since I have a deadline to finish my research.

From the Innovation Law of 2016, which inserted prospecting actions and competitive intelligence by the Centers for Technological Innovation - NIT (CARVALHO and RENAULT, 2019), it began to play an essential role in technological development when prospecting and informational monitoring formed bases for competitive intelligence, boosting processes through information and knowledge management (CARVALHO et *al.*,2019) .

CARVALHO *et al.* (2019) highlighted that NIT builds several formal and informal information structures within the organization, as well as prospecting and monitoring activities that generate systematized informational services and products, with high added value.

The importance of some innovation centers was verified by Santos *et al.* (2020), among them: development of policies to innovation, management and increase in awareness of technological transfer and the use of intellectual property, sharing of human resources - intellectual capital - equipment and laboratories, generation of guidelines on the operation of business incubators. The authors highlighted bureaucratic and legal difficulties regarding the regulation of laws by their respective decrees, slow, incremental and long-term learning capacity of universities - private companies - public sector, and technological delay and innovative inefficiency beyond regional, national.

In the stated assumptions it would be possible to understand that:

EPcIn my innovation proposals I must seek the NIT for guidance and protection on Intellectual Property resulting from my research.

▪   Sources of knowledge to innovation (CF)

It is understood that innovation can be the result of various forms of knowledge, and authors such as Kör and Maden (2013) presented in their study the relationships between knowledge in the management and innovation process applied to organizations through a mediation of the effects of innovativeness. In the view of   Apak and Atay (2014) the key component of a knowledge economy results from greater dependence on intellectual capacities on physical inputs or natural resources.

In view of these assertions, it is possible to infer that once social entrepreneurs represent the cell of a company and carry with them knowledge, and these, based on needs, present social innovations, according to Bhatti *et al.* (2018b), it is suggested that:

Fca. Practical knowledge of entrepreneurs and/or social inventors can contribute to the systematized innovation of academies.

Sternitzke (2010) argued that scientific knowledge from the public sector is considered important for all innovations.

Pedrosi Filho(2014) added that patenting and publishing are compatible and that the dissemination of the results of scientific research is fully compatible with the protection of the resulting inventions, through patents or any other form of industrial protection. However, he stressed that if the researcher believes that some invention derived from his investigations is new and has possibilities of commercial

exploitation, it should not be published. However, Mueller e Perucchi (2014) expressed the need for universities to be sources of knowledge applicable to the production of technologies.

It is understood that several studies of intellectual protection unders association with the relationship between the growth of knowledge measured by scientific publications and the technological growth measured by the index of publications of patent families (WIPO, 2019).

In view of the assumptions presented, the following are investigated:

FCb. All research should be published, since it can be a patent-producing source.

Aguillera (2013) perceived the University as a generating and disseminating element of knowledge, and innovation resulting from this passive scientific knowledge of protection, through intellectual property instruments, guaranteeing rights to the actors involved in terms of the proper appropriation of knowledge, besides enabling safe sharing and contributing to technological development.

Corsino; Mariani; Torrisi (2019) they stated that "external sources of knowledge by companies to develop patented inventions exploit the validity of patent citations as an indicator of knowledge flows between companies."

It was verified as structuring of technologies in Brazil, the support of the Brazil Bank Foundation, through its Social Technologies Bank (BTS), for including several publicly certified social innovations, in the form of articles of institutional dissemination, opening opportunities to know technological solutions capable of being reproduced free of charge with availability for incrementations (FUNDAÇÃO BANCO DO BRASIL, 2019).

According to the exposures verified, it would be possible to infer that:

FCc. Articles published by institutions can generate a source of knowledge to their innovation.
- Security Mechanisms (MS)

Several methods of valuation and technology transfer are used by the core of technological innovation, among them, there is the Theory of Real Options (TOR) (PAIVA; SHIKI, 2017), and the "TIRA" of the American acronym *Technology, Insertion, Recipient, Appreciation* (CARVALHO, T. V. *et al.*, 2017; DOMINGOS *et al.*,2018). With this, it is inferred that:

MSa. The researchers/inventors were/or should be responsible for evaluating the technology (e.g. TRL- Technology Maturity Level).

In the field of technology valuation and transfer, there is a recurrence of the theme in practical and theoretical discussions, since it involves several agents in the process of developing new technologies, in addition to researchers who do not accept interference, being refractory to responses from organs unrelated to their activities (ARAÚJO *et al.*,2017). With this, it is possible to consider that:

MSb. Researchers/inventors were/or should be responsible for the valuation of the technology.

It was verified in relation to the inventors that the various labor reasons, which lack the time for answering questionnaires about their activities and their laboratories in the valuation process (ARAÚJO *et al.*,2017), have proven to be one of the requirements that shift the focus away from patenting. However,

those who may submit refractories to the valuation method or patent application may feel more comfortable enumerating the clauses that permeate the relationship in technology transfer, and therefore:

MSc. Researchers/inventors were/or should be responsible for the production of technology contracts.

The researcher believing that the invention, based on his investigations, may present an innovative characteristic with possible commercial exploitation, should seek guidance from the body responsible for managing the intellectual property policy in his institution before any disclosure   (FILHO, 2014).

Given the assertion that the researcher should be guided by the management body of the IP policy of the respective academic institution, it is inferred that:

MSd. The University is a relevant licensing mechanism for innovations.
- Hybrid attributes in innovation (AH)

The innovations present attributes that characterize aspects of an invention, bringing to light the possibility of perceptively attracting the investor or consumer market, among some of them: economics, accessibility, minimization of material resources, easy use or handling, robustness, quality, suitable for sales at scales or still sustainable (WEYRAUCH; HERSTATT, 2017).

Bas (2016) advocated a balance in the design of innovations based on frugality, which can both mean cost reduction, and operate in the context of resource restriction in which it operates.

The study that analyzed the cases of the U.S. and London rates of slower economic growth and the increase in costs for health spending due to the increasing prevalence of disease burden, they led Prime, Bhatti and Harris (2017) to suggest a convergence of these challenges faced by global health systems to economic accessibility as a metric relevant to the socially and economically disadvantaged, and stressed that both developed and emerging countries were becoming equally important for all, even if they enjoyed good social and economic conditions.

Uzoigwe e Shoab (2020) highlighted the cost reduction for the use of innovations with expired patents, and justified the effect of identical *designs* capable of radically impacting on the provision of services with greater accessibility. They exemplified the expiration of drug patents, with the subsequent use of generics that reached annual levels in million-dollar figures in the economy, concluding that "intellectual property [...] encompasses anodyne principles that seek to protect innovation, but are open to manipulation and exploitation".

Faced with aspects focused on cost reduction in order to favor the economies of societies and offer greater accessibility to markets, it is believed that researchers or inventors:

AHa.In research or patents I personally seek to analyze elements that can attribute a significant cost reduction to innovations when possible.

Among the various attributes that frugal innovation has to increase the chances of meeting market demands, production in scale or scalability draws the attention of authors such as Liu; Mr. Feng; Wang, (2020) in which this characteristic is used as a success factor and which is also supported by Agarwal et *al*. (2017a).

The demands for innovations in the world scenario, concomitant with the search for boosting in corporations, were observations of the authors Bhatti; Basu *et al.* (2018a) in which they presented frugal innovation as a set of activities for organizations to redesign products, services and reconfigure value chains, leading the cost item in the organization, increasing profitability and competitive advantage by achieving high performance at production scales – scalability – improving efficiency in general and reaching social needs.

In the series in which the global community has been identified with global health problems, and still insoluble in the face of new demands and challenges, Feng (2020) verified the urgent need to overcome these demands, supported by a more robust collaboration between international organizations, which can with a circular model and their thematic axes of innovation, research, digital health, basic care, economic sustainability and participation of communities and civil societies, to achieve possible ways to minimize the impacts caused (WORLD HEALTH ORGANIZATION, 2019).

In the area of Information and Communication Technology - ICT - it was found that the Internet of Things - IoT - offers many opportunities for pioneering new products and influence interconnected systems with immeasurable scalability, especially with the use of cloud computing resources (JASMINE; THEJAS, 2020. In the same segment, Rahmani and Li (2020) exemplified with their proposal to generate a scalable digital infrastructure to provide a sustainable energy network.

In this set of statements declared by the urgent need to meet a global scale in the various spheres, or even to suggest innovative models, it becomes noticeable that:

> ***AHb. All innovation is a possible object of achieving a large scale for reproduction.***

Reverse innovation is one of the concepts most associated with frugal innovation (BHATTI *et al.*,2018a) and as a case series, the invention of Arunachalam Muruganantham is observed under the creation of hygienic products with few resources, having knowledge formation for such invention from other inventions in the same segment (PRIYADARSHINI, 2018) . In Syed's statement; Dadwal and Martin (2013) "Reverse innovation in global health systems has the potential to contribute to the numerous health challenges faced by populations around the world."

Depasse e Lee (2013) recommended policymakers, entrepreneurs, health system leaders, and researchers to consider reverse innovation in accelerating the movement of promising solutions. This innovation was recently endorsed as a vehicle to promote bidirectional learning and the flow of information between low, middle and high income countries, with the aim of meeting common unmet needs (HARRIS; DADWAL; SYED, 2020).

Given the assumptions verified, it can be understood that once reverse innovation accelerates the innovation process, the time and cost in innovative solutions are reduced. So:

> ***AHc. Using reverse innovation techniques will save time, resources and lead to even better innovation.***

▪   Technology Transfer (TT)

The technological transfer was presented as an object of academic and corporate interest in the publication of Sagafi-Nejad and Belfield (1941) in which they cited the role of the United Nations, supported by international agencies and agencies, in this international process.

Mueller e Perucchi (2014) expressed the need for universities to be sources of knowledge applicable to the production of technologies. Domingos *et al.* (2018) ratified this assumption, exploring the concept of Technology Transfer (TT) as a disseminator for science and technology produced in the academic environment to the productive environment, [...] ranging from the pure transfer of knowledge to the transfer of information, processes, functions, implementations, or even, enabling the promotion of the creation of new companies.

Thus, the numerous contributions based on the university-company relationship in favor of society by innovations, allows the observation of variables that arise in this relationship of technological transfer, such as: *sustainability, care for the environment, production on a global scale, negotiation mechanisms in technology transfer, information systems of logistic support, methods of technological valuation and the quality of these innovations..*

Sustainability

Organizations and social enterprises that have adopted frugal innovation strategies have achieved high-quality results in products and services, applicable and accessible to emerging markets, with a view to global sustainability due to the use of critical requirements or success factors. From his examples, we observed requirements such as: robustness; lightness of good (portable); *IoT* solutions with mobile connectivity; easy-to-use or intuitive projects; simplified or minimalist to meet functional requirements; available in unconventional channels; adaptable to existing products or services; usable with local resources, no need to import equipment or materials; powered by renewable *resources* (green technologies); affordability (BASU; BANERJEE; SWEENY, 2013).

In medicine, the gaps that made innovations scalable could be achieved by technological implementations to mobile devices and sensors, which meant a great potential for global health, through the defense of cheap and effective solutions to common problems in diagnostics, medical procedures and access to information, benefiting environments with or without resources (LUNDIN; DUMONT, 2017).

With regard to aspects of sustainability and scarcity of resources, it was found in Hossain (2018), that frugal innovation is appreciable as a means of providing economic and social benefits, preserving natural resources, such as materials, energy and water. In view of this, one can contribute to the awareness that:

TTa. Sustainability requirements should be mandatory items for technology transfer innovations as natural resources are becoming scarcer.

Through studies that presented paradoxes of sustainability to the environment, it was evaluated how solutions could be had to transfer, with greater safety, technologies that impact the environment, such as energies that produce radioactive or toxic waste and that are not yet being possible to reuse them fully (GUIMARÃES, 2016; KHELURKAR; SHAH; JESWANI, 2015; SOVACOOL, 2012).

Thus, based on patent studies, we examined the evolution of innovation in nuclear energy reactors in the period between 1974 and 2008 in twelve OECD countries, and evaluated the extent to which nuclear innovation has been driven by economic incentives, political decisions and considerations on safety regulations. It was found that after the nuclear accidents of *Three Miles Island* and *Chernobyl,* there were indexes with a negative impact on nuclear innovation (BERTHÉLEMY, 2012).

On the other hand, the work of Halevi *et al was verified.* (2020) in which it was possible to make an invention for selective removal of radioactive cationic species, decontaminating nuclear waste water with environmental cleanliness after accidents, as happened in the Fukushima Daiichi Nuclear Power Plant disaster in 2011, in which through three-dimensional (3D) digital light processing (DLP) printing, monoliths were formed from ionic post-exchange of zeolites, which are known to be good for the treatment of nuclear effluents or in applications and processes based on aqueous separation.

Analyzing results of unfavorable impacts from nuclear or positive accidents regarding radioactive waste remediating technologies, it is possible to understand that:

TTb. There must be technology transfer with innovations that degrade the environment.

Bureaucracy is among the various barriers to innovation and technological transfer (FABRIS, 2016; RUSSO, FABRIS and SILVA-MAN, 2019). This is an undoubted and essential variable for the formalization of proceedings between formal institutions that respond to the laws of the parties involved, or when these parties owe an obligation to the legal order of their territoriality, or when extraterritoriality uses the international treaties and agreements that permeate the intersection of interests (IRINEU et *al.*, 2019).

It is possible that *Smartcontracts* can contribute to the efficiency and acceleration of agreements as a way to assist in the dynamics of negotiations, speeding up approximations to convergent points and driving away divergences in the interests of the parties (MATTEREUM, 2020), as well as adapting fluidly, according to the dynamic conditions of new situations (RAHMANI; LI, 2020).

By observing the references about frugal innovations, it is possible to achieve technological solutions prone to scalability (AGARWAL *et al.*,2017b; AHUJA and CHAN, 2016), considering *startups* (CARVALHO *et al.*,2017) is that,

TTc   Transfer Contracts must present broad flexibility so that innovations can be prepared for productions on global scales.

Technological valuation

Paranhos, Cataldo e Pinto (2018) demonstrated the case of industrial, technological and foreign trade policy (PITCE), in which a Science and Technology (S&T) policy was established in the Science and Technology Growth Acceleration Program (S&T PAC) and the first incentive of the program was the training and training of human resources for the AREA of CT&I, demonstrating the relevance of people qualified in stimulating the partnership between Institutes of Science and Technology - ICT and companies through the "Capes National Postdoctoral Program".

Tavares, Philippi and Porto (2019) highlighted the role of agents who are trained to deal with the process and bureaucracy in licensing activities, in which there is a need for dynamism, both in its development and in its execution, aiming to minimize the response time and adjustments to meet the demand for commercialization of technology, observing the need for professionals who understand the subject to accelerate the flow of processes.

Depending on the assertions and among the various forms of technological valuation to reach the stage of transfer of intellectual assets (LEITE *et al.* 2019), the requirement of expanded knowledge by intellectual property professionals is unique, when observing the diversity of variables that involves the evaluation of innovations. And therefore, it is *sine qua non* to crave that the

TTd Valuation of innovation for transfer can be carried out through professionals who are accredited by academic NIT.

o   Methodology

The research developed by the *survey* method had the perception of 84 researchers-inventors, limited to capes research groups, in the areas of engineering, with an instrument validated by 5 doctors who know the intellectual property.

The sample was endowed with Westland's computational algorithm (2010) in the resources of the *G*Power* tool, which were based on Fisher's fundamental studies (1936). With the quantitative analysis of the sample, a qualitative analysis was previously performed, extracting those patents that had an inventor-company-government relationship with and without internationalization.

The query used Google's electronic forms tool®, with unique *email* account identified by *frugalsurvey@gmail.com.* Data collection was performed between the periods of 08/30/2019 and 03/28/2020, requesting answers to 307 contacts, returning, 84.

The measurement of the perception of the group of respondents (table 9) occurred with a gradual scale of intensity represented by 5 points, ranging from 1 to 5, being: {1 = I disagree totally; 2 = I disagree partially; 3 = Neither agree nor disagree; 4 = I partially agree; 5 = I agree totally} (LIKERT, 1932; YOUSSEF; HAAK-SAHEEM; YOUSSEF, 2017).

Table 1. Likert's proposal and scale adopted to the questionnaire

1	2	3	4	5
I disagree totally	I disagree partially	Neither agree, nor disagree	I partially agree	I agree totally

Source: Authors.

The instrument had open questions regarding the profile of the sample, invoking names or acronyms of graduate programs, affiliation, time of performance with patents, number of patents with technological transfer and number of patents that presented *royalties.*

The basis of the assumptions, with their respective evidence, was based bibliographically through scientific articles, peer-reviewed, however, certain references were obtained by *webpages* consulted by the Google and Google Scholar mechanism.

Pearson's correlation method (KOTHARI, 2010) was applied to analyze the relationship between technological production and technology transfer.

$$\rho = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(yi - y)}{\sqrt{\sum_{i=1}^{n}(x_i - \bar{x})^2} \cdot \sqrt{\sum_{i=1}^{n}(y_i - \bar{y})^2}} = \frac{\text{cov}(x,y)}{\text{var}(x) \cdot \text{var}(y)}$$

$x_1, x_2, ..., x_n$ and $y_1, y_2, ..., y_n$ are the measured values of both variables. And

$$\bar{x} = \frac{1}{n} \cdot \sum_{i=1}^{n} x_i \qquad \bar{y} = \frac{1}{n} \cdot \sum_{i=1}^{n} y_i$$

therefore, and are the arithmetic means of both variables.

As for the parameters of interpretation of the *Pearson* index, one has: 0.9 for more or less, indicates a very strong correlation; 0.7 to 0.9 positive or negative, indicates a strong correlation; 0.5 to 0.7 positive or negative, indicates a moderate correlation; 0.3 to 0.5 positive or negative, indicates a weak correlation; 0 to 0.3 positive or negative, indicates a negligible correlation (KOTHARI, 2010).

To discuss the results according to the hypotheses announced in theoretical reference, the following items are analyzed: Protection Elements, Knowledge Sources, Security Mechanism, Hybrid Attributes, Technology Transfer (Table 11).

Table 2. Set of hypotheses investigated

Block No.	Construct	Number of items
1	Protective Elements (EP)	3
2	Sources of Knowledge (FC)	3
3	Security Mechanism (MS)	4
4	Hybrid Attributes (AH)	3
5	Technology Transfer (TT)	4
Total		17

Source: Authors.

The research is the result of a database developed and ceded for the analysis of the relationships of Connections between Companies and University (FABRIS, 2016).

Results

The following will be possible to understand the results from the sub-items: Analysis of the sample, results and results of the hypotheses.

Sample analysis

Verifying the general data achieved and available in Appendix D, it was able to highlight and consolidate the results, by plotting an analysis in 4 levels: professional, geographic, institutional and technological, respectively in the sub-items 6.4.2 to 6.4.4.

Professional level

It was found at the level of training that there is a greater participation of the group belonging to the postdoctoral level, with, 55 participants, corresponding to 65.48% of the sample; doctorate (25; 29.76%); Master's degree (3; 3.57%); specialization (1; 1.9%). In the aspect that highlights the time of performance in the production of patents, in years, it was found that 3 respondents represent less than 1 year in operation. As for the professional with the highest expertise, in working time, there is 1 respondent with 55 years, with the modal value of 7 respondents equal to 20 years of experience, and the average time in working time, 22.38 years.

The main areas of activity of researchers in the North are concentrated in the areas of health, such as: Biomedicine, Dentistry, in at least 5 graduate programs. In the Northeast, the areas of Oil and Gas, Civil and Materials Physics in Sergipe stand out, and in other universities, there are researchers in the areas of Biochemistry, Chemistry, Biotechnology, Biomedicine, Mechanics, Pharmaceutical Nanotechnology, Materials, Biomaterials, Biotechnology, Metallurgical, Electrical. In the Midwest, they are: Biomedicine, Electrical, Pharmacy, Agronomic and Chemistry. In the Southeast, the researchers work strongly in the Rio-São Paulo axis with Chemistry, Naval and Oceanic, Physics, Electrical, Computing, Cell and Molecular Biology, Biomedicine, while in Espírito Santo are focused on the areas of the earth, such as Agrarian, Agronomy, Biology, Ecology, and in Minas Gerais, the Chemical, Biomedicine, Speech Therapy, Sanitary, Materials and Metallurgical, Food and Nanobiosystems areas. For the South region, the chemical, mechatronics and geomatics, electrical, materials, metallurgical, mechanical and aerospace areas stand out.

Geographical level

In a total of 37 institutions, the North region had the participation of 2 universities and 5 respondents, Midwest (3;8), Northeast (11;18), Southeast (16;39), South (6;14).

The mean and modal index of professionals regarding the level of education in all states are 4.42 and 4 per state, respectively. Above this average, the highest concentration of inventors at the level of training, post-doctors (PD), doctors (D), masters (M) follow the count: Paraná (3PD, 2D), Santa Catarina (3PD, 2D, 1M), São Paulo (7PD), Minas Gerais (9PD, 2D, 1M) and Rio de Janeiro (11PD, 5D).

Among the 78 graduate programs (PPG) that resulted in technological productions, The following indexes were presented respectively in number of programs and patent count (P) in the regions: North (6PPG; 8P), Midwest (8PPG;72P), Northeast (25PPG;82P), Southeast (28PPG;283P), South (11PPG;175P).

Institutional level

Of the 37 institutions analyzed that are part of the sample, it was verified the participation, in particular, for the Northern region of the Federal University of Pará with 7 patents (P), and it was not

possible to find patents at their time transferred (T) or with participation in *royalties* (R). For the Northeast, the Federal University of Sergipe (30P;0T;0R) stood out, however, the Federal University of Rio Grande do Norte, despite having a smaller number of patents in its count, presented a higher number of patents transferred and with royalties (5P, 2T, 17R). In the Midwest, the University of Brasília stands out (40P;10T;3R). In the Southeast region, the Federal University of Rio de Janeiro (89P;36T;2R) and UFSCAR (61P, 10T, 3R) stand out. In the Southern region, the Federal Technological University of Paraná with (63P, 56T, 0R), followed by the Federal University of Santa Catarina (36P, 4T,1R) and the Federal University of Rio Grande do Sul (26P, 1T, 2R) stand out.

Technical level

In the technological aspect of the institutes, it was found that among the amount of 620 patents produced, 158 reached the process of technological transfer, and effectively 35 patents, of this total quantity, reached the return of investments through *royalties*. In data on the total sample, patents with technological transfer resulted in approximately 20.31%, and patents with royalties presented about 5.34%. Thus, it is demonstrated that the productive chains can take advantage of up to 94.66% of the total knowledge potential produced in universities (Table 12).

Table 3. Technological indices by Institutos

Institute by Region	PATENTS in PPG	Patents with Transf. Technology	Patent Royalties
Midwest	**72**	**15**	**4**
UFG	12	2	1
UFMS	20	3	0
UNB	40	10	3
Northeast	**82**	**4**	**19**
IFBA	2	0	0
IFCE	3	0	1
IFPI	1	0	0
UFAL	1	0	0
UFBA	1	0	0
UFC	13	0	0
UFPE	22	2	1
UFPI	4	0	0
UFRN	5	2	17
UFS	30	0	0
North	**8**	**0**	**0**
UFAM	1	0	0
UFPA	7	0	0
Southeast	**283**	**74**	**7**
IFRJ	1	1	0
IME	13	0	0
INMA	1	0	0
PUC	14	3	2

UFES	1	2	0
UFF	2	1	0
UFMG	59	5	0
UFRJ	89	36	2
UFRRJ	4	0	0
UFSCAR	61	10	3
UFV	2	0	0
UNICAMP	34	16	0
UNIFAL	2	0	0
South	**175**	**65**	**5**
IFC	0	3	2
UDESC	6	1	0
UFPR	44	0	0
UFRGS	26	1	2
UFSC	36	4	1
UTFPR	63	56	0
National Average	**7,56**	**1,88**	**0,42**
National Total	**620**	**158**	**35**

Source: Authors.

By nationally correlating the production of patents in graduate programs (PPG) with the total number of patents that achieved technological transfer (TT), by region, by *pearson*method, the moderate correlation index R=0.65 could be found (Table 13). However, when evaluating the correlations by region with analyses of the universities individually, it is obtained that in the Midwest the correlation is very strong, reaching R=0.99 approximately; Northeast (0.27) negligible; Southeast (0.85) strong; South (0.69), moderate.

Table 4. PPG correlation and sum of patents by region

Region	Quant PPPG	Quant Patents	Correlation
North	8	0	-
Midwest	72	15	0,986241383
Northeast	82	4	0,271541396
Southeast	283	74	0,845094036
South	175	65	0,688035628
National			0,938654297

Source: Authors

Results of the hypotheses investigated

The metrics that sized researchers' perceptions about innovation and intellectual property in the process of technological transfer show that for the hypothesis classes: Disagree Totally (DT), Disagree Partially (DP), Do not Agree or Disagree (N), Partially Agree (PA), Totally Agree (TA), they are highlighted:

Elements of Protection to Innovations

EPa. Every researcher or inventor generating innovations must know about the protection mechanisms (TA 65.48%; PA 29.76%) (OPPENHEIM, 2020; BRAZIL, 1998; BRAZIL, 1996). EPb. To achieve the best protection in innovation I can publish my research without concern for Intellectual Property, since I have a deadline to finish my research (DT 50%; SD 19.05%)   (HENKEL; PANGERL, 2008; SHYAM 2014; ARAÚJO *et al.*,2017) . EPc. In my innovation proposals I must seek the NIT for guidance and protection on Intellectual Property resulting from my research (TA 67.86%, PA 25%) (OAK; RENAULT, 2019 ; CARVALHO *et al.*, 2019 ; SANTOS *et al.*,2020) .

Sources of Knowledge

FCa. Practical knowledge of entrepreneurs and/or social inventors can contribute to the systematized innovation of academies (TA 55.95%; PA 41.67%) (KÖR; MADEN, 2013; APAK; ATAY, 2014; BHATTI *et al.*,2018b). FCb. All research should be published, since it can be a patent-producing source (PA 41.67%, TA 32.64%) (STERNITZKE, 2010; PEDROSI FILHO, 2014; MUELLER; PERUCCHI, 2014; WIPO, 2019). FCc Articles published from institutions can generate a source of knowledge to their innovation (TA 79.76%; PA 15.48%) (AGUILLERA, 2013; CORSINO, MARIANI; TORRISI, 2019; BANCO DO BRASIL FOUNDATION, 2019).

Security Mechanisms

MSa. The researchers/inventors were/or should be responsible for the evaluation of the technology (PA 41.67%; TA 19.05%) (PAIVA; SHIKI, 2017 ; CARVALHO *et al.*,2017; DOMINGOS *et al.*,2018). MSb. Researchers/inventors were/or should be responsible for the valuation of the technology (PA 36.90%; SD 20.24%) (ARAÚJO *et al.*,2017) . MSc. Researchers/inventors were/or should be responsible for the production of technology contracts (DT 28.57%; SD 25%) (ARAÚJO *et al.*,2017) . MSd. The University is a relevant mechanism for licensing innovations (TA 53.57%; PA 30.95%) (PEDROSI FILHO, 2014) .

Hybrid Attributes in Innovation

Aha. In research or patents I personally seek to analyze elements that can attribute a significant cost reduction to innovations when possible (TA 59.52%; PA 30.95%)   (WEYRAUCH; HERSTATT, 2017 ; BAS, 2016 ;   PRIME, BHATTI; HARRIS, 2017 ; UZOIGWE; SHOAB, 2020). . AHb. All innovation is a possible object of achieving a large scale for reproduction (PA 45.24%, SD 19.05%)   (LIU; Mr. FENG? WANG, 2020 ; AGARWAL et al., 2017a ;   BHATTI et al., 2018a ;   FENG, 2020 ; WORLD HEALTH ORGANIZATION, 2019 ; Jasmine; THEJAS, 2020; Rahmani; LI, 2020). Ahc. Using reverse innovation techniques will save you time, resources and lead to even better innovation (PA 45.24%; TA 32.14%) (BHATTI; BASU et al., 2018a), (PRIYADARSHINI, 2018), Syed, Dadwal and Martin (2013) and Depasse and Lee (2013) , (HARRIS; DADWAL, SYED, 2020.

Technology Transfer

Tta. Sustainability requirements should be mandatory items for technology transfer innovations as natural resources are becoming scarcer (TA 44.05%; PA 41.67%) (BASU; BANERJEE; SWEENY, 2013; LUNDIN, D-200 DUMONT, 2017 ; HOSSAIN, 2018) . TTb. There should be technology transfer with innovations that degrade the environment (PA 33.33%; SD 21.43%) (GUIMARÃES, 2016; KHELURKAR; SHAH; JESWANI, 2015; SOVACOOL, 2012;   BERTHÉLEMY, 2012;   HALEVI *et al.*,2020). TTc. Transfer contracts must have broad flexibility so that innovations can be prepared for production at global scales (TA 42.86%; PA 33.33%),   (FABRIS, 2016; RUSSO, FABRIS, SILVA-MAN, 2019 ; IRINEU *et al.*,2019 ;   MATTEREUM, 2020 ; Rahmani; LI, 2020 ; AGARWAL *et al.*,2017b; AHUJA, AHUJA, AHUJA; CHAN, 2016 ;   CARVALHO *et al.*,2017) . (TTd) Valuation of innovation for transfer can be performed through professionals who are accredited by academic NIT (PA 41.67%; TA 35.71%) PARANHOS, CATALDO AND PINTO (2018); TAVARES, PHILIPPI AND PORTO (2019); (LEITE ET AL.; 2019).

In table 14, depending on the approaches performed with their respective main indexes, one can observe in visual detail, their utterances with all the ranges of options of the Likert scale.
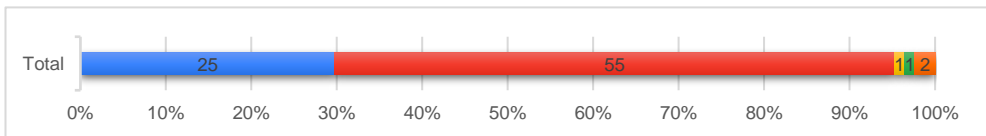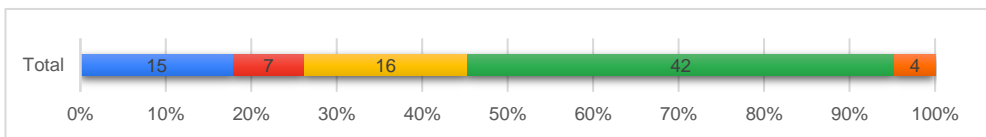
Table 5. Constructs and Likert scales

Constructs	Observable Variables / Description / Reference / Likert Scale / Status	
Protection Elements	EPa	Every researcher or inventor generating innovations must know about the mechanisms of protection Oppenheim (2020), (BRASIL, 1998), (BRASIL, 1996).
	EPb	To achieve the best protection of my innovation I can publish my research without concern for Intellectual Property once I have a deadline to finish my research (HENKEL; PANGERL, 2008). Shyam (2014) (ARAÚJO *et al.*, 2017)
	EPc	In my proposals for innovations, I must seek the NIT for guidance and protection on Intellectual Property resulting from my research (CARVALHO e RENAULT, 2019), (CARVALHO *et al.*, 2019),(SANTOS *et al.*, 2020)

Table 5. Constructs and Likert scales

Constructs	Observable Variables / Description / Reference / Likert Scale / Status		
	Total: 21, 57, 2, 4		
Knowledge sources	**FCa**	Practical knowledge of entrepreneurs and / or social inventors can contribute to the systematized innovation of academies. *Kör e Maden (2013); Apak e Atay (2014);* (BHATTI *et al.*, 2018b)	
		Total: 35, 47, 1, 1	
	FCb	All research must be published, since it can be a source of patents *Sternitzke (2010), Filho (2014), Mueller e Perucchi (2014),* (WIPO, 2019)	
		Total: 35, 27, 10, 5, 7 *Continue...*	
	FCc	Published articles from institutions can generate a source of knowledge to your innovation *Aguillera (2013),Corsino; Mariani; Torrisi (2019),* (FUNDAÇÃO BANCO DO BRASIL, 2019).	
		Total: 13, 67, 2, 2	
Security Mechanism	**MSa**	Researchers/inventors were/should be responsible for the evaluation (e.g. TRL-Technology Maturity Level)? (PAIVA; SHIKI, 2017)*,* (CARVALHO, T. V. *et al.*, 2017; DOMINGOS *et al.*, 2018).	
		Total: 35, 16, 10, 8, 15	
	MSb	Researchers/inventors were/should be responsible for valuing the technology (ARAÚJO *et al.*, 2017).	
		Total: 31, 12, 17, 10, 14	

Table 5. Constructs and Likert scales

Constructs		Observable Variables / Description / Reference / Likert Scale / Status
	MSc	Researchers/inventors were/should be responsible for producing the technology contracts (ARAÚJO *et al.*, 2017)
		Total: 20 / 7 / 21 / 24 / 12
	MSd	The University is a relevant licensing mechanism for innovations *(FILHO, 2014)*
		Total: 26 / 45 / 3 / 1 / 9
Atributos Híbridos	**AHa**	In research or patents I personally seek to analyze elements that may attribute a significant cost reduction to innovations when possible (WEYRAUCH e HERSTATT, 2017), Bas (2016), Prime, Bhatti e Harris (2017) Uzoigwe e Shoab (2020) *Continue...*
		Total: 26 / 50 / 1 / 7
	AHb	Every innovation is possible to achieve a large scale for reproduction (LIU; FENG; WANG, 2020), (AGARWAL *et al.*, 2017a), (BHATTI *et al.*, 2018a), *Feng (2020),* (WORLD HEALTH ORGANIZATION, 2019), *(JASMINE; THEJAS, 2020), Rahmani e Li (2020)*
		Total: 38 / 13 / 16 / 12 / 5
	AHc	Using reverse innovation techniques will save you time, resources and can lead to even better innovation *(BHATTI; BASU et al., 2018a), (PRIYADARSHINI, 2018), Syed, Dadwal e Martin (2013) e Depasse e Lee (2013), (HARRIS; DADWAL; SYED, 2020)*
		Total: 38 / 27 / 1 / 18

Table 5. Constructs and Likert scales

Constructs		Observable Variables / Description / Reference / Likert Scale / Status
Technology Transfer	**TTa**	Sustainability requirements should be mandatory items for innovations for technology transfer as natural resources are becoming scarcer *(BASU; BANERJEE; SWEENY, 2013,* (LUNDIN; DUMONT, 2017)*,* (HOSSAIN, 2018)
	TTb	There must be technology transfer with innovations that degrade the environment (GUIMARÃES, 2016; KHELURKAR; SHAH; JESWANI, 2015; SOVACOOL, 2012)*, (BERTHÉLEMY, 2012), HALEVI et al. (2020)*
	TTc	Transfer contracts must be flexible enough so that innovations can be prepared for production on a global scale *(FABRIS, 2016; RUSSO, FABRIS e SILVA-MAN, 2019).* (IRINEU *et al.*, 2019)*, (MATTEREUM, 2020)*, (RAHMANI; LI, 2020)*, (AGARWAL et al., 2017b; AHUJA e CHAN, 2016), (CARVALHO et al., 2017)*
	TTd	Do you understand that all valuation of my innovation for transfer can be done through professionals who are accredited by the NIT of the academies? PARANHOS, CATALDO E PINTO (2018); TAVARES, PHILIPPI E PORTO (2019); (LEITE *ET AL.*; 2019)

Legend: ■ I partially agree   ■ I totally agree   ■ Neither agree, nor disagree   ■ I partially disagree   ■ I disagree totally

1.1. Conclusion

The research revealed an important contribution of researchers with their perceptions about the themes related to Intellectual Property, Innovation and Technological Transfer, within the sets of hypotheses analyzed and willing to follow:

In the aspect of the protection of innovations, every researcher or inventor generating innovations should know about the protection mechanisms and that the proposals for innovations should seek the NIT for guidance and protection on intellectual property.

As for sources *of knowledge* inspiring innovation, the practical knowledge of entrepreneurs and/or social inventors can contribute to the systematized innovation of academies, just as all research should be published, since it can be a patent-producing source. As for articles published by institutions, they can generate a source of knowledge inspiring innovation.

With regard to *innovation security mechanisms,* researchers/inventors should partly be responsible for the evaluation and valuation of the technology produced and that the University is a relevant licensing mechanism for innovations.

Hybrid Attributes in Innovation should be observed regarding the significant cost reduction to future innovations, as well as scalability should be objectively sought when possible.

In *Technology Transfer,* requirements such as sustainability should be mandatory items for technology transfer innovations, since natural resources are becoming scarcer, and that instruments of agreements, such as transfer contracts, should present broad flexibility so that innovations can be prepared for productions on global scales. The valuation of innovations is relevant when performed through professionals who are accredited by the NIT of the academies

In global efforts among researchers, universities and companies, only about 5% of patents have reached the level of *royalty* generation, demonstrating that the other 95% are still available for potential exploitation for society. It was found that by nationally correlating the production of patents to graduate programs (PPG) with the total number of patents that achieved technological transfer (TT), by region with analyses of universities individually, it is obtained that in the Midwest the correlation is very strong, reaching R=0.99 approximately, Northeast (0.27) negligible, Southeast (0.85) strong, South (0.69), moderate. And at the national level evaluated by regional indices, the correlation index R=0,94, very 94 strong, is presented.

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Data Mining Generating Decision Trees to Alert System Against Death and Losses in Egg Production

Maria Elena Silva Montanhani [1]; Leda Gobbo de Freitas Bueno[1]; Érik dos Santos Harada[1]; Danilo Florentino Pereira[2]; Mario Mollo Neto[2]

[1]São Paulo State University (UNESP), Faculty of Agricultural and Technological Sciences, Dracena/SP Brazil - Rod. Cmte João Ribeiro de Barros, km 651 - Bairro das Antas - Dracena/SP ZIP code 17900-000Phone: (55 18) 3821-8200

[2]São Paulo State University (UNESP), Faculty of Science and Engineering, Tupã/SP Brazil Domingos da Costa Lopes Street, 780 - Jd. Itaipu - Tupã / SP - ZIP Code 17602-496 Phone: (55 14) 3404-4200

Corresponding author: Mario Mollo Neto[2], **mario.mollo@unesp.br**

Abstract

Climatic changes and high temperatures have been affecting animal production and the well-being of laying birds, with heat stress and high mortality rates, generating economic losses. Legacy databases can contain information to help model thermal comfort at climatic extremes. They can enable decision trees to be created through the use of data mining to prevent mortality and production losses. Thus, the objective of this study is to seek to develop decision trees, for application as an alert system, for the incidence of caloric stress in the production of layers. We used a database of three aviaries located in the city of Bastos-SP, collected in 2013. The data were organized in Excel® spreadsheets, and processed with the Weka® software with the J48 (C4.5) algorithm for mining of the data. The technique allowed the construction of decision trees that in the chosen sheds were classified with respectively 99.73%, 99.61%, and 98.71% of correct answers and with Kappa indexes equal to 0.9958, 0.9907 and 0.9663, which indicate that the three classifiers built are excellent. Thus, the proposed system, with the decision trees built, can serve as a basis for the construction of an alert system to be applied to the three warehouses simultaneously.

Keywords: Sustainability. Climatic Extremes. Data Mining. Layer Poultry.

1. INTRODUCTION

Climate change has been affecting agricultural systems. INMET- Brazilian National Institute of Meteorology [1] issued a heatwave warning with a degree of severity of danger with temperatures of 5 ° C above average for a period of 3 to 5 days that began on September 12, 2019, the one where it reaches several regions of the states of São Paulo and Mato Grosso do Sul, with Bastos-SP being one of the affected

municipalities.

At the same time, the demand for this animal production increases in the world due to the growth of the population and the increase in per capita income in developing countries, according to [2], the world population by 2050 should surpass 9 billion, consequently the demand for products of animal origin (meat, milk, eggs) also increases. Therefore, it is necessary to understand how animal production systems are affected by extreme events, which are becoming more frequent and intense with climate change.

There is a discussion within the global context, which presents itself as a major interdisciplinary challenge of studies applied to propose strategies to mitigate the impacts of climate change on production systems [3], [4] and [5].

These advances must occur in a combination of expanding current knowledge, innovative research, and effective dissemination of research [6].

One of the main causes of losses in modern poultry is the bioclimatic and aerial environment, being one of the main causes. According to [7] the climatic extremes that have been happening can generate severe losses in production, due to heat stress, severely impacting the use of new approaches in the genetic selection of animals. In addition to thermal stress being harmful to laying birds as it leads to increased mortality, it also causes loss of body condition that directly affects the number of eggs that would be produced, and it is important that geneticists can predict the impact of environmental factors on climate adaptation [8].

Thermal stress causes a drop in feed intake, lower growth rate, higher water consumption, an acceleration of the heart rate, changes in feed conversion. And it leads to a drop in egg production and a higher incidence of eggs with soft shells, a decrease in egg size, a noticeable decrease in quality standards and a reduction in fertility and hatchability of eggs [9], [10] and [11].

Searching for solutions to mitigate these problems that directly affect productivity and mortality, consequently, animal welfare, producers, and researchers began to collect a large volume of data regarding their production. For this, much data is currently collected through research, but often they are not used or still do not offer the expected result.

Data mining is a very promising technology in this context, making use of this collected data generating useful information for the development of decision trees, giving the producer the decision making in a given problem through the use of the data mining tool in the database that the producer has collected. Is also, among other tools aimed at decision making and more precise actions, has contributed to the advancement and speed of research in animal production.

Data mining is a database analysis technique that stands out, being very promising in several areas of knowledge, according to [12] involves tasks of classification, association, or grouping. The classification encompasses several interesting application possibilities, derived from the ability to develop patterns that can be represented graphically through a decision or classification tree.

Given the presented scenario, it is assumed that, based on data mining, decision trees can be developed,

generating the bases for the creation of an alert system for the incidence of caloric stress, minimizing the losses caused by heat that affect the well-being and productivity of laying hens in production sheds.

2. LITERATURE REVIEW

According to [13], the increase in productivity is related to several factors, such as improvement of lines and inputs, investments in the automation of the production process, improvement of employees concerning management, control of sanitary conditions, among others.

External environmental factors can interfere with the microclimate generated inside the facilities, thereby causing impacts on production, with consequent economic losses to exploration. Besides, heat stress can affect the metabolism of laying hens, generating reflexes, and impacts on the production amounts and egg quality.

As indicated by [14], maximum productivity in laying hens is achieved when they are in an environment that provides minimal energy changes and meets welfare needs, where the bird has the complete state of its physical and mental health, comfort state for the animal.

For this, in the last ten years, a lot of data has been collected through research, however, these legacy databases are often not fully used or still do not offer the expected result.

Data mining is a very promising technology and in this context it has been making use of this collected and unused data in its entirety, thus allowing it to be generating useful information for the development of decision trees, giving the producer the support for decision making about some of the problems that arise in the day-to-day processes through the use of the data mining tool in the database that the producer has previously collected.

This large volume of data requires computational means and specific techniques to interpret them [15].

Several Data Mining Techniques have been used to detect relationships between the different attributes found in large databases [16].

Decision trees classify cases using their rules based on the values of each determinant data. Each node in a decision tree represents a rule in a classification instance, and each branch represents a value that the node can assume. A decision tree starts at the root node which is the most relevant attribute and is ordered based on their values up to the leaves [17].

According to the authors [18] and [19], data mining is a database analysis technique that has been applied in several areas of knowledge. This fact, according to [12], involves classification, association, or grouping tasks.

In their work, [20] related, the occurrence of heatwaves with the incidence of high mortality of layers created in different types of facilities, using a database. The classification was made on normal and high mortality through data mining using the J48 algorithm. The authors find a classification tree with 71% accuracy for high mortality. Thus, the use of mining with the generation of the classification, made it possible to associate the occurrences of a heatwave with the increase in the mortality of laying hens.

3. MATERIAL AND METHODS

This study was divided into two stages, wherein the first stage the survey of the database resulting from a collection of data from Dry Bulb Temperature (ºC) and Relative Air Humidity (%), carried out in 2013, was carried out. in three commercial laying hens, two of the vertical system type and one of the pyramid type.

The aviaries belonged to the same commercial farm, located in the municipality of Bastos-SP (latitude 21º55'19 "south and longitude 50º44'02" west, the altitude of 445 meters).

The region's climate is subtropical Aw (rainy tropical with dry winter and coldest month with an average temperature above 18ºC. The driest month has precipitation below 60 mm and the rainy season is late for autumn).

The layers used in the study were from the Dekalb White line, all of the same age and with the same dietary composition, which entered the production system in March 2013, at 17 weeks of age.

The aviaries differed concerning the typology, construction material, and air conditioning systems (without air conditioning, the tunnel with negative pressure, and sprinkling on the roof), named A1, A2, and A3 respectively.

This experiment was approved by the Commission for the Use of Animals in Research, Teaching, and Extension (CEUA) of FCAT / Unesp under protocol number 11/2012.

The monitoring of the external environment was carried out through the collection of meteorological data from the station installed on the Tupã Campus, which is about 20 km from the municipality of Bastos.

During the study, the year of production of 2013 was evaluated.

Data loggers were distributed inside each aviary to measure the variables.

To characterize the internal environment of the warehouses, dry bulb temperature (Tbs) and relative humidity (UR) were monitored, using thirty-one HOBO U12-012 data loggers (Onset®).

Five HOBO data loggers were separated for possible substitutions.

Seven HOBO data loggers were distributed in aviary A1 and twelve HOBO data loggers in shed A2 and A3.

These data loggers recorded bioclimatic variables every thirty minutes, installed in each corridor of the warehouses, and at three different heights.

Operation of shed A1 (Pyramidal): The production system is of the pyramidal type, with three floors of cages and two batteries.

Feeding was carried out automatically, water was supplied ad libitum and carried out by nipple drinkers.

This shed did not have any type of air conditioning system.

Operation of shed A2 (Negative tunnel): It was a production system of the vertical type, containing three batteries with six floors of cages.

The feed was supplied by automatic feeder and water was available in ad libitum drinkers, three for every two cages. The feed was the same provided in shed A1 due to the birds being of the same age and lineage.

In this warehouse, twelve HOBO data loggers were installed, distributed in three units per corridor.

In this shed, the air conditioning system was carried out by exhaust fans and pad cooling (made of

cellulose). With fourteen exhaust fans at one end of the building and the other, the pad cooling also presents on the right and left sides of the end.

As for the handling of the curtains of this shed, they remained closed throughout the day, due to the air conditioning system that requires total sealing of the environment for the adiabatic tunnel to function and so that the internal conditions were not affected by the external ones.

Operation of the A3 shed (without air conditioning): The A3 shed was of the vertical type and had no air conditioning system, its natural ventilation, and sprinkling on the roof.

Feeding was performed by the automatic feeder, nipple drinkers, and water was offered ad libitum. The diet offered was the same as in sheds A1 and A2.

There were two batteries with six levels of cages, one battery consisting of wire cages and the other made of polyethylene. Twelve Hobos were installed in this shed.

Calculation of the THI: For each assessment, both those carried out by the HOBO data loggers from the data from the experiment, the Temperature and Humidity Index (THI) was calculated using the equation proposed by [21].

Comfort bands were used according to the THI, these bands were obtained through the 4 stress zones. The definition in 4 zones, were based on the thermoneutrality center using air temperature (minimum and maximum) and relative humidity (RH), which are based on [22] and [23], and the laying lineage manual [24].

Table 1 describes each of them:

Table 1 - Comfort zones according to THI.

Zone	THI	Stress Level
1	< 67,16	Mild Stress
2	67,16 to 76,96	Thermoneutrality
3	76,97 to 89,85	Heat Stress
4	> 89,96	Emergency

Source: Adapted from [22] and [23], and the laying lineage manual [24].

Data Mining: The second stage of the study consisted of carrying out the Data Mining process and this was divided into distinct phases, which were cyclically followed, to allow for new considerations and reassessments concerning the domain and the inclusion or exclusion of attributes, according to the methodology proposed by the CRISP-DM consortium [25].

The data were computationally processed using the Weka® program version 3-8-3 [17] and using the J48 algorithm as applied by [20]. The task that should be used in the analyzes will be the classification, with the construction of decision trees.

The models induced with a variation in the number of instances (or observations), per sheet, were evaluated using the cross-validation method. Pruning of attributes that did not contribute to the performance results of decision trees was carried out. The selection of the best model was made based on the measures: precision; the number of leaves (rules) and the Kappa coefficient.

The Kappa coefficient is used to describe the measure of agreement between the predicted and

observed classes. This coefficient ranges from 0 to 1, representing very poor to excellent classification results, respectively [26].

As a result of the decision tree model induction, it was possible to obtain the confusion matrix, which according to [27] is widely used in the statistical analysis of concordance.

From the confusion matrix, according to [26], it was possible to obtain performance evaluation measures.

4. RESULTS AND DISCUSSION

Through the data that was organized for the period, in an Excel® spreadsheet for each aviary and classified in THI ranges, a file compatible with the Weka® software was built, which is a text file, formatted to organize the collected data, with its attributes corresponding to the values and the comfort range understudy that was determined, this file receives the extension ".arff".

With the ".arff" files completed, they were executed with the Weka® software, applying the classification procedure with the choice of the J48 algorithm as applied by [20], which resulted in the construction of the answer outputs for the construction of the decision trees of this research.

Annual analysis for THI indicator
Pyramidal aviary (A1):
The file with extension ".arff" referring to the data of the pyramidal aviary (A1) of the summer for THI (temperature and Humidity Index), used the attributes of the database referring to the sensor readings for dry bulb temperature, relative humidity, THI and stress status of the birds and the result of the processing in the software generated the corresponding decision tree that is presented in algorithm format:

(The numbers indicated in parentheses indicate the number of processing instances that were selected with this classification indicated in the line of the algorithm).

THI <= 76.94
| THI <= 67.13: Mild Stress (171.0)
| THI > 67.13: Thermoneutrality (330.0)
THI > 76.94: Heat Stress (242.0)

The algorithm obtained as a mining model leads to classification with 99.73% correct answers.

The Kappa index has a value of 0.9958, which according to the methodology proposed by [26] allows us to infer that the classifier obtained from mining is excellent, as the value is very close to 1, which indicates the best condition.

Air-conditioned vertical aviary (A2):
The file with extension ".arff" referring to the data of the air-conditioned vertical aviary (A2) for THI (temperature and Humidity Index), used the attributes of the database referring to the sensor readings for dry bulb temperature, relative humidity, THI and stress status of the birds and the result of the processing

in the software generated the corresponding decision tree that is presented in algorithm format:

(The numbers indicated in parentheses indicate the number of processing instances that were selected with this classification indicated in the line of the algorithm).

THI <= 76.96
|　　THI <= 67,08: Mild Stress (49.0)
|　　THI > 67.08: Thermoneutrality (580.0)
THI > 76.96: Heat Stress (157.0)

It is observed that the algorithm obtained as a mining model leads to classification with 99.61% correct answers. The Kappa index, in this case, also reached the value of 0.9907, which according to the methodology proposed by [26] allows us to infer that the classifier obtained from mining is also excellent.

Vertical unheated poultry house (A3):
The file with extension ".arff" referring to the data of the non-conditioned vertical aviary (A3) for THI (temperature and Humidity Index), used the attributes of the database referring to the sensor readings for dry bulb temperature, relative humidity, THI and stress status of the birds and the result of the processing in the software generated the corresponding decision tree that is presented in algorithm format:

(The numbers indicated in parentheses indicate the number of processing instances that were selected with this classification indicated in the line of the algorithm).

THI <= 67.14: Mild Stress (78.0)
THI > 67.14
|　　THI <= 76.22: Thermoneutrality (227.0)
|　　THI > 76.22
|　　|　　dbt <= 26.755: Thermoneutrality (4.0)
|　　|　　dbt　>26.755: Heat Stress (2.0)

It is observed that the algorithm obtained as a mining model leads to classification with correct answers of 98.71%. The Kappa index obtained, in this case, had a value of 0.9663 which according to the methodology proposed by [26] allows us to infer that the classifier obtained from mining, in this case, is also excellent.

In this research, the three aviaries, after pruning the attributes that did not contribute to the results, it is observed that only the THI indicator was used in the decision trees, which shows that the Temperature and Humidity Index using based on an adaptation of the equation proposed by [21], it is a tool that helps a lot in the process of controlling thermal comfort conditions for production warehouses in countries with a tropical climate like Brazil.

Thus, the proposed alert system, in the year 2013, can be applied to warehouses (A1), (A2) and (A3) based on the generation of trees for the three breeding models as a basis for algorithms for the generation of an alert system with high precision that was indicated by the results of the Kappa indices.

As presented in theory by [17], the trees corresponding to warehouses (A1) and (A2) have a size equal to 5 with three decision branches.

The tree generated for the shed (A3), as indicated by [17], the size obtained was equal to 7 with 4 decision branches, thus being a little more complex in terms of processing.

In summary, the technique finally allowed the construction of decision trees which, in the chosen sheds, were classified with respectively 99.73%, 99.61% and 98.71% of correct answers and with Kappa indexes equal to 0.9958, 0, 9907 and 0.9663, which indicate that the three classifiers constructed were excellent as indicated by the authors [26].

The warehouses (A1) and (A2) are very close in their results to the classifiers with accuracy in their hits always greater than 99%, although the construction characteristics are very different, which can be a point to be considered by producers in the region when the definition of the type of house to be built aiming at the thermal comfort of birds based on THI, meeting the comfort indications made by [14].

The shed (A3), on the other hand, brought slightly fewer precision results, but even more than 96%.

The Kappa indicators in the three cases were excellent, which indicates that the trees allowed the design of a support system for the decision of high-quality discrimination regarding the monitoring of THI.

Thus, we observed that the proposed system, having in its motor algorithm the construction of the coding with the decision trees constructed as indicated by [15] due to the computational application, can serve as a basis for the construction of an alert system with great accuracy to be applied to the three warehouses simultaneously.

From this study, producers can monitor and act to mitigate heat stress problems for their three breeding models simultaneously with a single computer program that will generate THI-based alerts.

5. CONCLUSION

Through the legacy database used, it was possible to identify the thermal comfort bands that were used for the development of the scenarios created for the construction of decision trees with the return of classification.

The generated models allowed us to identify and predict environmental conditions for laying hens in the production phase that presented excellent Kappa coefficient performance in the study cases, using the THI indicator as a priority.

The study allowed prospecting by an indicator that allowed trees to be generated for the three shed models simultaneously, with great accuracy in classification, taking advantage of a legacy database and which provided the basis for building a future information system for supervision and control of the sheds understudy in the city of Bastos in São Paulo/Brazil.

6. ACKNOWLEDGMENT

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Process of Establishment And In Vitro Development of Simaba Cedron Planch Seedlings. (Simaroubaceae)

Abstract Marcia Santos de Freitas Lira

Federal University of Pará (UFPA),
Belém - PA, Brazil.

Simone da Silva

Amazon Biotechnology Center (CBA),
Manaus - Amazonas, Brazil.

Fábio Leandro Calderaro

Amazon Biotechnology Center (CBA),
Manaus - Amazonas, Brazil.

Jandecy Cabral Leite

Institute of Technology and Education Galileo Amazon (ITEGAM),
Manaus - Amazonas, Brazil.

Abstract

Simaba cedron, popularly known as "cedron", is largely used for fever and snake bites. Its seeds are used in the treatment of stomach problems and liver infections. The fruits are used for the treatment of pain and malaria while its bark is an antispasmodic. Simaba cedron is generally propagated through seeds, but with limited success, as the low viability of same restricts its propagation. In view of such difficulty, it becomes necessary the study for adequate conditions for the large scale production of these seedlings. Being it known that in several species, the use of micropropagation has made it possible to obtain a large amount of disease-free and more homogeneous seedlings, in reduced time and physical space, in comparison with conventional propagation methods, the objective of this work was to analyze the effect of two culture media on the production of aseptic parent plants as a first step in the development of a micropropagation protocol for Simaba cedron. The seeds were collected from a matrix plant located in the Amazon Biotechnology Center (CBA), in Manaus/AM. The experiment was installed at the Vegetable Tissue Culture Laboratory, where the explants were desinfected and grown in culture medium according to Murashige & Skoog (MS) and in Wood Plant Medium (WPM), during 60 days. The disinfestation rate obtained was 75% and, of the disinfested seeds, 100% germinated. The cultivation medium that was more favorable to the cultivation of simaba was the MS, where the multiplication rate was of 8.0: 1, whose seedlings reached, in average, 4.8 cm and 75% of rooting.

Keywords: Plant tissue culture; Micropropagation; Plant production and Biotechnology.

1. Introduction

The Simaroubaceae family consists of approximately 32 genera and 200 species, distributed in all tropical and subtropical regions of the globe. In Brazil it is represented by *Quassia* and *Picrolemma* genera in the Amazon region; *Castela* and *Picrasma*, in the South of the country; *Simaba* and *Simarouba* in almost all Brazilian (Hall *et al*., 1983; Devecchi, 2018). *Simaroubaceae* usually appear as trees or shrubs, with a distinctive bitter flavor in their cortex (Kletter and Kriechbaum, 2001; Seth, 2003; Vermeulen, 2008). So, many species of this family (*Quassia amara, Picrasma excelsa, Jamaica quassia*) have been known for more than a century due their bitter substances denominated "*quassina*", a name borrowed to all this class of composts structurally related, called quassinóides (Polonsky, 1973).

Simaba cedron Planch popularly known as cedron, it is widely used for the treatment of fevers and snake bites. Its seeds are used to treat stomach problems and liver infections (Kufer, 2005; Ocampo and Mora, 2011; Giovannini and Howes, 2017). The fruits are used for colic and malaria treatment, while the peel is used as an antispasmodic (Gupta, 1995). Ext Simaba extracts, from the species *Simaba cedron* (Planchon), *S. cuspidata* (Spruce), *S. moretii*, *S. multiflora* (Adr. Juss), *S. guyanensis* (Alblet Engl.) are used in the manufacture of cosmetic or pharmaceutical composition and, particularly dermatological, or in cell culture medium of the skin due to their significant activity on the depigmentation of the skin and in the differentiation of keratinocytes, and can be used in the treatment of skin disorders, in particular vitiligo and psoriasis (Bonte *et al*.,1997).

Simaba cedron is generally propagated by seeds, which can bring about genetic variations that, consequently, influence the content of the active principles present in plants. For many forest species of economic importance or in danger of extinction, micropropagation has been a useful tool for obtaining more uniform seedlings on a large scale, in reduced time and space (Dousseau *et al*., 2008). *In vitro* cultivation, through micropropagation, is a viable method for the multiplication of several native species, providing the formation of homogeneous plant populations, thus enabling the production of seedlings with high health and vigor. (Souza *et al*., 2007).

Several criteria are important for the establishment of *in vitro* cultures, such as the choice of explant type and nutrient medium. Although, theoretically, any tissue can be used as a source of explant, some aspects must be considered and tested regarding the choice of the most suitable to the morphogenic processes of interest (Grattapaglia and Machado, 1998).

In micropropagation, the use of efficient methods of disinfestation and germination, *in vitro*, of seeds, allows obtaining aseptic plants that supply contaminant-free propagules which can be used for multiplication and later rooting *in vitro* or ex *vitro* (Grattapaglia & Machado, 1998). Several substances have been used for the disinfestation of seeds of tree species, among which the hypochlorite (sodium or calcium) stands out, due to the ease of removing the tissue from the seeds during washing with water, by favoring germination due to the ability to stimulate α-amylase activity and, furthermore, by promoting the breaking of dormancy of the seeds of some species (Kaneko and Morohashi, 2003). As for nutritional means, there exist distinct formulations that must be adjusted to each species. The MS medium (Murashige & Skoog, 1962) and their dilutions are usually the most used. However, there are formulations specific to certain groups of plants, such as, for example, the WPM medium (Lloyd and McCown, 1981), more

common in woody species (Caldas *et al*., 1998).

In an attempt to optimize the *in vitro* growth of plant tissues, several studies propose the reduction or increase of some macro and/or micronutrients that compose these culture media, better meeting the nutritional requirements of each species, such as the 23 modified media for black mulberry (*Rubus* sp.) and grapevine (*Vitis* sp.) (Villa *et al*., 2008; Villa *et al*., 2009).

Due to the importance of this plant for multiple purposes and the conventional method of propagation by seed germination, which can cause differences in the composition of its active principles, actions involving the production of standardized seedlings are essential to outline strategies aimed at conservation, management sustainable development and genetic improvement of this specie (Debnath and Bisen, 2006; Podile and Kishore, 2007; Chadwick *et al*., 2013). The objective of this work was to evaluate the influence of the use of two different culture media on the establishment and *in vitro* development of *Simaba cedron* seedlings, as a first step in the development of a micropropagation protocol for the species (Ocampo and Mora, 2011).

2. Materials and Methods

Simaba cedron seeds collected from a parent plant at the *Amazon Biotechnology Center*, in Manaus/AM, were taken to the Plant Tissue Culture Laboratory, where they were washed with liquid detergent (of commercial origin) and running water and subsequently immersed in autoclaved distilled water for 24 hours. After this period, they were immersed in a commercial detergent solution for thirty minutes (under agitation) and, immediately afterwards, in autoclaved distilled water for twenty minutes.

Then, in a laminar flow chamber, they were disinfected with successive washes in 70% alcohol for 5 minutes, followed by immersion in sodium hypochlorite (2% active chlorine) for 30 minutes, and washed (three times) in sterile distilled water, for 5, 5 and 15 minutes. The seed coat was removed and they were inoculated in glass flasks (250 ml) containing 40 ml of basic culture medium of basic composition according to Murashige & Skoog (1962), without growth regulators (MS0), supplemented with 3% sucrose; 4.1 μM nicotinic acid; 0.6 mM myo-inositol; 2.4 μM pyridoxine-HCl; 1.5 μM thiamine-HCl and solidified with 2% phytagel. The pH was adjusted to 5.8 and the media were sterilized in an autoclave at 120 ^{0}C and 1.1 Kgf/cm^2, for 15 minutes.

Cultures were kept in the dark, at $25 \pm 1°C$, for one week. After this period, they were kept under lighting, with fluorescent lamps (Sylvania, Phillips/daylight) with intensity of 30.0 μ moles.m^{-2}.s^{-1}, and 16 hours of photoperiod. Daily observations were made, evaluating the development and the percentage of contamination. When the seedlings reached the maximum free height of the test tubes (8 cm), they were used as donors of explants for the tests with the culture media MS (Murashige & Skoog, 1962) and WPM (Lloyd & McCown, 1981) (Table 1). Each explant or phytomer consisted of a nodal region, without leaves, with an approximate size of 1 cm.

Table 1 - Composition of MS culture media.

Components	MS (mg/L)	WPM (mg/L)
Macronutrients		
$CaCl_2.2H_2O$	440	96
$Ca(NO_3)_2.4H_2O$	-	556
KH_2PO_4	170	170
KNO_3	1900	-
K_2SO_4	-	990
$MgSO_4.7H_2O$	370	370
NH_4NO_3	1650	400
Micronutrients		
$CoCl_2.6H_2O$	0,025	-
$CuSO_4.5H_2O$	0,025	0,25
H_3BO_3	6,2	6,2
KI	0,83	-
$MnSO_4.4H_2O$	22,3	22,3
$Na_2MoO_4.2H_2O$	0,25	0,25
$ZnSO_4.7H_2O$	8,6	8,6
FeEDTA		
$FeSO_4.7H_2O$	27,8	27,8
Na_2 EDTA.$2H_2O$	37,3	37,3
Orgânics		
Nicotinic Acid	0,5	0,5
Glycine	2,0	-
Myo-inositol	100	100
Pyridoxine.HCl	0,5	0,5
Thiamine	0,1	1,0
Sucrose (g / L)	30	20

Source: Murashige and Skoog, (1962) and WPM (Lloyd and McCown, 1981).

The experimental design was completely randomized, with two treatments and three repetitions, using 30 explants for each treatment, which were performed in triplicate. The evaluations were performed after 60 days of cultivation. The data obtained regarding the effect of different culture media (MS and WPM) on the height of the seedlings, the number of shoots and nodal segments per shoot and the multiplication rate were evaluated by analysis of variance (ANOVA) and the averages were compared by the Tukey-Kramer test, at the 5% significance level.

These analyzes were performed using the *Graph Pad in Stat*, version 3.01. For the analysis of the germination and rooting percentages, according to the medium used, the difference test between percentages (p_1 and p_2) was used at the 5% level of significance using the Statistic for Windows[TM] software, version 5.0.

3. Results and Discussion

After five days of cultivation, it was observed that 75% of the seeds were aseptic, being used for the beginning of the culture, of which 100% germinated. The break in integumentary dormancy and pre-asepsis of the seeds allow the establishment *in vitro* of plants of *S. cedron*. The hypochlorite may have acted as a germination stimulant, due to the ability to stimulate α-amylase activity by increasing the amount of this enzyme in the seed, or even by promoting the breaking of seeds dormancy in some species (Kaneko and Morohashi, 2003).

For Silva (2015), when carrying out experiments with *Quassia amara*, obtained a disinfestation rate of 28% and, of the disinfested seeds 83% germinated in MS0 medium.

Developmental evaluations in WPM were compared with those obtained from seedlings grown in MS medium. Significant differences occurred between the culture media MS and WPM for the length of the aerial part of *S. cedron*, because, when using the MS medium, seedlings with an average height of 4.8 cm were obtained, while those cultivated in WPM medium had a 2.4 cm growth (Figure 1 and Table 2).
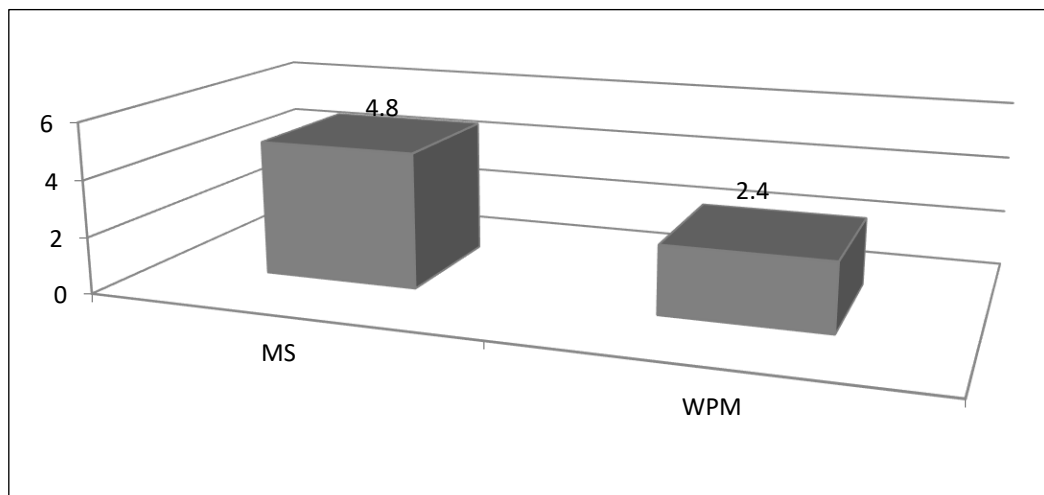

Figure 1 - Medium height of *Simaba cedron*, after 60 days of cultivation in MS and WPM media.
Source: Authors, (2020).

Figure 2 - *Simaba cedron*, after 60 days cultivation in MS medium.
Source: Authors, (2020).

Table 2 - Effects of MS and WPM culture media on in vitro cultivation of *Simaba cedron*.

Evaluated Parameters	MS	WPM
Height (cm)	4,8[a]	2,4[b]
Number of shoots	1,5[a]	1,3[a]
Number of nodal segments per shoot	8,0[a]	3,0[b]
Multiplication rate	8,0:1,0[a]	3,0:1,0[b]
Rooting rate (%)	75[a]	0[b]
Callogenesis rate (%)	38[b]	70[a]

Source: Authors, (2020).

When elaborating the tissue culture protocol of *Quassia amara* in MS medium, Silva (2015), obtained seedlings that reached an average of 5.23 cm, at 60 days of cultivation, while those cultivated in WPM medium originated seedlings with an average height of 1.39 cm.

Lencina *et al*. (2014), when carrying out experiments with grápia (*Apuleia leiocarpa Vog. Macbride*) observed that there was no significant difference between the culture media WPM, MS and MS ½ for the length of the aerial part, number of leaves and length of the root, after 15 days of cultivation.

In plants of *Cordia trichotoma*, it was verified growth of the aerial part (1.6 cm) and of the root (7.3 cm) significantly higher in cultures in WPM medium, when compared to those carried out in MS ½ culture medium (0.7 and 1,3 cm respectively), at 28 days of evaluation (Fick, 2007).

Regarding sprouting, the results obtained with the MS and WPM medium were statistically similar, with an average production of 1.5 and 1.3 sprouts, per explant, respectively (Figure 3 and Table 2).
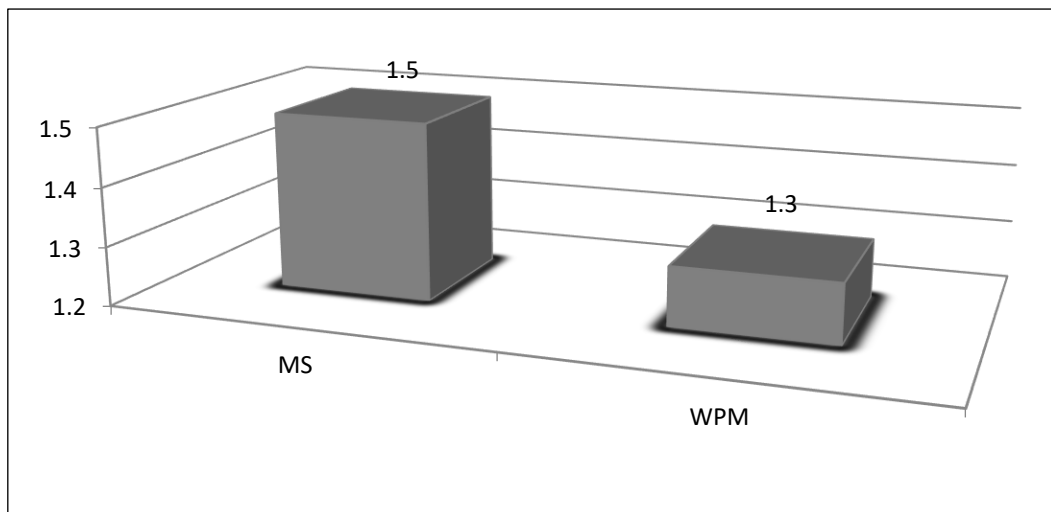
Figure 3: Average production of *Simaba cedron* shoots, after 60 days of cultivation in MS and WPM media.
Source: Authors, (2020).

In micropropagation, plants with a greater number of nodal segments or axillary buds are preferred, considering that these types of propagules have less somaclonal and epigenetic variation (Torres *et al.*, 1999). In this study, there was a significant difference between the MS and WPM culture media for the number of nodal segments (Table 2), indicating that the culture medium influenced the *in vitro* growth of Simaba seedlings, where the MS medium led to seedling development with, on average, 8 nodal segments, each. While WPM medium promoted the average development of 3 nodal segments per seedling. However, the WPM culture medium was used in the experiments because of its formulation, which was developed especially for woody species and presents 25% of the concentrations of nitrate and ammonia ions of the MS medium (Melo *et al.*, 1999), stimulating *in vitro* growth due to low concentrations of nitrogen in ammoniacal form (Grattapaglia & Machado, 1998). In addition, the WPM culture medium has a higher amount of vitamin thiamine - HCl, when compared to the MS culture medium (Table 1). Thiamine is identified as a beneficial substance for *in vitro* multiplication, allowing greater bud induction in explants of tree species (Mantovani & Franco, 1998), thus justifying its use in these experiments.

Compared to the MS culture medium, the WPM medium proved to be more suitable for the *in vitro* establishment of lash horse plants (Luehea divaricata Mart. & Zucc.), In which a greater number of nodal segments per shoot was observed (4,9) and greater rooting of explants (66.8%), after 60 days of evaluation (Flôres, 2007).

Regarding the multiplication rate, the best result was obtained in seedlings grown in the MS0 medium, where the production of an average of 8.0 new seedlings per explant was observed, after 60 days of cultivation (Figure 4 and Table 2). Hassan *et al.*, 2012, report that when working with Eurycoma longifolia, a species from the same botanical family as Simaba, they obtained a higher multiplication rate in MS0 than in WPM.
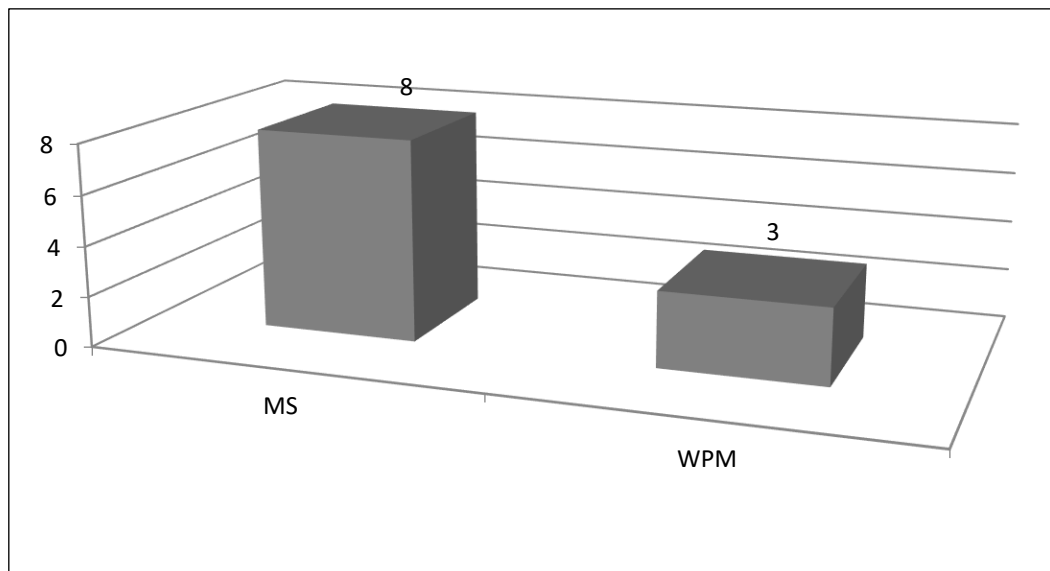
Figure 4: Multiplication rate of *Simaba cedron* after 60 days of cultivation in MS and WPM medium.
Source: Authors, (2020).

For Silva (2015), obtained a multiplication rate of 3.75: 1 when cultivating *Quassia amara*, for 60 days in MS medium, while seedlings grown in WPM medium generated a multiplication rate of 3.05: 1.

As for the seedling rooting, the maximum rooting rate (75%) was obtained in MS0 medium. The WPM medium did not promote rooting in 60 days of cultivation (Table 2). Rooting *in vitro* depends on the genotype of the plant, and can occur naturally during the micropropagation process, so that the use of growth regulators in the culture media can be avoided (George & Sherrington, 1984). The medium MS ½ was used to analyze the *in vitro* rooting process of *E. longifolia*, since it was observed that the concentration of lower mineral salts helps to increase the percentage, length and number of roots in other species. However, the reaction can vary between cultivars of the same species. It has been suggested that the proportion of carbon/nitrogen and nitrogen compounds in auxin metabolism affects the rooting process. On the other hand, limited nutrients may affect the production and development of the entire plant root system *in vitro* (Karhu, 1997).

For Silva (2015), when working with *Q. amara*, obtained 25% of rooting when using the MS medium and no evidence of root formation, with the use of WPM.

As for callus formation, it occurred in all treatments tested, however, in WPM medium it was observed in 70% of explants (Figure 5 and Table 2). This rate of callogenesis can be attributed to the adaptation of explants to *in vitro* culture conditions, (Oliveira *et al*., 2000).
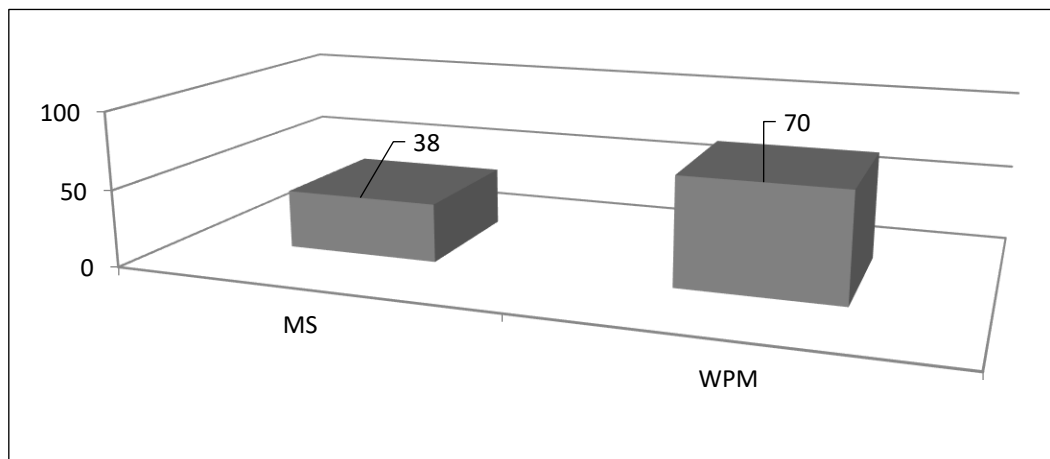
Figure 5: Callogenesis rate of *Simaba cedron*, after 60 days of cultivation in MS and WPM medium.
Source: Authors, (2020).

The stage of *in vitro* establishment which precedes the phases of *in vitro* cultivation itself is fundamental for the success in the development of a micropropagation system, mainly for native woody species. The composition of the culture medium, in relation to macro and micro elements and organic elements are fundamental. In this sense, when starting a biotechnological process with plant cells, one must, in the first instance, establish the appropriate formulation of the medium that will be used (Drapeau *et al*., 1986).

Micropropagation or *in vitro* propagation has the purpose of producing seedlings of high genetic and phytosanitary quality and has contributed to prevent the extinction of many plant species. Because the plants worked are genetically standardized, the interference of genetic variability in the results can be eliminated. Consequently, the results obtained are effects of the variables introduced in the process by the experimenter (Silva and Astolfi Filho., 2018).

4. Conclusion

The disinfestation process used guaranteed the asepsis of 75% of the seeds, however, it is possible to improve this percentage through new experiments related to the concentrations and immersion times in the disinfesting agents. The MS0 medium can be considered the most suitable for the development of the other micropropagation stages of this species, since in this medium the plants had a multiplication rate of 8,0: 1 and 75% of rooting of explants, at 60 days of cultivation.

5. Acknowledgments

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Yield parameters and water productivity of tropical and overseeded winter forages

Arthur Carniato Sanches; Débora Pantojo de Souza; Fernanda Lamede Ferreira de Jesus; Fernando Campos Mendonça; Eder Pereira Gomes; José Ricardo Macedo Pezzopane; Rodrigo Couto Santos; Adriano Bicioni Pacheco; Cristiane Fernandes Lisboa; Raimundo Rodrigues Gomes Filho

Corresponding Author's name, address, affiliation and e-mail: Rodrigo Couto Santos, Rodovia Dourados-Itahum, km 12. Campus Universitário (Unidade II) - Caixa-Postal: 533, CEP: 79804-970. Dourados, MS – Brasil, Faculty of Agricultural Sciences / Federal University of Grande Dourados, rodrigocouto@ufgd.edu.br, fone: +55(67)981908799

Abstract

Intensive pasture exploitation with tropical forages is one of the most efficient forms ruminant production. However, the results depends on the knowledge about these forages and the experience in its management. The objective of this work was to evaluate water productivity (WP) and yield parameters of Megathyrsus maximum cv. Mombaça "Guinea grass" and Cynodon spp. "Bermuda grass", in single culture and overseeded with oats + ryegrass in autumn/winter period. Irrigation management was done considering a depletion factor of 0.3 (70% of the humidity the field capacity). The experimental design was a randomized complete block design with four replications, in which the forages are the treatments with evaluation at the time of the cycles. For all evaluated parameters, the best results were obtained with the Guinea grass in exclusive cultivation. The TFP (Total Forage Productivity) of Guinea grass was superior to Bermuda grass (59.3 and 30.2 Mg ha^{-1}, respectively), in accordance with its average LAI (Leaf area index) values of 4.8 and 2.5, respectively. The most efficient use of water occurred for Guinea grass in exclusive cultivation, and the intercropped crops did not present increases in the WP. In the autumn/winter period, the accumulated TFP of the exclusive crop of Guinea grass was higher than the other crops. However, the SDM of Bermuda grass was higher than the other crops. In winter, the highest LAI occurred in Guinea grass in exclusive cultivation, followed by the overseeded Guinea grass, 4.8 and 4.5, respectively. Consortia did not increase forage yield during the winter. The consortiums did not increase forage yield during the winter.

Keywords: Pasture irrigation, tropical forages, dry matter yield and water use efficiency.

1. Introduction

A great challenge for human society is the production of enough food to feed a growing population, which is highly dependent on the expansion of irrigated agricultural land (Liu 2011). However, the use of innovative practices that increase the efficiency of water use is a constant challenge toward the goal of food security (Liu 2011; Levidow et al. 2014). Forages are a major component of global agroecosystems that

contribute significantly to world food production. Contrary to popular belief, forages benefit the ecosystem via soil erosion prevention, air and water purification, impact mitigation of greenhouse gasses, and providing wildlife habitats (Putnam and Orloff 2014).

In recent years, the increased use of technologies has allowed for increased cattle productivity, and this is dependent on the constant improvement of their main food resource – pastures (Soares et al. 2015). In a climate that favors plant growth, the key to ruminant production is in a diet derived from forage, grown either for grazing or for storage and later use (Morris & Kenyon 2014; Chobtang et al. 2017a, 2017b).

Pasture irrigation is a promising technique to maintain crops during periods of drought, when forage plants display pronounced seasonality, which is reflected in livestock production (Mochel Filho et al. 2016). However, when the productivity of irrigated and non-irrigated pastures is compared, irrigation yields an increase in average daily forage accumulation between 25 and 55 kg ha^{-1} d^{-1} (Gomes et al. 2015b; Sanches et al. 2015, 2016, 2017; Dantas et al. 2016).

Thus, the use of irrigation has led to the development water productivity (i.e. water use efficiency), which seeks to quantify the unit return of each unit of water volume used in the production of dry matter (Neal et al. 2011). Dantas et al. (2016) compared water use efficiency in tropical forages during different seasons and observed that it was higher in autumn than in winter, measuring 8.8 and 6.5 kg ha^{-1} mm^{-1}, respectively. In a study with *Brachiaria decumbens* (Syn. *Urochloa decubens*), yields of 44.3 and 21.2 kg ha^{-1} mm^{-1} were obtained at supplemental irrigation depths of 3.8 and 10.5 mm d^{-1}, respectively (Lopes et al., 2014).

Although water use efficiency is an important indicator, it should not be used in isolation, as it may result in inaccurate cultivation strategies that do not generate a return on investment. As in the case of fertilizers, the benefits obtained from irrigation follow a law of diminishing returns. De Paula Lana (2009) developed a function that allows for the calculation of an optimal economic level of fertilization that is based on the benefit-cost ratio. Like fertilizers, water is a scarce resource and when applied by irrigation, one has to aim for the best possible return in crop yields.

Forage production throughout the year does not constantly meet the requirements of the animals, and although irrigation attenuates over the course of the seasons, it does not eliminate it (Sanches et al. 2015). Thus, the consortium between summer and winter forages or overseeded winter forage, can optimize forage production in the winter period and prolong the annual period of pasture utilization, as well as improve forage quality (Silveira et al. 2015).

In pastures of *Cynodon spp.*, there is a possible synergy with overseeded winter forages, indicated by the low oscillation of the qualitative variables and significant quantitative contributions to forage production (Castagnara et al. 2012; Da Silva et al. 2012; Neres et al. 2012; Aguirre et al. 2014, 2016; Gomes et al. 2015a; Sanches et al. 2015). Two studies with coast-cross grass in Santa Maria/RS, (Aguirre et al. 2014, 2016) showed positive effects of overseeding in the winter, with a daily forage accumulation rate of 44.7 and 37.8 kg DM d^{-1}, for crops overseeded with clover and exclusive coast-cross grass, respectively.

In studies with Tifton 85 grass in the northwest region of Paraná (Gomes et al., 2015a; Sanches et al. 2015), it was observed that oat overseeding significantly increased the leaf/stem ratio between 50 and 60%. In Dois Vizinhos-PR, an experiment was conducted with Cynodon nlemfuensis Estrela Africana that was overseeded with *Lotus corniculatus L.* and ryegrass (Silveira et al., 2015); however, the consortium did not change the total forage production.

The objective of this study was to evaluate water productivity, botanical composition, and yield parameters (total forage productivity - TFP, canopy height - CH and leaf area index - LAI) of Guinea grass (*Megathyrsus Maximum* Mombaça, Syn. *Panicum Maximum*) and Bermuda grass (*Cynodon spp*.) in exclusive cultivation throughout the year, and when overseeded with black oats + ryegrass during the autumn/winter cultivation period.

2. Material and Methods

2.1 Experimental site and forages

The experiment was conducted between February 2016 and February 2017 in an experimental area of the Department of Biosystems Engineering at the "Luiz de Queiroz" School of Agriculture - ESALQ / USP, in Piracicaba-SP, Brazil (lat. 22º42'S, long. 47º37 'W, altitude 546 m).

According to the Köppen classification, the climate of the region is of a Cwa - subtropical or tropical type (Pereira et al. 2016). During the experimental period, the accumulated rainfall was 1457.6 mm and total water supplementation by irrigation was 570.7 mm (Figure 1).
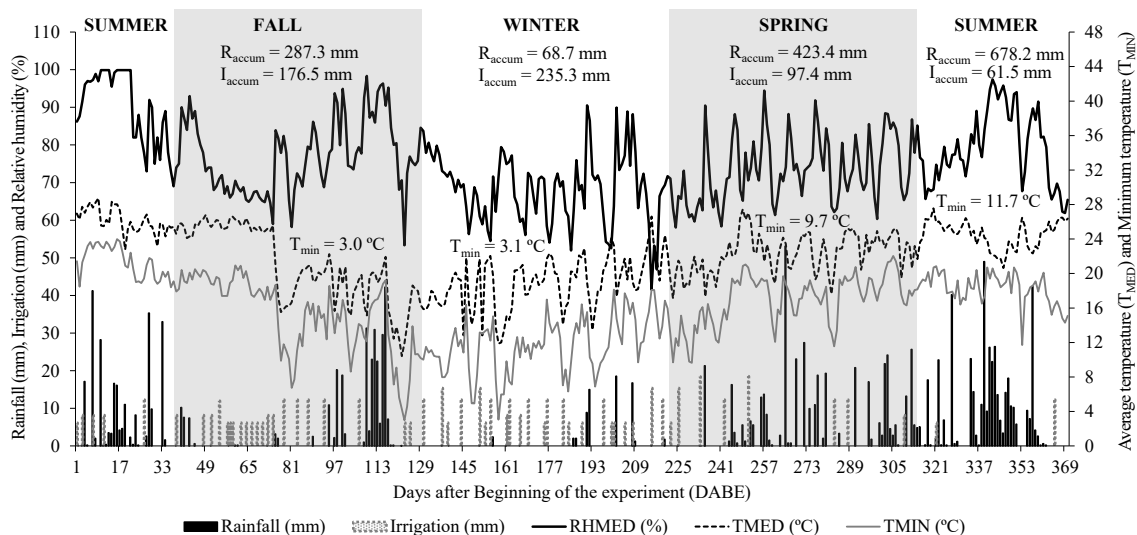
Figure 1. Precipitation values (mm), relative humidity (%), minimum temperature (ºC) and average temperature (ºC) during the experimental period between 02/2016 and 02/2017 (Piracicaba City 2016/17).

Legend: Raccum = accumulated rainfall in the period, Iaccum = accumulated irrigation in the period, Tmin = minimum temperature presented in the period.

The soil in the experimental area is classified as Clayey Oxisol 'Nitossolo Vermelho Eutroférrico Latossólico in brazilian classification' (Weil and Brady, 2016). In the previous year (2015), conventional soil preparation included plowing and harrowing, weed control, pH correction with the application of 4 mg ha^{-1} dolomitic limestone and basic fertilization according to criteria established by Raij et al. (1997) and based on chemical and granulometric analysis (Table 1).

Table 1. Chemical and granulometric analysis of the soil of the experimental area in the 0-20 cm and 20-40 cm layers (Piracicaba City 2016)

Layer	pH	P	K Al	Ca	Mg	H+Al		CEC	Sand	Silt	Clay
(cm)	CaCl$_2$	mg dm^{-3}		cmol$_c$ dm^{-3}				cmol$_c$ dm^{-3}	(%)	(%)	(%)
0 – 20	5,3	72	0,94	3,9	1,8	3,1	0,2	9,74	35,7	19,2	45,1
20 – 40	4,9	31	0,44	1,3	1,0	4,2	0,2	6,94	29,3	18,7	52,0

P = phosphorus; K = potassium; Ca = calcium; Mg = magnesium; H + Al = potential acidity; Al = exchangeable aluminum; CEC = cation exchange complex.

During the experiment, nitrogenous fertilization fractionated with urea was applied after each growth/cut cycle at the rates of 80 kg ha^{-1} cycle^{-1} and 50 kg ha^{-1} cycle^{-1} of N in the spring/summer and autumn/winter periods, respectively. Recent studies of irrigated pastures have shown that nitrogen split application provides good productive results, with fertilization varying between 40 kg ha^{-1} cycle^{-1} and 100 kg ha^{-1} cycle^{-1} (Magalhães et al. 2012; Gomes et al. 2015b; Sanches et al. 2017).

The forages we used were Guinea grass (Megathyrsus maximum cultivar Mombaça, Syn. Panicum Maximum) and Bermuda grass (Cynodon spp.), in either exclusive cultivation or overseeded with the winter forages black oats (Avena strigosa. Embrapa 29 - Garoa) and ryegrass (Lolium multiflorum Fepagro São Gabriel) in the fall/winter period. The experiment was conducted with four treatments and four replicates, totaling 16 experimental plots that were designed as follows: treatment 1, Guinea grass grown alone from 02/12/16 to 13/02/17, with 12 regrowth cycles (12 RC); treatment 2, Guinea grass + black oat + ryegrass grown from 05/07/16 to 09/22/16 (4 RC); treatment 3, Bermuda grass grown alone from 02/19/16 to 02/15/17 (14 RC); and treatment 4, Bermuda grass + black oats + ryegrass grown from 04/30/16 to 10/14/16 (6 RC) (Table 2).

Table 2. Dates and cut periods of the exclusive and overseeded grasses performed during the experimental period (Piracicaba City 2016/17)

RC	Treatment 1**	Treatment 2***	Treatment 3**	Treatment 4***
	Period (Cycle interval - Start and End)			
1º	02/12 - 03/11/2016	------	02/19 - 03/18/2016	-------
2º	03/12 - 04/08/2016	------	03/19 - 04/08/2016	-------
3º	04/09 - 05/06/2016	------	04/09 - 04/29/2016	-------
4º *	05/07 - 06/15/2016	05/07 - 06/15/2016	04/30 - 06/01/2016	04/30 - 06/01/2016
5º	06/16 - 07/25/2016	06/16 - 07/21/2016	06/02 - 07/01/2016	06/02 - 06/28/2016
6º	07/26 - 09/03/2016	07/22 - 08/22/2016	07/02 - 08/06/2016	06/29 - 07/22/2016
7º	09/04 - 10/01/2016	08/23 - 09/23/2016	08/07 - 09/08/2016	07/23 - 08/12/2016
8º	10/02 - 10/29/2016	-------	09/09 - 10/11/2016	08/23 - 09/08/2016
9º	10/30 - 11/25/2016	-------	10/12 - 11/01/2016	09/09 - 10/14/2016
10º	11/26 - 12/19/2016	-------	11/02 - 11/22/2016	-------

11º	12/20 - 01/16/2017	-------	11/23 - 12/13/2016	-------
12º	01/17 - 02/13/2017	-------	12/12 - 01/04/2017	-------
13º	-------	-------	01/05 - 01/25/2017	-------
14º	-------	-------	01/26 - 02/15/2017	-------

*First winter cut: fixed with 40 days for exclusive and overseeded, and 33 days for exclusive and overseeded *Cynodon spp*. **exclusive grass cuts, ***overseeded cuts in grasses.

2.2 Experimental site and forages

The irrigation was performed using a fixed and automated conventional sprinkler system with 12 x 12 m (emitters x lines) spacing. The irrigation time was variable according to the water consumption of the crops, which was measured with weighing lysimeters. The application intensity of the sprinklers (Ai) was 12.3 mm h^{-1} with a pressure of 250 kPa. Irrigation was composed of low flow sectorial sprinklers that had restricted irrigation at a 90º angle and a flow rate of 0.592 m^3 h^{-1}.

The applied irrigation blade (IB) was determined by the ratio of the volume consumed by the lysimeter (liters) and its area (m^2), with an effective depth (Z) equal to 60 cm. The previously established irrigation interval was based on a 70% limit of the water availability factor. The moisture at field capacity (θ_{fc}) was considered to be the moisture corresponding to the value of the matrix potential, $\Psi_m = 0.1$ bar (Benevenute et al. 2016). The values of current moisture (θ_c) were estimated by means of the soil water retention curve, which was obtained with the aid of a tensor table and Richards extractor in the Laboratory of Soils and Water Quality of ESALQ/USP and was adjusted with the equation described by Van Genuchten (1980):

$$\theta_c = 0.2938 + \left[\frac{(0.4934 - 0.2938)}{\left[1 + (0.113\Psi_m)^{1.3211} \right]^{0.2431}} \right] ; (R^2 = 1.00 \text{ e } P < 0.01) \qquad (1)$$

where:

Θ_c = current volumetric humidity (cm^3 cm^{-3})

Ψ_m = current matrix potential of water in the soil (bar).

2.3 Experimental management

RC was fixed for the exclusive crops of Guinea grass and Bermuda grass at 21 d and 28 d after the cut (DAC) in spring/summer, and 33 and 40 DAC in autumn/winter, respectively. The height after cutting (residue) was adopted according to the literature at 30 cm for Guinea grass (Simonetti et al. 2016) and 10 cm for Bermuda grass (Sanches et al. 2017). For the overseeded plots, the cutting cycles were variable as a function of the growth of the winter forages as measured with an LAI 2000, in which the first cycle consisted of 40 DAC and 33 DAC in the overseeded cultivation with Guinea grass and Bermuda grass, respectively, in order to establish winter forages. The overseeded Guinea grass a had a post-cut height (residue) of 15 cm; in the Bermuda grass, the height remained the same throughout the growth cycles. The cutting and collecting procedures were repeated until the oats and ryegrass were extinguished from the pastures.

2.4 Parameters evaluated

In the laboratory, samples from the exclusive cultures of Guinea grass and Bermuda grass were submitted to botanical separation (leaf, stem, and dead material) and dried in a forced air circulation oven at 65ºC for

72 hours. The dry matter of the forages was determined: TFP (total forage productivity), LY (leaf yield), SY (stem yield), DMY (dead material yield). In the overseeded cultures, the samples were separated such that the Guinea Grass was separated from the oat + ryegrass, and the Bermuda grass from the oat + ryegrass. Thus, TYOR (total yield of oats + ryegrass), YOLR (yield of oat leaves + ryegrass), and YOSR (yield of oat stems + ryegrass) could be determined; the dead material was not identified and separated because it was in the process of decomposition.

At the end of the cycle, the leaf area index (LAI) and final height of the forage canopy (H) were evaluated. We evaluated the LAI, with a LI 3000C table sensor (LI-COR Environmental, Nebraska, USA). Therefore, 10 samples were chosen randomly to calculate the specific area (cm^2 g^{-1}) by the area (cm^2) in the sensor divided by the dry mass (g) of the tiller (Costa et al. 2016). With the specific area, the LAI was determined according to the equation:

$$LAI = SA * FY; \qquad (2)$$

where;
LAI = leaf area index (dimensionless);
SA = specific area (cm^2 g^{-1});
FY = forage yield (g cm^2);

In order to estimate the water consumption and the water productivity (WP) of the forages, the precipitated and irrigated total were used (Figure 1) from the experimental period in each cycle, taking into account efficient water use. Water productivity was calculated using the following equation:

$$WP = \frac{TFP}{10*(R+I)} \qquad (3)$$

where;
WP - Water productivity in (kg m^{-3})
TFP - Total Forage Productivity (kg ha^{-1})
R + I - Rainfall and Irrigation (mm)

2.5 Data analyses

The experimental data were submitted to analysis of variance ($p \leq 0.05$) and significant averages were compared with the Tukey test ($p \leq 0.05$) using SAS for Windows 7 and Assistat 7.7 (Francisco and Carlos 2016).

3. Results and Discussion

3.1 Biometric and Productive parameters of forages

The highest average leaves and forage yield of the Guinea grass corresponded to the highest leaf area indexes (LAI). Analyzing daily TFP values (Table 3), we measured 162.4 and 86.0 kg ha^{-1} d^{-1} of dry mass for Guinea grass in exclusive and overseeded crop, respectively. Additionally, in exclusive and overseeded Bermuda grass crops, we measured 82.6 kg ha^{-1} d^{-1} and 66.9 kg ha^{-1} d^{-1} of dry mass, respectively. In irrigated cultivation with nitrogen fertilization between August and December, Mochel Filho et al. (2016) conducted an experiment with Guinea grass in Parnaíba-PI that accumulates 141.5 kg ha^{-1} day^{-1} of forage, which was slightly lower than that reported by Silva et al. (2009), who worked with the same grass in Araras-SP and

observed daily forage accumulation rates that were higher than 200 kg ha^{-1} day^{-1} in January, 2001.

Table 3. Average data per cycle of total forage productivity, leaf yield, stem yield, dead material yield, canopy height, leaf area index and water productivity (Piracicaba City 2016/17)

	TFP (kg ha^{-1})	LY (kg ha^{-1})	SY (kg ha^{-1})	DMY (kg ha^{-1})	H (m)	LAI	WPA (kg m^{-3})
Guinea grass	4941 A	4175 A	666 A	100 A	91,3 A	4,8 A	3,3 A
Mom + Oat + Rye	3009 B	2149 B	753 A	107 AB	61,4 B	4,3 B	2,5 B
Cynodon	2154 C	1151 C	873 A	130 A	27,8 D	2,5 C	1,9 C
Cyn + Oat + Rye	1873 C	1108 C	750 A	15 B	44,3 C	2,9 C	1,9 C

Legend: TFP = total forage productivity, LY = leaf yield, SY = stem yield, DMY = dead material yield, H = forage canopy height, LAI = leaf area index, WP = water productivity.

Sanches et al. (2016) performed experiments with Cynodon spp. cultivar Tifton 85 under irrigation in the northwest of Paraná and observed of daily forage accumulation rates of 102.7 kg ha^{-1}d^{-1}, which were higher than the values found for the Bermuda grass (Cynodon spp.) used in this experiment. A probable justification for this difference is the fact that Cynodon spp. were sown months before the experiment and were likely to be a mix between Tifton and Star grass or coast-cross cultivars, which are less productive than Tifton 85.

The average height of the Guinea grass in exclusive cultivation (91.3 cm) was consistent with the literature (Silva et al. 2009; Simonetti et al. 2016); however, the height of the canopy in the overseeded consortium with ryegrass and Guinea grass had an average intermediate value of 61.4 kg ha^{-1} d^{-1} (Table 3), which may be due to the lower cut management, the 15 cm from the soil, in an attempt to guarantee the establishment of winter forages.

The productive values during the summer forage seasons for Guinea and Bermuda grass are presented in Table 4. The highest TFP were observed in the spring/summer period for both Guinea and Bermuda grass, consistent with the results from Aguirre et al. (2016), who worked with coast-cross grass and found greater dry matter yields in the spring/summer period that corresponded to 61.5% of the total annual production. In our experiment, about 60% of the TFP was obtained in the spring/summer period for Bermuda grass Sanches et al. (2016) conducted an experiment with Cynodon spp. cultivar. Tifton 85 in Mariluz-PR and found 71% of the production in irrigated Cynodon in the same period, which confirms that most of the TFP is produced in the hottest and brightest seasons of the year.

Table 4. Mean TFP, LY, SY and LAI data accumulated during the year between seasons for Guinea grass and Cynodon spp. in exclusive cultivation Piracicaba City 2016/17)

		Fall	Winter	Spring	Summer	Average	CV%
PTF	Guinea	13138.6 aB	12752.9 aB	15645.1 aAB	17756.6 aA	14823.3 a	4.97
	Cynodon	5512.9 bB	6584.3 bB	10876.6 bA	7181.0 bB	7538.7 b	15.44
	Average	9325.8 B	9668.6 B	13260.8 A	12468.8 A	11181.0	---
LY	Guinea	10862.6aA	10833.8aA	14177.5 aA	14228.8 aA	12525.7 a	7.31
	Cynodon	2774.8 aA	3762.9 aA	5656.5 aA	3924.6 aA	4029.7 b	16.24
	Average	6818.7 C	7298.4 BC	9917.0 A	9076.7 AB	8277.7	---
SY	Guinea	2029.8 aB	1301.5 bB	1362.7 bB	3304.3 aA	1999.6 b	11.39
	Cynodon	2297.6 aB	2256.0 aB	4929.7 aA	2732.8 aB	3054.0 a	19.89
	Average	2163.7 B	1778.8 B	3146.2 A	3018.6 A	2526.8	---
LAI	Guinea	5.29 aAB	4.76 aB	6.59 aA	6.67 aA	5.83 a	6.83
	Cynodon	2.51 bA	2.41 bA	2.89 bA	2.31 bA	2.53 b	15.44
	Average	3.90 AB	3.59 B	4.74 A	4.49 AB	4.18	---
WP	Guinea	2.62 aB	3.92 aA	3.13 aB	2.53 aB	3.05 a	5.17
	Cynodon	1.90 bA	1.49 bAB	2.18 bA	1.00 bB	1.64 b	14.96
	Average	2.26 AB	2.70 A	2.66 A	1.77 B	2.35	---

Legend: TFP = total forage productivity, LY = leaf yield, ST = stem yield, LAI = leaf area index, WP = water productivity. Capital letters for lines and lower case letters for columns.

Comparing the production of tropical forages throughout the seasons, Guinea and Bermuda grass did not present significant differences in leaf yield; however, Guinea grass was average the higher producer of leaf yield. The stems yield of Bermuda grass was higher in winter and spring, and had the highest overall average. These results may be related to their morphological characteristics, cespitose growth in the habitat, launching of tillers with stolons, and the high stem yield of the Cynodon genus (Gomes et al. 2015a; Aguirre et al. 2016; Sanches et al. 2016, 2017).

The highest values of TFP and LY occurred in the exclusive Guinea grass cultivation plots, with no positive interaction between Guinea grass and the overseeded crops that included oats and ryegrass (Table 5). During the experiment, it was observed that some allelopathy rather than a synergism could have occurred between these species. Cavalli et al. (2016) carried out an experiment with Sudan grass in São José do Cedro-SC and observed allelopathic effects on plant and root growth between Sudan grass and the overseeded black oats and ryegrass.

Table 5. Productive and biometric data in the winter period for the treatments (Piracicaba City 2016/17)

	TFP (kg ha⁻¹)	LY(kg ha⁻¹)	SY (kg ha⁻¹)	DMY (kg ha⁻¹)	H (m)	LAI	WP (kg m⁻³)
Guinea grass	12752.9 a	10833.8 a	1301.5 b	617.6 a	82.6 a	4.8 a	3.92 a
Mom + Oat + Rye	9612.7 b	6249.0 b	2956.3 a	407.5 ab	62.0 b	4.5 a	3.05 b
Cynodon	6584.3 c	3762.9 c	2256.0 ab	565.4 a	25.7 d	2.4 b	1.49 c
Cyn + Oat + Rye	7283.4 c	4392.4 c	2854.6 a	36.5 b	43.4 c	2.9 b	2.05 c
CV (%)	10.60	13.00	19.07	48.28	4.09	11.,39	11.31

Legend: TFP = total forage productivity, LY = leaf yield, ST = stem yield, DMY = dead material yield, H = canopy height, LAI = leaf area index, WP = water productivity. Lower case letters for columns.

The exclusive and overseeded Bermuda grass plots, had the lowest values planting designs of TFP and LS, without significant differences between these values. The Cynodon crops overseeded with ryegrass did not present a significant difference in these variables, which was consistent with the results obtained by Gomes et al. (2015a), who did not report significant effects of Tifton 85 with oat overseeding on TFP. Conversely, Sanches et al. (2015) indicated significant and positive results in Tifton 85 when overseeded with oats. These results indicate that there could be interference on TFP and LF from other factors that were possibly not verified in these and our present work.

The amount of dead material was lower in the plots that included the overseeded crops that included oats and ryegrass in addition to Bermuda grass, in relation to the others conditions. This result shows a positive synergism between the three forages, which also produced a good amount of TFP and high stem yield when the overseeding is compatible. Neres et al. (2012) described the importance of forage compatibility, and in their experiment, they identified problems with the height of the overseeded pigeon pea crop that promoted shading of the Bermuda grass and reduced the overall forage yield.

In the different growth cycles, the Guinea grass had high production in the 6th cycle (7759.6 kg ha^{-1} cut^{-1}; Figure 2). In the period (6th cycle), the average and minimum temperatures were 19.4ºC and 6.3°C, respectively (Figure 1), which do not justify such a high production. However, in the previous cycle, there was a management error in forage harvesting (cut), as can be observed by the absence of stem production in the 5th cycle, caused by error in plant height after cutting (residue). Thus, much of the forage from the 5th cut was not harvested and remained in the field, where it may have contributed to the high yield in the next cycle. In addition, this condition favors development of plants due to the greater leaf area that remained after cutting, which increases the accumulation of photosynthetic products. In a study by Silva et al. (2009), significant differences in the cutting heights were observed, similar to the observations from this work.
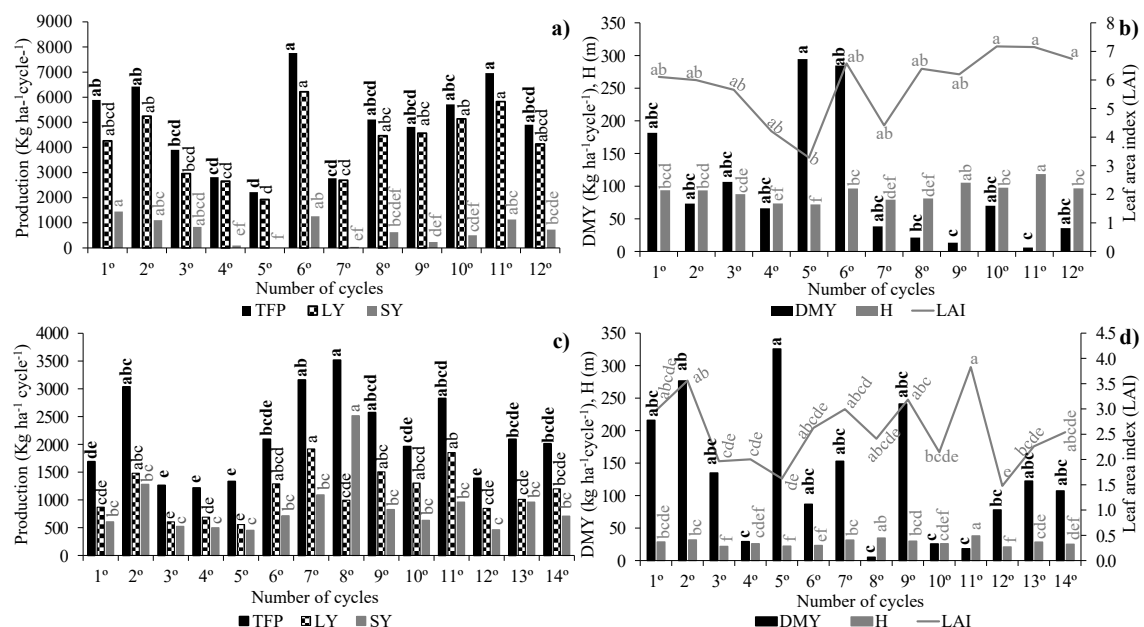

Figure 2. Average data for total forage productivity (TFP), leaf yield (LY), stems (SY), dead matter yield (DMY), height (H), and leaf area index (LAI) per cut cycle for Guinea grass (a and b) and Bermuda grass (c and d) (Piracicaba City 2016/17).

The values for TFP and LY in Guinea grass were lower in the autumn/winter cycles, especially in cycles 4, 5, and 7, which presented the lowest averages of TFP of 2,813.5 kg ha^{-1} cycle^{-1}, 2,219.6 kg ha^{-1} cycle^{-1}, and 2,773.7 kg ha^{-1} cycle^{-1}, respectively, with an average accumulation rate of 72.3 kg ha^{-1} d^{-1}. The spring/summer period corresponded to cycles 1, 8, 9, 10, 11, and 12, with an average forage accumulation rate of 203.7 kg ha^{-1} day^{-1}, which was similar to the results obtained in other studies that reported a marked reduction in the annual period of seasonal of production (Castagnara et al. 2012).

Bermuda grass had significant production variability between the growth cycles, with the highest TFP occurring in the 8th cycle at the beginning of spring (3,515.7 kg ha^{-1}), and the lowest yields in the 3rd, 4th, 5th, and 12th cycles (Figure 2c). Aguirre et al. (2014) reported high forage yields in coast-cross grass of 5,204 kg DM ha^{-1} in the 2nd autumn cycle; however, we observed larger forage yields for Bermuda grass in spring/summer in the present work.

In the 5th cycle (winter), Bermuda grass had the highest production of dead material (Figure 2d), with approximately 24% of the total and 9.3% on average produced in the fall/winter cycles. Gomes et al. (2015a) worked with an oat overseed and Cynodon spp. Tifton 85 crop and found that in a single winter cycle, dead material composed 25.7% of all dry matter produced and a mean of 12.2% dead material produced in the winter cycles.

In the overseeded crop (Figure 3), Guinea grass planted with oats + ryegrass presented higher production in the 3rd cycle with 4,237.2 kg ha^{-1} TFP, a high accumulation rate of 132.4 kg ha^{-1} d^{-1}, and 86 kg ha^{-1} d^{-1} average production throughout the period. In some intercropping of grasses with winter forage, the rates of forage accumulation varied between 66.5 - 143.5 kg ha^{-1}d^{-1} (Da Silva et al. 2012; Aguirre et al. 2014; Gomes et al. 2015a; Sanches et al. 2015; Silveira et al. 2015).
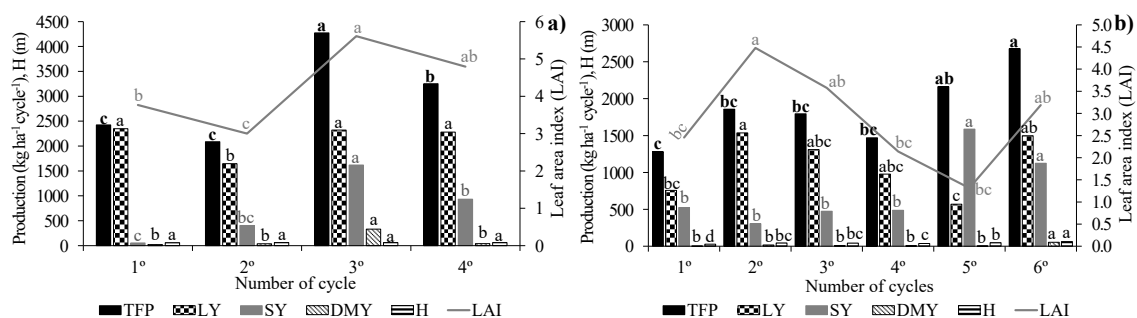

Figure 3. Mean data per cycle for the overseeded crops of Guinea grass + oat + ryegrass (a) and Bermuda grass + oat + ryegrass (b) (Piracicaba City 2016).

Leaf area index (LAI) was directly proportional to the total forage production (TFP) in the overseeded Guinea grass (Figure 3a), similar to the observations of Silva et al. (2009), who reported a direct relationship between forage production and LAI in Guinea grass.

Bermuda grass Grown with oat + ryegrass had the highest TFP in the 6th cycle at the beginning of spring, with production of 2676 kg ha^{-1} and a forage accumulation rate of 74.3 kg ha^{-1} d^{-1}. These results are consistent with the work of Sanches et al. (2015), who obtained an accumulation rate of 74.2 kg ha^{-1} d^{-1} in Tifton 85 grass grown with irrigated oat crops. Cycles 2 to 5 occurred in the winter, with an accumulated TFP of 7,283.4 kg ha^{-1}, which were higher than that of African Star grass + ryegrass + Lotus corniculatus that produced 6,676.2 kg ha^{-1} in three winter cycles in Dois Vizinhos-PR (Silveira et al. 2015).

During the experimental period, the mean percentage contribution of winter forages (oats + ryegrass) to

the total production was 42% and 90%, in the Guinea and Bermuda grass crops, respectively. During the winter, Bermuda grass had a low contribution to forage production, which was predominantly from oats and ryegrass. In contrast, Gomes et al. (2015a) observed that Cynodon provided 65% of total forage in oat cultivation in the fall/winter period.

3.2 Water productivity

When we evaluated water use efficiency in our different crop conditions, the exclusive Guinea grass cultivation had an average annual water productivity of 3.3 kg m^{-3} DM, which was higher than the others crops. In Northeastern Germany, a study on pasture silage and maize with water supplied by rainfall and irrigation had values of 1.5 kg m^{-3} and 2.6 kg m^{-3} of DM (Kraus et al. 2015). Lopes et al. (2014) conducted an experiment with *Brachiaria decumbens (Syn. Urochloa)* under different irrigation depths and found WA values between 2.2 kg m^{-3} and 4.4 kg m^{-3} for green forage biomass. Considering an average of 30% for dry matter (higher than the standard of 20%) and changing WP to dry mass, we would obtain approximate values of 0.7 and 1.3 kg m^{-3}, respectively. Comparing the results from this current study, the Guinea grass grown as both exclusive and overseeded crops had higher water use efficiency, with WP values of 3.3 kg m^{-3} and 2.5 kg m^{-3}, respectively.

The WP in Guinea grass was higher than in the Bermuda grass during all growing seasons (Table 4). The lowest WP values occurred in the hot and rainy summer periods in Bermuda and Guinea grass crops, concurrent with a large accumulation of rainfall in the summer, which was approximately 47% of the annual total, which justifies the highest WP observed in Guinea grass crops in the last season. Moreover, the rainfall is not completely used in the summer due to the high intensity or the soil moisture before rainfall. Winter rains are more likely to be utilized due to their lower intensity and frequency, and because the soil is drier in this season. The water productivity of the crops is strongly influenced by rainfall during the experimental period, for example, Dantas et al. (2016) observed greater water use efficiency in the autumn than in the winter, with increases of 603 kg ha^{-1} DM (0.23 kg m^{-3}) in *Brachiaria brizantha*.

Compared to the winter cycles, the highest WP was obtained in the Guinea grass grown in exclusive crop plots, followed by Guinea grass overseeded with oats + ryegrass (Table 5). In other reports of oats and ryegrass over seeding in autumn/winter periods, variations in WP between 0.95-2.5 kg m^{-3} (Neal et al. 2011) were observed, indicating that the consortium between Guinea grass and oats + ryegrass contributed to WP decline in relation to the exclusive cultivation conditions.

4. Conclusions

Guinea grass had the highest forage productivity, with TFP of 59.3 mg ha^{-1} year^{-1} and LY of 50.1 mg ha^{-1} year^{-1}, as well as the highest average leaf area index of 4.8. Bermuda grass had a total cumulative production of 30.2 Mg ha^{-1} year^{-1} and an average LAI of 2.5. Water productivity was higher for Guinea grass grown in exclusive cultivation compared to overseeding conditions; furthermore, the overseeding of winter forages in tropical climates did not increase water use efficiency in the fall/winter period.

Grasses grown as single cultures in the spring/summer had higher TFP compared to autumn/winter growth seasons, with average yields of 25,729.6 kg ha^{-1} in spring/summer and 18,994.4 kg ha^{-1} in autumn/winter. The highest TFP was measured in Guinea grass during the spring/summer, which accumulated 33401.7 kg ha^{-1} and represented 56% of the total production of the year.

When Bermuda grass was grown as an exclusive crop, it had increased accumulation of stems, mainly in winter and spring seasons. The intercropping of tropical grasses with oats and ryegrass did not have a significant effect on forage production. In the winter growing period, the Guinea grass in exclusive

cultivation produced the highest forage yield among all combinational growth conditions.

5. Acknowledgement

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Traffic Education involving Children in Latin America and Brazil.

Drª Rosana Maria Matos Silva

Professor at Fac. of Education - UNIRON

rosanammatos@yahoo.com.br Fone: + 55 (69) 99982-0470

Rondonia, Brazil

PhD Drº Tomás Daniel Menendez Rodriguez

Mathematics Department

Federal University of Rondonia, - UNIR,

Rondonia, Brazil

tomasdanielm@gmail.br.com Fone: + 55 (69) 99983-1397

Paola Matos Menendez

Academic.

Rondonia, Brazil

pa.olamatos@hotmail.com   Fone: + 55 (69) 99909-1222

Abstract

The Traffic Education is currently a reality to be considered, considering that traffic accident is the main cause of death among children and adolescents, surpassing even homicides and any other "natural" cause of death, where it aims to preserve the life and physical integrity of humans beings in traffic situations. Thus, this article aims to present the contextualization of public policies for the reduction of accidents suffered by children from Early Childhood Education to Elementary School in Latin America and Brazil in the last decade. In conclusion, Traffic Education can contribute to the formation of adequate behaviors of children and adolescents, changing, in the medium and long term, the behavior of adults, where the school, family and government should be involved, emphasizing that this work should begin from an early age and extend to higher education.

Keywords: Education; Traffic; Training; Politics; Children.

1. INTRODUCTION

Traffic education is a way to combat traffic violence in the medium and long term, and should be introduced from elementary school, so that contact with the reality of traffic can be learned from the initial years of the student's training process.

In this sense, it seeks to form a more conscious citizen and involved with the issues related to traffic and its process of humanization in elementary school from a relationship with reality, without letting this process of training and awareness begin only with the age of obtaining the *National Driver's License* (CNH).

The consequences caused by the lack of specific educational public policies are particularly relevant among the negatives externalities produced by traffic, not only by the economic costs caused, but above all by the pain, suffering and loss of quality of life attributed to the victims, their families and society as a whole, which shows a picture, still worrying, especially when compared to developed countries.

Despite the gravity situation, which has been repeated for several decades, Latin America and Brazil have always relied on parameters derived from foreign research to assess the impacts of traffic accidents.

Thus, a methodology based on bibliographic research will be presented, aiming to present aspects about how traffic education has been treated, serving as parameters for new studies that reflect the importance of the theme as a mechanism for preventing traffic violence and valuing life.

Therefore, the approach of the theme will start from the study and analysis of knowledge of the reality of the environment and other facts that show the situation of traffic education in Latin America and Brazil, to better know this reality, creating subsidies for decision-making and implementations of actions, where the first step towards the change of this cruel situation, where the "road" problem was incorporated into people's daily lives, silent and impactful, should occur through education.

The scientific contribution of this work will allow the enrichment of theoretical-pedagogical knowledge in relation to the role of the school in the formation of the citizen child, as well as the importance of working the coexistence of the child within the transit system, thus rethinking the behaviors of individuals and how they interact in the teaching-learning process.

2. TRAFFIC EDUCATION IN LATIN AMERICA

> *We can't wait any longer to act when we know there are children dying on the roads.*
>
> (MANDELA, 2010)

In terms of road safety, Latin America continues to occupy one of the first places, in the sad world ranking of regions with the highest mortality rates from traffic accidents. According to Ambev, (2017):

> According to the WHO and the Pan American Health Organization (PAHO), the issue of road safety is also alarming in the Americas, whose death rate per 100,000 inhabitants is 15,9. In a specific report, the organizations recommend the region, characterized by strong income inequality and education, investment in infrastructure, reform of safety legislation and effective enforcement to improve the behavior of road users and reduce traffic casualties.

"This is a global epidemic. But the difference from other crises is that we know exactly what to do: strengthen safety limits, improve spaces for pedestrians and roads, make vehicles safer and raise awareness through **education**", Ambassador Mandela said.

> His words have a special meaning in Latin America, with the highest road accident rates in the world (19,2 deaths per 100,000 inhabitants). South America, for its part, is almost 2 points above the regional index and more than double that of the European.   (CARRILLO, 2019)

Since 2011, the Ibero-American Observatory of Road Safety (OISEVI) has established bridges so that the different countries in the region can share their knowledge, while setting up a solid database on which it articulates efficient public policies.

At the same time, the first Ibero-American database on traffic accidents was created (OISEVI, 2019). This ambitious project, rooted in the Decade of Action for Road Safety launched by the United Nations, came true thanks to the efforts of countries in the regiom and the World Bank, which provided technical and financial assistance for its design and implementation, and served as an intermediary between institutions such as the Organization for Economic Cooperation and Development (OECD) and the **International Road Taffic and Accident Database** (IRTAD).

Each year, the lives of aproximately 1.35 million people are disrupted due to a traffic accident. Between 20 and 50 million people suffer non-life-threatening injuries, many of them resulting in disability. (PAHO/WHO, 2019)

The World Health Organization (WHO) estimates by 2030 that injuries from traffic accidents will be the fifth leading cause of death, even for diseases such as tuberculosis and HIV/AIDS.

Traffic injuries cause considerable economic losses for individuals, their families and countries as a whole. These losses arise from treatment costs (including rehabilitation and accident investigation), as well as from reduced/lost productivity. Traffic accidents cost most countries 3% of their gross domestic product (GDP).

In the study of Child Traffic Safety in cars in Spain and Latin America "Child Safety Seats", published by the MAPFRE Foundation (2016), presents the situation of child road safety in Latin America countries:

> **... children from the most deprived communities are the ones most at risk of suffering the consequences by the combination of impacts that traffic generates for health.** It is that millions of children in Latin America live in areas where the limits of air contamination exceed in a very dangerous way, the fact is that vehicle emissions contribute significantly.
>
> The report also highlights that **almost 50 children lose their lives on the region's roads every day.** At this point, it should be recalled that the most vulnerable are children living in poor neighborhoods and that in many countries children die more as pedestrians than as car passengers.

Reading again, because sometimes the numbers are cold. We are talking about thousands of Latin American children who would have no need to die if they took some road safety measures that already work in other countries.

The study also points to several measures to be considered, first, to improve the recognized information about accidents (including childhood accidents).

Unifying statistical criteria and improving data accessibility contributes to studies to identify possible areas for improvement. Moreover, it is an exercise of transparency that helps a better segment of the evolution of the problem.

More important here is to introduce specific legislation on the use of child restraint systems. Only Brazil and Puerto Rico there is a complete law on the use and technical requirements of child seating and

seat belts. At least five countries (El Salvador, Guatemala, Honduras, Peru e Dominican Republic) there is no legislation on this subject. In the other countries considered in the study, the regulations are partial.

Together with the improvements of the legislation, it is necessary to exercise a review of the measures implemented, to prove that they are fulfilled.

One recommendation is **to improve education and citizen awareness.** Brazil, Puerto Rico and Uruguay get the best score in this study, thanks to their permanent and far-reaching campaigns on the use of child safety seats. Argentina has campaigns considered medium-range, while Chile, Costa Rica, El Salvador and Mexico have one-off campaigns. In the ten remaining LAC countries included in the study, no campaign was found on child restraint in automobiles.

> Despite progress, traffic deaths continue to increase, with 1.35 million deaths annually. Traffic injuries are now the main causes of death for children and young people between 5 and 29 years old. Worldwide, of all traffic deaths, pedestrians and cyclists account for 26% and motorcyclists and passengers by 28%. The risk of death in transit remains three times higher in low-income countries than in high-income countries, with higher rates in Africa (26,6 per 100.000 inhabitants) and lower in Europe (9,3 per 100.000 inhabitants). (WHO, 2019).

The problem of traffic safety and its consequences worldwide has been charged for its degree of importance in the recent years, especially when it comes to making known figures from various sources such as the World Health Organization.

2.1 Educational Policies and Road Training.

> ... education is a way to improve the world in which we live and transform relationships between people in moments of learning, coexistence, respect and affection. (FREIRE, p. 1984)

Traffic education in schools is one of the key aspects in the human factor, which qualifies the behavior of future users. Likewise, in traffic training, understood as the specific training of the future driver is fundamental for his subsequent behavior, whether to include information about its regulation and

compliance (in cases where it is regulated, it is mandatory, even if numerous non-compliances are found in many countries). The most significant data are recognised in the following table:

Figure 1. Regulations related to traffic safety

Country	Traffic Education in Schools Driver Training
Argentina	It is present in schools, in a transversal way according to law 23.348 and law 24.449. There are no guarantees of its application. Numerous deficiencies in training are recognized. The improvements are regulated in the new Traffic Law No. 26,363, but so far there has been no practice.
Bahamas	Traffic education is present in schools through traffic safety discipline. It is regulated; there are no guarantees of compliance.
Barbados	In a transversal way it is regulated; there are no guarantees of compliance. There are no guarantees of its application.
Belize	It is not regulated; there are no guarantees of compliance.
Bolivia	It is not regulated; there are no guarantees of compliance.
Brazil	It contemplates itself in the law. The number of institutions that systematically adopt Traffic Education in their curriculum is very low. It is regulated and there is no evidence of non-compliance.
Chile	It contemplates itself in the law. It is present in schools as a vertical and transversal objective. It is regulated and there is no evidence of non-compliance.
Colombia	It is contemplated in the law and is carried out in a transversal way. There is a legal framework for obtaining the license, but numerous cases of non-compliance are recognized.
Costa Rica	It is not mandatory even if extended by covenants. It is regulated and there is no evidence of non-compliance.
Ecuador	It is contemplated in the law and is carried out in a tranversal way. It is regulated; there are no guarantees of its compliance. There are no guarantee of its application.
El Salvador	It is contemplated in the law, but there are no guarantees of its application. It is regulated; there are no guarantees of its compliance.
Guatemala	It is not implanted; even if one is working to achieve it. It is regulated; there are no guarantees of compliance.
Guyana	It is not regulated; there are no guarantees of its compliance.

Honduras	No, even if there's some isolated initiative.
	It is regulated; there are no guarantees of compliance.
Jamaica	It is not mandatory by law, even if education initiatives are carried out.
	Numerous deficiencies in training are recognized, which are improving in a bill.
Mexico	Level of development variable according to the states, there is no global policy at the national level.
	Numerous deficiencies due to the existence of several criteria in the states and a lack of national control.
Nicaragua	There's no implant, even if you're working to get it.
	It is regulated; there are no guarantees of compliance.
Panama	It is present in schools, in a transversal way. There are no guarantees of its application.
	It is regulated; there are no guarantees of compliance.
Paraguay	It is present in schools, in a transversal way. There are no guarantees of its application.
	It is regulated; there are no guarantees of compliance.
Peru	It is not mandatory by law.
	It is regulated; there are no guarantees of compliance.
Dominican Republic	It is contemplated in the law, but there are no guarantees of its application.
	It is regulated; there are no guarantees of compliance.
Uruguay	There is no legal coverage about it, even if some activities are carried out.
	It is adjusted incompletely.
Venezuela	It is contemplated in the law, but there are no guarantees of its application.

Font: IDB and AEC, 2009, p. 44 (adapted)

While traffic education appears well mentioned in numerous legal texts of the different countries, in reality its instrumentation is not observed systematically, there are many isolated public and private efforts, but they do not imply a state commitment to the real introduction of traffic education at all levels of schooling.

This is a field where there is much to be done and where private collaboration can play an important role, because there is a lot of developed training material and road parks that are already installed in some countries.

Traffic education and accident prevention campaigns can be applied in all countries, using mainly graphic, oral, television and digital means. The most repeated themes are sensitization (either with dramatic style or with positive type messages) about alcohol and driving, use of seat belts and prudence of

pedestrians among others. In most cases, an estimate of the effectiveness of campaigns is not performed, which can result in inefficient use of resources.

With regard to the traffic training of drivers, in almost all countries it is regulated, but in many of them high rates of non-compliance are identified while driving without a license and other problems derived from control deficiencies.

Although the qualifications to drive are in each Latin American standard, there are differences in psychophysical requirements, theoretical and practical examinations between the different institutions that provide driver's licenses, even comparing between locations in the same country.

The concern with accidents with children, in developed countries today, has led many countries to verify the physical and behavioral aspects that possibly intervene and that will make this user more vulnerable to accidents, including the factors of child exposure to traffic and accidents in the home-school-home route, with a concentration of the number of road risks.

Based on these results, developed countries have taken broader preventive measures involving school, community and family.

3. BRAZIL - INCLUSION OF TRAFFIC THEME IN EDUCACION.

Accidents are now the leading cause of death for children aged one to 14 years in Brazil. Every year, about, about 3,600 children of this age group die and another 111,000 are hospitalized due to these causes in the country (CHILD SAFETY/BRAZIL, 2020)

It is quite recent in Brazil to include the theme of traffic and at the same time it is known that educational actions that promote the formation and change of attitudes, which in turn materialize in appropriate behaviors, both for children and adolescents, as for adults, can contribute to safer traffic.

For this reason, among others, this article considered to emphasize in the education of children and adolescents and not that of adults:

        a. Educating children and adolescents for traffic can be more efficient than educating adults, because the former are in the process of training as people, while adults already have their behaviors consolidated, which requires the proper use of special strategies, such as Social Marketing;

        b. Traffic education can contribute to the formation of appropriate behaviors of children and adolescents by altering the behavior of adults in the medium and long term (OECD, 1993).

And this improvement in Traffic Education will occur according to Farias, (2002, p. 25), through three approaches:

        a. The constructivist approach, to make the student active in his/her training process, where his visions, perception and expectations will be considered;

        b. The Socio-Cultural, to promote citizenship through the analysis of real traffic situations and reflection on the consequences of the freedom enjoyed by individual motorized transport in the increased risk of traffic accidents;

c. The holistic approach or education in human values, so that the student has experiences of solidarity and cooperation in the classroom and traffic, as well as to transform his fragmented vision of the inclusive view of the world.

Transit education must act simultaneously in these three dimensions: to make the student active in his/her process of knowledge construction, to develop the potential for critical reflection of the student and to provide the experience of solidarity and cooperation in school and in traffic, because knowledge is built, human potential develops and value is lived. There is no discourse capable of teaching values, it is necessary to live them (MIGLIORI, 1998).

The deepening of the multidisciplinary approach of Traffic Education will help in understanding the issues studied here. First, trying to understand how the student perceives traffic and then formulate educational actions to reduce traffic risks and prevent accidents.

According to (Mauro, 2001, p. 208) in Brazil, an important preventive measure to reduce traffic accidents was the implementation of the New Traffic Code (CTB). Media and traffic technicians information on the new code revealed that significant progress has been made. The new code is based on three relevant pillars: education, citizenship and infractions. This involves setting boundaries, allowing education and punishing. They point out that the new Brazilian traffic code will have the difficult task of becoming one of the most violent transits in the world in insurance. It will have the force of strict punishments, fines and education to try to reduce the sad statistics of Brazilian traffic, as well as the rigor in: impunity, vehicle safety vehicle inspection and emission of pollutants and noise.

For Braga & Santos (1995), the biggest problem in the transit education process is to give users a passive role to receive information, for example, in educational campaigns, which, in addition to improving the passive role, there is no evidence of its re-educational effect. The ultimate goal is to change the view, the attitude of users with regard to their participation in traffic.

3.1 Legal Aspects of Traffic Education in Brazil.

When drafting the Federal Constitution of 1988 (arts. 6 and 23, XII), legislators have already demonstrated the concern and importance of education for transit in the social context, giving the powers

to the Union, States, Municipalities and the Federal District, as well as the CTB dedicates a chapter to the theme (Chapter VI, arts. 74 to 79), prioritizing this task to all the component bodies of the National Transit System (Chapter VI , arts. 74 to 79), prioritizing this task to all the component organs of the National Traffic System (Chapter VI, arts. 74 to 79), prioritizing this task to all the component organs of the National Traffic System, a fact that was ratified in Article 5.

Article 320 of the CTB also states that resources from the collection of traffic fines must be applied, among others, in traffic education.

More than ever, the school must actively participate in traffic education, because today's children will be the young people of the future, who will be users and traffic managers, able to transform this reality. (Anonymous, 2017)

And that traffic education, in addition to teaching rules, techniques, accident prevention methods, should have the concern to transform young people into conscious citizens, because we live in society and this concern must occur, in the short, medium and long term, because the complexity of the factors that cause these problems can no longer wait.

As educator Paulo Freire says: **"Education is not the solution, but there is no solution without education"**.   Education is not to end the amenities offered by vehicles, but to adapt the use of these "facilities" rationally and consciously, due to their importance in our current life, that their coexistence with vehicles is in an orderly and healthy way, because traffic was created to serve man and not destroy him.

Brazilian traffic is regulated by Law 9.503/97- Brazilian Traffic Code - CTB and by complementary resolutions. In addition to the CTB and resolutions, states complement legislation through ordinances and decrees.

In general, Brazilian traffic legislation is considered good and even serves as an example for other countries. When it came into force in 1998, the CTB had many controversial points that allowed more than one interpretation that have already been clarified by experts today.

The Code defines the powers of the various authorities and bodies related to traffic, provides guidelines for Traffic Engineering and establishes rules of conduct, violations and sanctions for different users of this complex system, based on the Brazilian Constitution, as well as compliance with the agreements of the Vienna Convention and the MERCOSUR Agreement.

> <u>Vienna Convention</u> – In 1968, representatives from several countries approved the standardization of international traffic signs and standards, which were adopted by several countries, including Brazil. This standardization allows drivers from different backgrounds to travel safely in other countries, even without mastering the local language.
>
> <u>MERCOSUL Agreement</u> – Signed in Montevideo in 1992, it entered into force in 1993, It established the basic rules for regulating and standardizing vehicle amd international traffic in MERCOSUL participating countries – Brazil, Argentina, Bolivia, Chile, Paraguay, Peru and Uruguay – to increase the safety of people and vehicles in international circulation in theses countries. (BRUNS, p. 16, 2006).

Article 74 of the CTB (1997) states that: Education in transit is a right of all and is a priority duty for the components of the National Transit System:

§1 - The existence of educational coordination in each organ or entity component of the National Transit System is mandatory.

§2 - Executive bodies or transit agencies must promote, within their organizational or contractual structure, the operation of public transportation schools in the manner and standards established by CONTRAN.

Art. 75 The CONTRAN shall establish annually the themes and deadlines of the campaigns at national level which must be promoted by all organs or entities of the National Transit System, especially during periods corresponding to school holidays, long holidays and national traffic week.

§1 - The organs or entities of the national transit system must promote other campaigns within their electorate and according to local peculiarities.

§2 - The campaigns covered by this article are permanent, and the radio and transmission services of sounds and images operated by the government are obliged to disclose them free of charge, with the frequency recommended by the competent organs of the National Traffic System.

Art. 76 Traffic Education will be promoted in preschools and 1st, 2nd and 3rd grades, through planning and coordination actions between the organs and institutions of the National Traffic System, the Federal District and the municipalities, in their respective areas of operation.

Single paragraph. For the purposes provided for in this article, the Ministry of Education and Sport, acting on a proposal from CONTRAN and the Council of Rectors of Brazilian Universities, directly or through conventions, will promote:

I - The adoption, at all educational levels, of an interdisciplinary curriculum with programmatic content on road safety;

II - The adoption of content related to traffic education in schools of training and training of teachers and multipliers;

III - Creation of inter-professional technical bodies for the study and analysis of statistical data related to traffic;

IV - The elaboration of plans to reduce traffic accidents in interdisciplinary university transit centers, with a view to the integration of the University - Society in the area of traffic.

Art. 77. In the context of traffic education, it will be up to the Ministry of Health, through the contran proposal, to establish the national campaign clarifying the conduct to be followed for first aid in the event of a traffic accident.

Single paragraph. The campaigns will be permanent through the Unified Health System (SUS), being intensified during the periods and in the modes provided for in Article 76.

CTB's concern about the importance of traffic education is clear and imposes rules. Therefore, by promoting it, you will do nothing but your obligation. In CTB, it is mandatory in early childhood, elementary, high school and higher education.

If there was adequate and coherent road education, it would solve most of the problems of Brazilian traffic, in a positive domino effect. When people understand what is required of them, they understand the need to protect life and see all the mechanisms designed to make a safe transit: they become collaborators and not critical without knowledge of the cause.

In these times of greater control of spending in the public sphere, with greater exposure of administrators, the concrete results provided by a Traffic Education, produce excellent political and social dividends (Anonymous, 2008).

In Brazil, where there is much to do in this area, the initial results are likely to be highly visible. On the contrary, in countries such as Sweden and Japan, improving rates would be very difficult.

Traffic education is growing in importance in all developing countries. Here, we are seeing a great interest even from institutions that are not directly linked to traffic, perhaps because other measures have lost a little encouragement, because they have not given the expected result.

In 2006, DENATRAN, through the National Traffic Council and the Ministry of Cities, issued a resolution establishing standardization criteria for the operation of Public Traffic Schools – EPT throughout the country, in which the School of Public Traffic is primarily intended to offer courses, actions and educational projects, aimed at the exercise of citizenship in traffic, prioritizing the development of social coexistence in public space , promoting the principles of equity, ethics, aiming at a better understanding of the transit system with an emphasis on safety and the environment.

DENATRAN will establish the quality indicators to be observed in the control of the results, as well as the methods of monitoring the actions implemented by the EPT, in accordance with Article 6 of Res. 207/2006.

> It depends on the school of public transport:
>
> I – Indicate traffic educators to form their technical team according to established criteria;
>
> II – Define themes, curricula, establish content and evaluation systems to be developed, according to the public – object and in line with the objectives and guidelines of the National Traffic Policy;
>
> III – Plan and execute courses, action and projects of educational transit, as established in the plans and programs of Traffic Education of the respective traffic agency or entity;
>
> IV – Develop your pedagogical project according to the established parameters;
>
> V – Manage databases and information relevant to road education, establishing criteria for its access;
>
> VI – Develop and provide technical guidance for the preparation of teaching support material;
>
> VII – Propose partnerships with other organs, entities, institutions and organized sectors of society, for the integrated implementation of specific projects of education, studies and traffic research;
>
> VIII – Encourage the production of local knowledge and actions;
>
> IX – Interact with the social media activity of the respective traffic agency or Executive Agency;
>
> X – Develop continuous activity of studies and research focused on education in transit, including the organization and maintenance of a library, including arrangements and specialized library;
>
> XI – Carry out periodic evaluations of the implemented actions.

3.2 Good Practices and Outstanding Challenges in Traffic Safety

In Brazil, the concern with the adoption of educational measures can be verified since the end of the 1960s. Through the Resolution of the National Traffic Council - CONTRAN, the National Traffic Week guideline was established and guided the development of the campaign that should reach all citizens, through intense advertising and implementation by people of legal aspects of systematic traffic. With this measure, the Brazilian government believes that it will contribute to people's awareness of the safe practice

of traffic. The educational measures adopted by Brazil are summarized in the daily inspection and the National Traffic Week, the behavior and obligations of users and road signs, in addition to the moral and cultural aspect, which can influence the order of traffic. In recent years, we have received from Brazil numerous examples of good practices in road safety, which serve as a model for other countries.

> Countries that invested in Traffic Education achieve excellent results. Good examples of this are Sweden and Japan, which have had statistics as pitiful as ours and are now global benchmarks for safe traffic. The experience of countries that have experienced critical situations shows that traffic education works. (PORTAL SÃO FRANCISCO, 2016)

However, the number of traffic accidents continues to grow in a country with a thriving economy where vehicles and travel are increasing.

Brazil has a very restrictive law regarding driving under the influence of alcohol, which prohibits getting behind the wheel with any degree of alcohol in the blood. The so-called **"Prohibition" came into force in 2008**, with promising initial results, since mortality decreased by 13.6%. However, the effectiveness of the measure was reduced over time, so the law again hardened, with greater sanctions and controls.

In child restraint systems (SRI), Brazil also has **one of the most advanced regulations in its environment**, which also includes technical requirements with international approval. In the study conducted by the MAPFRE Foundation (2016) on SRI in Latin America and the Caribbean, it scored **74 out of 100**, being the second highest-rated country, behind **Only** Puerto Rico. According to this same report, it was necessary to improve the monitoring or police **control** of the use of NIS.

The Inter-American Development Bank (IDB) points out other points of improvement, such as **traffic education** and social awareness. The IDB analyzed in detail the characteristics of road accidents in Brazil in a report that compares the severity and frequency of accidents in different types of road infrastructure and identifies the conditions that most influence.

Among them is the lack of perception of the **risk of road users**, a problem that tries to combat with campaigns to promote road safety from the public and private sectors. For example, we find the videos and teaching materials of CESVI Brazil, the blog "Education for Traffic" or the web (*criancasegura.org.br*), in addition to the campaigns carried out by the National Department of Traffic of Brazil (DENATRAN).

We must not forget that **road safety is based on many pillars**, although **legislation** and **infrastructure** are essential, not least is monitoring and education. It will be of little use to improve the tracks if users are not taught how to cross them safely, with respect and responsibility. Similarly, the rules alone are also not sufficient: it is important that they are widely known and that compliance is well monitored.

3.3 Risks in Children from 0 to 14 years

According to data from the Ministry of Health (2017), about 6,000 children died and another 140,000 were hospitalized due to domestic and traffic accidents, according to the following data presented in the figure below. Only traffic was responsible for almost half of these deaths.
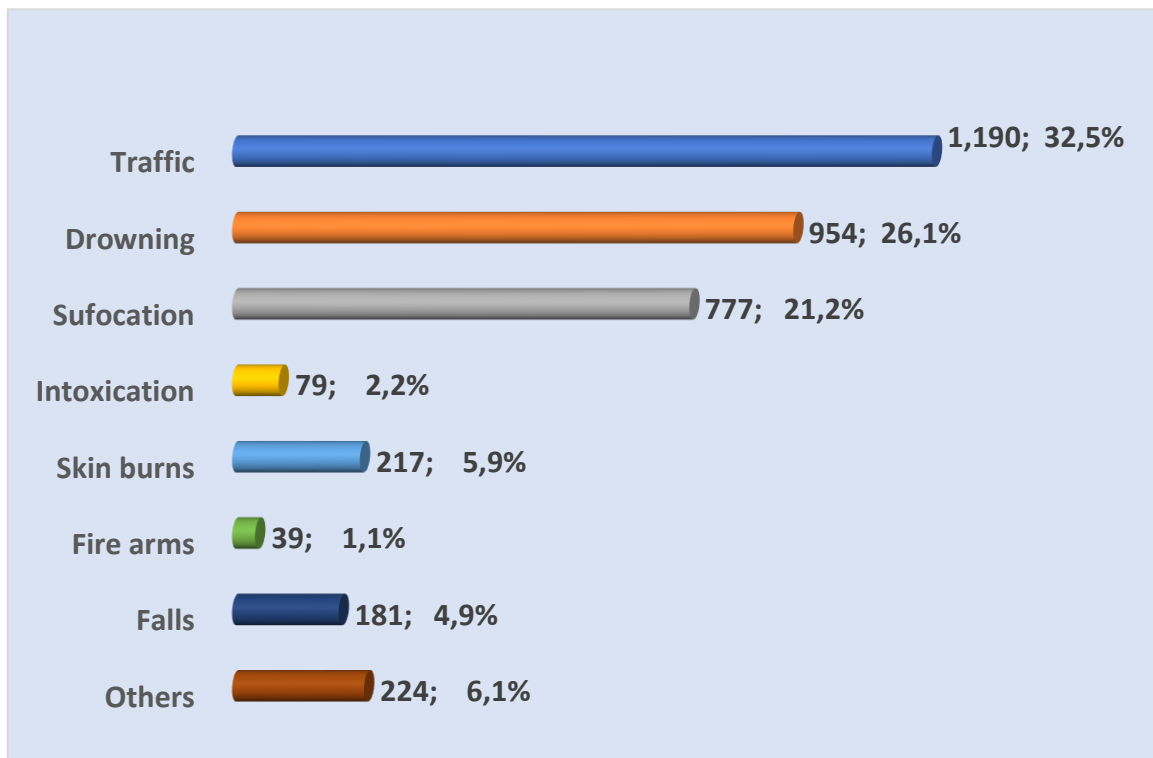
Figure 2. Deaths from accidents aged 0 to 14 years in Brazil

Font: The authors, adapted of DATASUS, 2020

All these data demonstrate the importance of accident prevention actions with children and adolescents. Studies show that 90% of accidental deaths could be prevented by adopting simple prevention measures, such as behavior change, adaptation of the environment or use of safety equipment.

Figure 3. Deaths by age group/type of accident.

Font: The authors, adapted of DATASUS, 2020.

In the age group from 10 to 14 years is precisely when the child can sit in the front seat of the vehicle and that is when one perceives a greater number of occurrences.
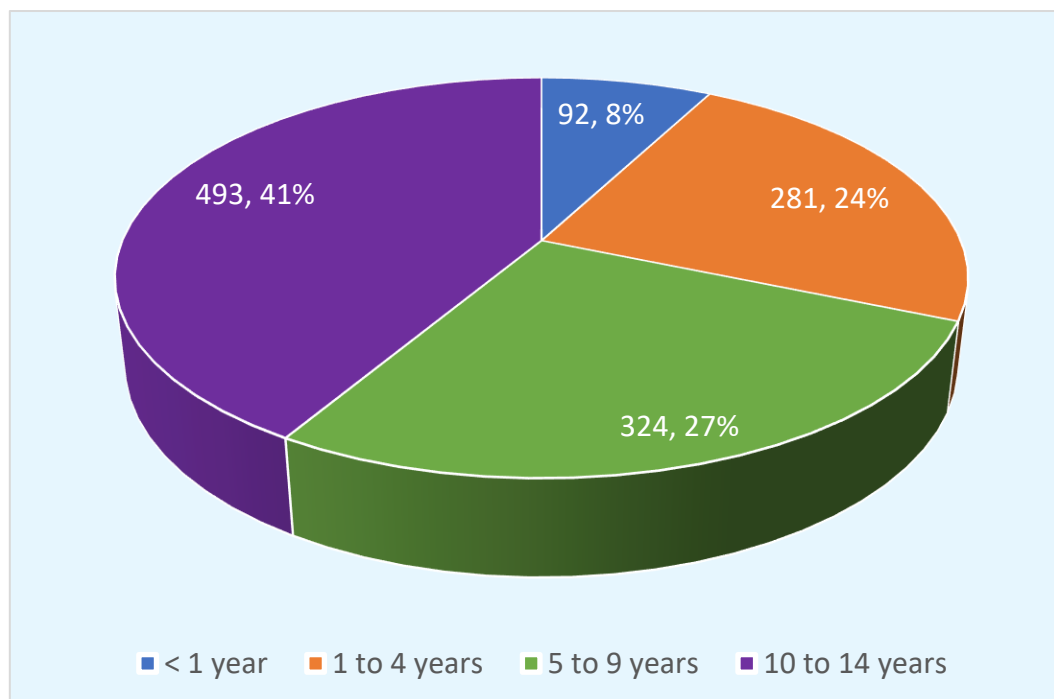
Figure 4. Deaths of children by age groups

Font: The authors, adapted of DATASUS, 2020

This makes us reflect on the responsibility of adults and how much their safety is still neglected.
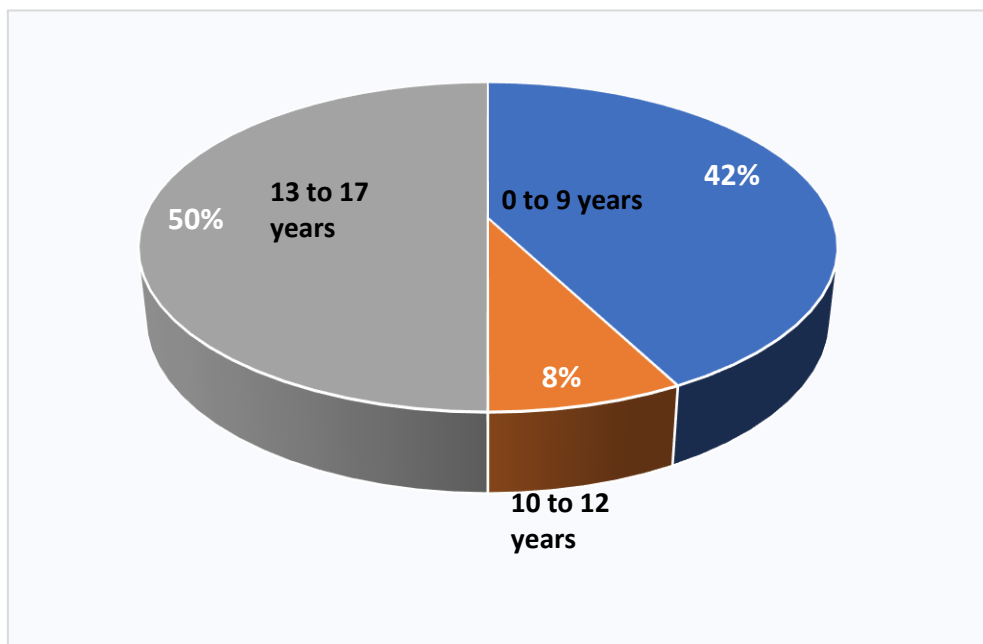
Figure 5. Percentage of deaths in children and young people.

Font: The authors, adapted of DATASUS, 2020.

According to Jorge and Martins (2013), children are identified as the most frequent victims of hit-and-run accidents, especially in the age group from thirteen to seventeen years of age and reaching a coefficient of 2.2 deaths per 100,000 inhabitants, being responsible for the highest lethality when compared to other types of traffic accidents.

> The literature points out that this is due to their lower perception of danger, because they cannot estimate the speed of vehicles when crossing the street, for not using the safety lane, for playing in the street in the middle of the movement of vehicles, for not knowing the rules in traffic, in short, by the very mental and physical immaturity of the children to follow the rules of traffic , due to the spirit of competition and speed characteristic of this age group, in addition to the urban conflict between vehicles and pedestrians, combined with the non-respect for pedestrians by drivers of vehicles. (JORGE and MARTINS, 2013)

Educational measures are emphasized here as of paramount importance aimed at forming, even in the long term, a more conscious generation, aware of risks and with greater capacity to face them.

It is necessary, however, to remember that the potentiating factors, such as disrespect for signage, excessive speed and the important problem of alcohol, can, even if the child crosses the safety range or is on the sidewalk, contribute to the victim of trampling. Supervision and education, in this case, is an important element in the prevention of these events.

Therefore, it is important to know who are the main victims, described below, as presented by the (SAFE CHILD PROGRAM, 2006):

a) Children under 5 years

Typically, there are no significant rates of mortality rates for pedestrians under five years of age, and in part this can be explained by the lower exposure of these children, as they would be under surveillance or in the company of parents or guardians.

b) Children from 5 to 10 years

Hit-and-run is the leading cause of death from accidents involving children aged five to ten years.

Often, children at this age start school life, so they present "a window of vulnerability" in which, both the expectations and demands of adults, go beyond the skills that these same children are able to offer, if viewed as pedestrians, from whom one expects sufficient maturity to make a safe crossing. Thus, as those responsible overestimate the abilities of this being, still in training, children older than five years would be, in a way, more exposed to hazards and, for this reason, much more vulnerable to traffic accidents.

c) Children and adolescents over 10 years

The age group over 10 years has a reduction in the level of death from traffic accidents, but it is worth mentioning, as well as deaths in 70% of victims over 10 years of age are caused by traffic accidents involving passengers or motor vehicle drivers

d) Boys and Girls

As in other events of deaths from external causes, in the condition of pedestrians, boys stand out as more frequent victims than girls.

According to THOMPSON, RIVARA and BARBEIRO, MELLO JORGE, WAKSMAN, BASSAOLS, BASSO, CHAN, cited by Alves (2001, p. 44), in Brazil, in studies conducted in the cities of São Paulo, Porto Alegre and Londrina, the predominance of occurrences in relation to males was verified. Alves (2001, p. 45) observed in Curitiba the predominance of males in deaths from traffic accidents involving children under 14 years of age (68.79%), in relation to female minors, which follows the worldwide profile.

Moreover, according to Novo (2006), children with more precarious socioeconomic conditions and living in regions that concentrate low-income populations are more likely to run over. Many studies from different countries report that children of low socioeconomic status have a higher risk of injury when they are moving in pedestrian situations.

4. CONCLUSION

Traffic Education, especially that of the children's public, can contribute to the reduction of traffic accidents in the medium and long term, through changes in risk behaviors and the development of appropriate behaviors, awareness of individual responsibility and respect for the rights of others. Society can more easily get its citizens to develop these values from an early age if children and adolescents are educated so that, when they are adults, they become pedestrians and, especially, more conscientious drivers.

Educating works and the countries that have invested in Traffic Education have achieved excellent results. Good examples are Sweden and Japan, which eclipse statistics as pitiful as ours and are currently the parameters of safe transit in the world.

The experience of countries that have experienced critical situations shows that Traffic Education works. What doesn't work or works badly, are short-term campaigns because they have a transient effect, as well as interrupted programs.

Although the Law guarantees Traffic Education through article 76 of the CTB, as presented, most schools do not include the theme "Transit" in their curricula.

We see that long-term education programs, consistent and with appropriate methodologies, take effect. We need continuity, because it is a new theme, in which the audience to which it is addressed (children, young people or adults) very little or nothing, saw, heard or read about it.

Traffic Education in Brazil is very recent. It is essential to develop a methodology that takes into account the public, their age, level of education, needs, desires, socioeconomic profile, etc. It is almost as a condition for it to be possible to educate for traffic.

In relation to Traffic Education in Elementary School, research shows that there is a lack of permanent strategies in schools for the effective realization of Traffic Education. The theme is worked on in isolation (mainly focused on patterns), as well as for a very short period of time, such as the week of transit. There is no continuous and systematic work.

Therefore, when trying to place within it a theme of enormous social relevance, it is noted that the school will not only strengthen its bond with the community, but will also make room for the qualification of life. In addition, talking about locomotion can stimulate the debate about social harmony, social behaviors in the face of differences, in short, can make the school environment increasingly open to work with themes that mobilize society.

In this sense, it is important to invest in the development of educational projects and activities that lead to better living conditions, changing their behavior in traffic, which means saving lives and helping many others to also enjoy their lives without the limitations imposed by the bad behavior of citizens. Therefore, the task is to educate for a more civilized and safe transit.

The data presented in this study support the need to educate for traffic and life, seeking to train generations of future drivers of vehicles and pedestrians more aware of their rights and duties in a continuous and systematic way.

Traffic education goes beyond the mere transmission of information. It focuses on the human being and works on the possibility of a change in values, behaviors and attitudes. It is not limited to sporadic events and does not allow uncoordinated actions. It takes on a continuous learning process and must use different methodologies to achieve different ...

Essential measures to improve government initiatives should be implemented, such as: reducing speed on streets and roads, controlling alcohol consumption and, undoubtedly, efficient work of Traffic Education.

Transit education should be a transversal program of school, family and government and, finally, of the whole society, emphasizing that this work must begin from Basic Education and extend to Higher Education.

If the school of basic education in Brazil manages to get involved in traffic education, its first job should be to look at the issue as a transversal curricular component, that is, not as a subject or an isolated activity that guarantees traffic education, but with the participation of the school in the task of preparing the student to move consciously and responsibly (as citizens) in brazilian streets and roads.

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Changes in Soil Acidity Attributes in Areas of Municipal Organic Waste Composting, Santa Catarina, Brazil[1]

Cleiton Junior Ribeiro Lazzari[2]*; Matheus Junckes Müller[3]; Guilherme Wilbert Ferreira[3];
Monique Souza[3]; Paul Richard Momsen Miller[3]; Jucinei José Comin[3]; Rafael da Rosa Couto[3];
Gustavo Brunetto[4]; Arcângelo Loss[3]; Cledimar Rogério Lourenzi[3]

[1]Este trabalho é parte da dissertação do primeiro autor; [2]Universidade do Estado de Santa Catarina, Centro de Ciências Agroveterinárias. Av. Luiz de Camões, 2090 – Conta Dinheiro, 88520-000, Lages, Santa Catarina, Brazil. E-mail: cleitonlazzari@yahoo.com.br; *Autor correspondente; [3]Universidade Federal de Santa Catarina (UFSC), Centro de Ciências Agrárias, 1346, 88034-000, Itacorubi, Florianópolis, Santa Catarina, Brazil; [4]Universidade Federal de Santa Maria, Centro de Ciências Rurais, Avenida Roraima, 1000, 97105-900, Camobi, Santa Maria, Rio Grande do Sul, Brasil.

Abstract

Composting is an alternative for treating and recycling municipal solid waste. Composting directly on the soil changes the attributes related to soil acidity. The study aimed to evaluate the influence of municipal solid waste composting in a small scale system on the attributes related to the acidity of soils used for making compost piles. Soil samples were collected at depths of 0-5, 5-10, 10-20, 20-30 and 30-40 cm in four areas under composting (1C, 2C, 3C and 4C) and four adjacent reference areas with no history of composting (1R, 2R, 3R and 4R). The soil was submitted to evaluation of pH in water, total organic carbon (TOC), potential acidity (H+Al), aluminum saturation and base saturation. We found the composting in a small scale system with piles directly on the soil promoted the increase of soil pH values, TOC contents and base saturation up to 40 cm, regardless of the time of use. This shows the potential of the leachate to reduce acidity and aluminum saturation in the subsoil.

Key words: Chemical attributes, organic compost, leachate.

Introduction

A large amount of waste is generated in preparing and consuming food. One way to reuse these wastes, especially in urban areas, is via composting, which is a biological process of decomposition and stabilization of organic substrates (CADIS & HENKES, 2014). Composting produces the organic compost used for soil conditioning and plant nutrition (HARGREAVES et al., 2008; LOURENZI et al., 2016).

The production of leachate (percolated from the compost pile) occurs in municipal solid waste composting. The volume of leachate produced and its chemical characteristics are dependent on the type and diameter of the material used to make the compost, and how the compost pile and rainfall that reaches the compost pile are managed (Chatterjee et al., 2013). A suitable pile should be able to maintain the oxygen content to favor the development of aerobic microorganisms, which are responsible for the decomposition and

humification of organic material (INÁCIO & MILLER, 2009). Thus, the pile should have adequate size and internal structure to allow enough aeration and humidity for the aerobic decomposition process. Pile porosity, which is determined by the particle size of the materials, influences aeration and humidity. Porosity provides drainage of excess water and intake of air. Anaerobic conditions formed when aeration is below 10% and humidity above 65% negatively influence the composting process, in addition to changing the characteristics of the leachate, forming a percolate with acidic pH, known in Brazilian legislation as compost slurry (BILGILI et al., 2007, BRASIL, 2017). The production of compost slurry is a major problem of composting under inadequate conditions, because it lowers soil pH and favors the availability of metals such as Al and Pb, which are toxic to plants.

In small scale composting, the piles are placed directly on the soil, without waterproofing. Aerobic decomposition generates a percolate with pH between 7.0 and 8.0 called leachate (BRASIL, 2017). As CO_2 generated by the decomposition of the organic material is released, there is an increase in the pH of the compost and leachate (SINGH & KALAMDHAD, 2013). Also, studies have found K, Ca and MG concentrations of 40-2000, 70-1100 and 10-400 mg L^{-1} in leachate, respectively (INÁCIO & MILLER, 2009; CHATTERJEE et al., 2013). These concentrations vary in soil, reducing aluminum saturation and increasing base saturation. This favors the use of the area for crops after composting or the use of the topsoil, which can be removed with the compost, as it contains elements leached from the pile.

Composting sites in urban regions are typically located in areas where soils no longer have original characteristics due to human activity (PEDRON et al., 2004; LADEIRA et al., 2012). In fact, the change in urban soils caused by the addition of materials that are not derived from the process of pedogenesis is reported in the literature, and easily observed in practice (LADEIRA et al., 2012). These soils are altered because of the different functions they exert in urban environments, such as support for green areas (parks and gardens), urban agriculture, construction, and waste disposal (PEDRON et al., 2004). Therefore, this study is important because it evaluates the effects of composting in urban areas on soils transformed by human activity (PEDRON et al., 2004; LADEIRA et al., 2012).

The aim of this study was to evaluate the influence of municipal solid waste composting in a small scale system on the attributes related to the acidity of soils used for making compost piles.

Material and Methods

Soil samples were collected in four composting areas/sites located in the city of Florianópolis, Santa Catarina State, Brazil. Soils sampled in the composting sites (C) under piles in a small scale system (BRAZIL, 2017) were 1C, 2C, 3C and 4C. These sites were installed 12, 16, 7 and 1 year(s) ago, respectively. Soils sampled from an area adjacent to the composting sites were used as reference (R - 1R, 2R, 3R and 4R). The locations of the areas are as follows: 1C and 1R (27°35'50'' S and 48°30'55'' W); 2C and 2R (27°34'43'' S and 48°30'19'' W); 3C and 3R (27°35'0" S and 48°30'51" W); 4C and 4R (27°35'6" S and 48°30"32" W).

The areas used in this study are not representative of the natural soils of the region, as they were landfilled. All the sites contain inert construction waste and clay material used for waterproofing was also found in areas 2C, 3C and 4C. Area 1C only contained construction waste. All the composting sites are outdoors

and there is no protection against rainfall and no leachate collection. Sites 1C, 2C, 3C and 4C had an approximate area of 1500, 1200, 5000 and 1800 m^2 respectively. Composting piles were set up with food waste from restaurants, snack bars, supermarkets (low C/N ratio materials), and shavings, sawdust or remains of tree pruning (high C/N ratio materials). Approximately 700 to 1000 tons of waste per year was deposited in the composting areas. These wastes were arranged in piles of different lengths, with 1.5-2.0 m wide and 1.3-1.5 m high when built manually; 3.0 m wide and 3.0 m high when built with tractors (INÁCIO & MILLER, 2009). Each pile contains approximately 1.33 tons of material per m^2 yr^{-1}. Piles were built in different locations so that the entire area had a compost pile on its surface at some point. On average, the organic compost produced in the composting areas had the following characteristics: 8.9 pH; 33% humidity; 31.7% Total Organic Carbon (TOC); 0.86% Total P; 0.9% Total K; 3.4% Total Ca; 0.4% Total Mg; 532 mg kg^{-1} Total Na; 28.4 mg kg^{-1} Total Cu; 15.3 mg kg^{-1} Total Zn.

The composting method used in this study with natural aeration and without turning is known as the UFSC method (INÁCIO & MILLER, 2009). In 1C and 3C, when the compost piles were ripe and removed from the composting sites, the soil below the pile was also removed at a depth of about 10 cm and carried together with the compost. Landfill was added to the surface of the composting areas when necessary, which usually consisted of material from sandy soil nearby.

In January 2014, in 1C and 1R, and in February 2015, in the other areas, three trenches (0.5 x 0.5 x 0.5 m) were opened, and soil samples were collected at depths of 0-5, 5-10, 10-20, 20-30 and 30-40 cm. The samples were air-dried, ground and passed through a 2 mm mesh sieve to obtain fine air-dried soil (FADS), which was reserved for physical and chemical analysis.

We determined the texture of the samples (sand, silt and clay) according to Embrapa (1997), the values of pH in water (ratio 1:1), SMP index, available content of K and Na (extracted by Mehlich-1), and exchangeable Al, Ca and Mg contents (extracted by KCl 1.0 mol L^{-1}) according to Tedesco et al. (1995). These five elements were used to calculate aluminum saturation (m%) and base saturation (V%). Total organic carbon was also determined by the Walkley-Black method (EMBRAPA, 1997). The values of potential acidity (H+Al), m% and V% were calculated according to CQFS-RS/SC (2016).

The data related to soil acidity were submitted to homogeneity of variance test and analysis of variance (F-test, p <0.05). Among the composting areas and corresponding reference areas, the data were evaluated by Student's t-test. Within each area, the layers were compared by the Scott-Knott test (p <0.05). The variables pH, TOC, H+Al, aluminum saturation and base saturation of all the areas were submitted to principal component analysis (PCA).

Results

There was a significant difference in texture among the study areas, especially in soil clay contents (Table 1). These differences were found both within the profile of the same area and at the same layer of different areas. The soil in 1C, 1R, 2C and 3C was classified as loamy sand, in 2R and 3R as clay loam, 4C loam and 4R as sandy loam (SANTOS et al., 2015).

Table 1. Sand, silt and clay contents in soil of the composting areas and corresponding reference areas.

Depth, cm	San	Silt	Clay	Sand	Silt	Clay
	g kg^{-1}			g kg^{-1}		
	1C			1R		
0-5	805	80	113	651	188	159
5-10	626	155	218	736	167	96
10-20	575	211	213	741	159	99
20-30	591	244	164	638	216	145
30-40	597	179	223	726	117	155
	2C			2R		
0-5	593	193	212	495	246	258
5-10	599	191	209	334	316	349
10-20	619	174	205	225	327	447
20-30	570	206	222	174	433	392
30-40	590	205	204	170	390	438
	3C			3R		
0-5	695	128	175	505	203	291
5-10	638	151	210	469	241	288
10-20	574	208	217	424	279	296
20-30	681	134	183	464	277	257
30-40	654	177	168	549	259	191
	4C			4R		
0-5	482	189	327	638	189	171
5-10	428	211	359	570	238	191
10-20	403	206	390	615	199	185
20-30	495	264	239	693	184	121
30-40	498	57	443	715	150	134

The soil pH values of the composting areas were between 7.0 and 8.0, which were higher than in corresponding reference areas up to 40 cm. However, 3C had higher pH than 3R up to 10 cm (Figure 1). TOC levels in 1C, 2C and 4C were higher than in reference areas up to 40 cm, while TOC levels in 3C were higher up to 10 cm (Figure 2). In general, the highest TOC contents were found in the surface layers of the evaluated areas, reducing with increasing depth.

The values of H+Al in soil of the composting areas 1C, 2C and 4C were lower than in corresponding reference areas in all the layers evaluated in this study (Table 2). However, H+Al in 3C was lower than in the reference area in the surface layers (0-5 and 5-10 cm). The highest values of H+Al in all the areas were found mainly in the surface layers, except for 1C in which higher values were found from 10-40 cm (Table 2).
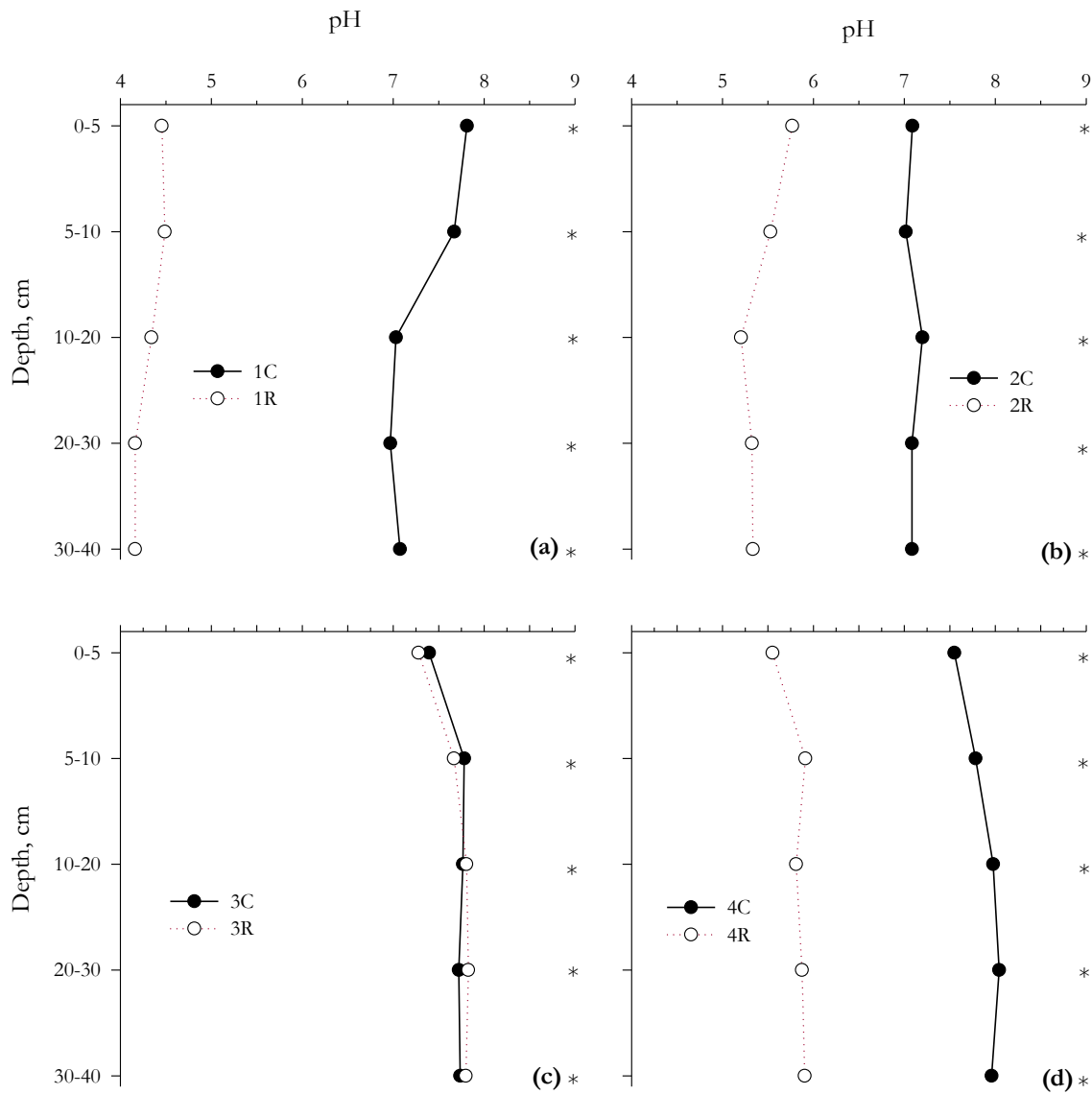
Figure 1.

Soil pH values of 1C and 1R (a), 2C and 2R (b), 3C and 3R (c) and 4C and 4R (d). *Significant difference by Student's t-test (p <0.05); ns: not significant. C: composting area, R: reference area.
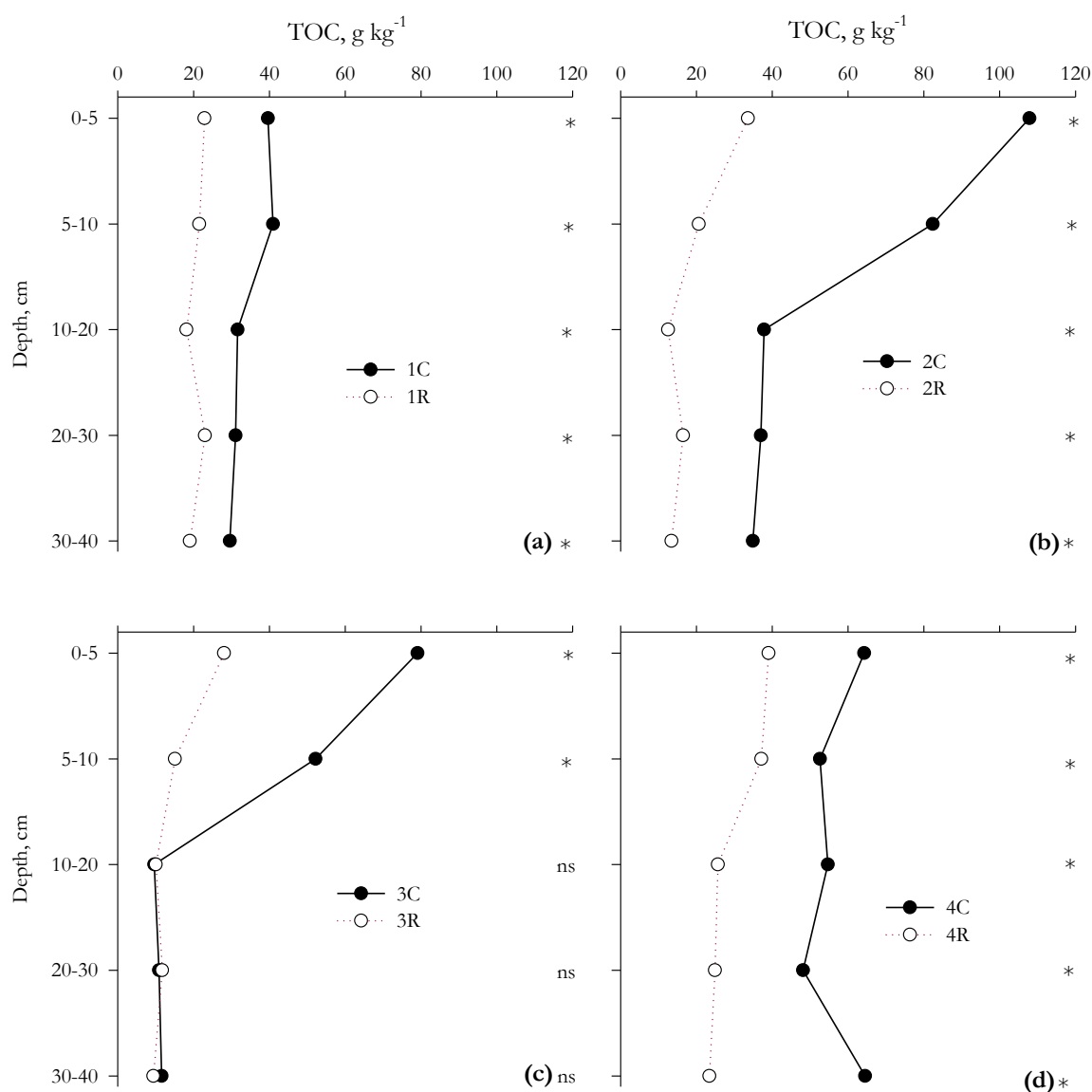
Figure   2.

Total organic carbon (TOC) in 1C and 1R (a), 2C and 2R (b), 3C and 3R (c), and 4C and 4R (d). *Significant difference by Student's t-test (p <0.05); ns: not significant. C: composting area, R: reference area.

Table 2. Potential acidity (H+Al), and percentage aluminum saturation and base saturation in soil of the composting areas and corresponding reference areas.

Depth,	H+Al, $cmol_c\ kg^{-1}$					
cm	1C	1R	CV, %	2C	2R	CV, %
0-5	1.1 b[(1)]B[(2)]	6.9 aA	22.78	1.8 bB	3.0 bA	3.44
5-10	1.4 bB	4.6 bA	5.57	1.9 aA	3.2 bA	1.74
10-20	1.7 aB	5.8 bA	13.27	1.3 dB	3.9 bA	0.00
20-30	1.6 aB	8.2 aA	4.93	1.4 cB	18.4 aA	0.66
30-40	1.6 aB	4.4 bA	7.47	1.4 cB	2.4 bA	4.10
CV, %	11.41	11.88		2.63	29.31	
Depth	3C	3R	CV. %	4C	4R	CV. %
0-5	1.2 aB	1.3 aA	0.66	0.7 aB	3.4 aA	4.10

	1C	1R	CV. %	2C	2R	CV. %
5-10	0.9 cB	1.1 bA	5.22	0.6 bB	2.4 bA	5.74
10-20	0.9 cA	1.0 bA	1.97	0.6 bB	2.7 bA	3.52
20-30	1.0 bA	1.0 bA	4.93	0.6 bB	2.5 bA	3.01
30-40	1.0 bA	0.9 cA	1.75	0.5 cB	2.8 bA	3.06
CV, %	3.29	3.49		4.30	11.79	

Depth	Aluminum saturation %					
cm	1C	1R	CV. %	2C	2R	CV. %
0-5	0.0 a[1]B[2]	41.8 cA	0.00	0.0 aB	1.3 eA	0.00
5-10	0.0 aB	73.5 bA	0.00	0.0 aB	15.9 dA	0.00
10-20	0.0 aB	75.8 bA	0.00	0.0 aB	44.0 cA	0.00
20-30	0.0 aB	94.0 aA	0.00	0.0 aB	59.6 bA	0.00
30-40	0.0 aB	93.6 aA	0.00	0.0 aB	82.9 aA	0.00
CV, %	0.00	2.27		0.00	2.92	

Depth	3C	3R	CV. %	4C	4R	CV. %
0-5	0.0 aA	0.0 aA	0.00	0.0 aA	0.0 aA	0.0
5-10	0.0 aA	0.0 aA	0.00	0.0 aA	0.0 aA	0.0
10-20	0.0 aA	0.0 aA	0.00	0.0 aA	0.0 aA	0.0
20-30	0.0 aA	0.0 aA	0.00	0.0 aA	0.0 aA	0.0
30-40	0.0 aA	0.0 aA	0.00	0.0 aA	0.0 aA	0.0
CV, %	0.00	0.00		0.00	0.00	

Depth,	Base saturation %					
cm	1C	1R	CV. %	2C	2R	CV. %
0-5	91.9 a[1]A[2]	21.6 aB	1.47	93.1 aA	71.1 aB	0.17
5-10	91.1 aA	13.3 bB	0.99	91.2 bA	65.6 aB	0.10
10-20	89.5 aA	10.6 bB	1.26	90.9 bA	54.1 bB	0.29
20-30	90.7 aA	1.9 cB	0.41	89.7 cA	15.2 dB	0.05
30-40	91.2 aA	3.1 cB	0.46	88.0 dA	23.6 cB	0.46
CV, %	1.01	16.40		0.26	9.26	

Depth	3C	3R	CV. %	4C	4R	CV. %
0-5	93.3 aA	90.8 bB	0.10	93.7 bA	84.9 aB	0.11
5-10	92.3 aA	91.2 aB	0.24	93.2 bA	87.4 aB	0.51
10-20	90.9 aB	91.6 aA	0.35	92.5 cA	84.1 aB	0.31
20-30	88.6 bB	90.6 bA	0.59	92.7 cA	84.4 aB	0.14
30-40	87.7 bA	91.4 aA	3.02	94.8 aA	83.0 aB	0.18
CV, %	1.35	0.30		0.30	1.87	

[1]Means followed by the same lowercase letter in the column did not show significant differences by the Scott Knott test (p <0.05); [2] Means followed by the same uppercase letter in the row did not present significant differences by Student's t-test (p <0.05). C: composting area, R: reference area.

The values of m% in 1C and 2C were lower than in corresponding reference areas up to 40 cm, while there were no differences between composting and reference areas in 3C and 4C (Table 2). However, the m% in all the composting areas was zero up to 40 cm.

Higher values of V% were found in the composting areas than in corresponding reference areas (Table 2). Base saturation above 85% was found up to 40 cm in all the composting areas.

In multivariate analysis, the attributes evaluated were set in two principal components, and the fitting of these data in the model explained 87.02% of the accumulated variability (Figure 3). The first component (PC1) explained 74.69% of the variability of the soil attributes. In PC1, pH, H+Al, m% and V% contributed significantly, as they had scores ≥ 0.5, except TOC in layers 10 to 40 cm (Table 3), which are considered highly significant (Coelho, 2003). As for the contribution of the attributes in the second component (PC2), only TOC stood out, starting at a depth of 5 cm, which showed coefficients with significance above 0.5 (Table 3).

There was separation in two main groups, one group with reference areas 1R and 2R, and another group with the other areas (Figure 3). This can be attributed to the higher values of potential acidity and aluminum saturation in 1R and 2R.
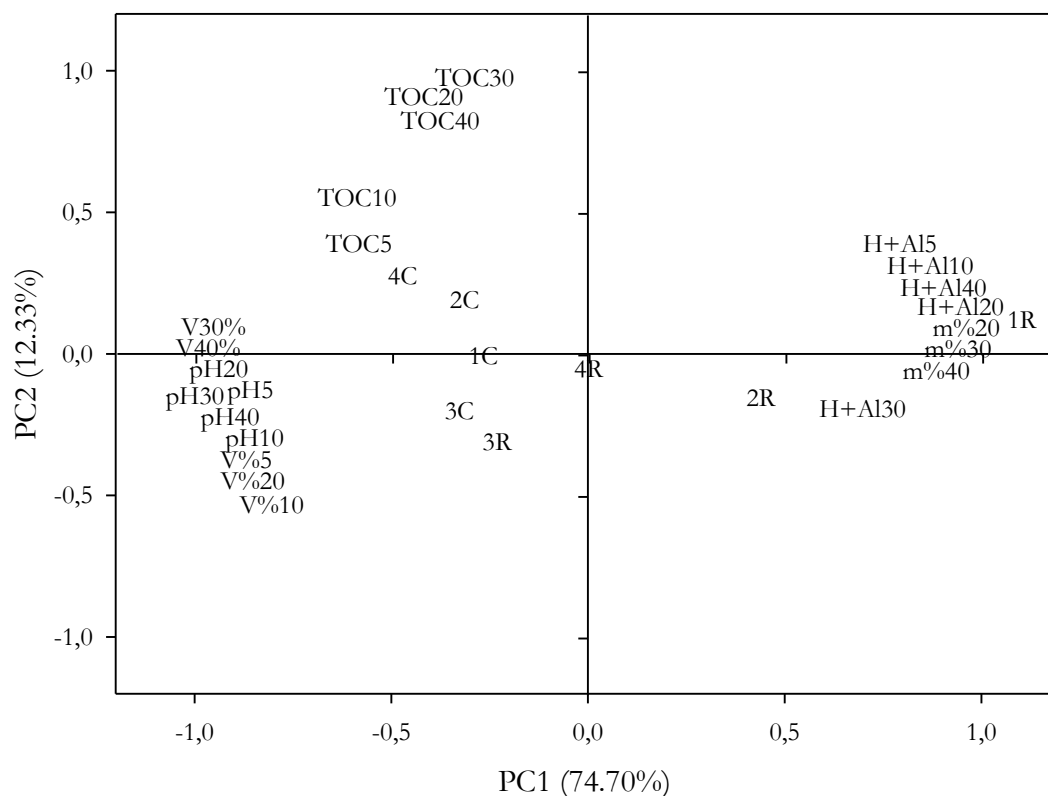

Figure 3. Ordination diagram produced by principal component analysis of the collected data. TOC: Total Organic Carbon, H+Al: potential acidity, m%: aluminum saturation, V%: base saturation. C: composting area, R: reference area. 5 = depth of 0-5 cm, 10 = depth of 5-10 cm, 20 = depth of 10-20 cm, 30 = depth of 20-30 cm, 40 = depth of 30-40 cm.

Table 3. Principal component analysis (PCA) of the variables evaluated in the soil of the composting areas and corresponding reference areas.

Variance component	PC1	PC2	PC3	PC4	PC5
Eigenvalue	18.67	3.08	1.11	1.07	0.89
Variability (%)	74.69	12.32	4.44	4.31	3.57
% accumulation	74.69	87.02	91.47	95.78	99.36
Variable	Correlation with principal components				
TOC 5	-0.57*	0.39	0.34	0.51*	0.34
TOC 10	-0.56*	0.57*	0.28	0.49	0.16
TOC 20	-0.41	0.87*	0.00	-0.23	-0.12
TOC 30	-0.30	0.91*	0.02	-0.21	-0.11
TOC 40	-0.39	0.84*	-0.03	-0.32	-0.02
pH5	-0.92*	-0.05	-0.05	-0.14	0.24
pH10	-0.94*	-0.10	-0.15	-0.09	0.20
pH20	-0.95*	-0.05	-0.17	-0.03	0.24
pH30	-0.95*	-0.07	-0.14	-0.08	0.21
pH40	-0.96*	-0.09	-0.13	-0.07	0.20
H+Al5	0.94*	0.14	-0.13	0.19	-0.12
H+Al10	0.97*	0.09	0.10	0.13	-0.10
H+Al20	0.98*	0.05	0.04	0.02	-0.11
H+Al30	0.71*	-0.18	0.57*	-0.32	0.11
H+Al40	0.93*	0.09	-0.06	0.20	-0.26
m%5	0.84*	0.24	-0.42	0.13	0.17
m%10	0.91*	0.19	-0.28	0.05	0.20
m%20	0.96*	0.08	-0.01	-0.09	0.22
m%30	0.96*	0.06	0.02	-0.11	0.22
m%40	0.93*	0.001	0.17	-0.19	0.23
V%5	-0.95*	-0.14	0.22	-0.03	-0.10
V%10	-0.95*	-0.14	0.19	-0.02	-0.15
V%20	-0.97*	-0.11	0.09	0.02	-0.14
V%30	-0.95*	0.01	-0.16	0.14	-0.18
V%40	-0.97*	-0.01	-0.13	0.08	-0.17

*Characters with higher factor loadings (scores) selected within each component. The criteria for classification were: absolute value <0.30, considered slightly significant; 0.30-0.49, moderately significant; and ≥0.50 highly significant according to Coelho (2003). TOC: Total Organic Carbon, H+Al: potential acidity, m%: aluminum saturation, V%: base saturation. 5 = depth of 0-5 cm, 10 = depth of 5-10 cm, 20 = depth of 10-20 cm, 30 = depth of 20-30 cm, 40 = depth of 30-40 cm.

Discussion

The increase in soil pH of the composting areas is associated to the pH of the compost, which reached an average value of 8.9. Also, the leachate from the piles had a pH of around 7.0 to 8.0, which in contact with the soil, favored the increase in pH to deeper layers. The alkaline pH of the compost and the leachate is the result of a proper composting process in which the aerobic decomposition of the waste and the oxidation of the organic acids produced during the decomposition of the organic material occurred, increasing the pH value (STRAATHOF & COMANS, 2015). As the leachate is in liquid form, it facilitates migration to deeper soil, also changing the pH in depth.

The contact of the compost pile directly on the soil promoted the increase of TOC contents in the surface layers of the composting areas, as there is a large volume of decomposing organic material. The contact of the organic material with the soil promotes the incorporation of carbon into the soil in the form of microbial biomass, non-humic substances and especially humic substances. Similar results were observed by Lourenzi et al. (2016) with the application of 0, 2, 4, 8 and 16 t ha^{-1} of pig slurry with wood shavings on the soil surface. After six years of annual compost applications, an increase in TOC contents was found at a depth of 0-4 cm. We found that the amount of organic material on the soil surface of the composting areas is approximately 1250 times higher than the highest dose applied by Lourenzi et al. (2016). The increase in TOC levels was also found by Brunetto et al. (2012) in evaluating the application of pig slurry and pig deep litter to supply one and two times the need for N in corn/black oat succession. The authors reported an increase in TOC up to 30 cm with the application of a dose of 180 kg ha^{-1} of N via pig slurry. Smaller increases in TOC contents in depths of 20-40 cm are also related to dissolved organic carbon (DOC) of the leachate. It should be noted that the increase found in our study was much higher than that found at the same depths by Brunetto et al. (2012) and Lourenzi et al. (2016), which indicates that it is the organic fraction of the leachate. This organic fraction is the result of thermophilic decomposition, which provides soluble organic carbon. Municipal waste compost has high amounts of DOC (above 4.5 g kg^{-1}), while manures generally have less than 1.0 g kg^{-1} DOC (MELO et al., 2008; STRAATHOF & COMAND, 2015). This organic fraction of the compost leachate has greater mobility than the organic fractions found in other wastes, such as in liquid wastes or stable organic composts, thus increasing TOC up to a depth of 20-40 cm. Similar results were found by Sorrenti & Toselli (2016) with the application of biochar, municipal waste compost, and a mixture of biochar and municipal waste compost in soils stored in lysimeters (considering a depth of 35 cm) in which peach trees were grown under irrigation. The leachate was evaluated for 12 months after the addition of the treatments, with monthly leachate collection. The authors found an increase in DOC content in the leachate, especially in the treatments with the use of the compost (single and mixed). This indicates that the compost (because of higher DOC contents) favors the increase of DOC and TOC in deeper soil depths.

The reduction of H+Al in the soil of the composting areas is a result of the consumption of H$^+$ ions present in the soil solution due to the increase in pH (Figure 2). The Al^{3+} of the soil solution, which is toxic to plants, is also neutralized by OH$^-$ groups, forming Al(OH)$_3$. With the increase in pH, H$^+$ and Al^{3+} are displaced from the CEC to the soil solution and neutralized by OH$^-$, reducing potential soil acidity (BRUNETTO et al., 2012). There is also a decrease in Al saturation in the composting areas due to the

increase in soil pH, which consequently promotes the reduction of H+Al and leads to a reduced amount of binding sites occupied by H^+ and Al^{3+}. With the decrease in Al saturation, there is an increase in base saturation, because with the consumption of H^+ and Al^{3+}, binding sites are available for the adsorption of K^+, Ca^{2+}, Mg^{2+} and Na^+.

Because of the increase in base saturation at all depths, the available sites are mainly occupied by Ca and K, and in smaller proportions by Mg derived from the concentration of these nutrients in the leachate (INÁCIO & MILLER, 2009; CHATTERJEE et al., 2013). The composting process releases Ca from the cell wall and K from the within the cell of plant tissues. Part of these elements (in soluble form in the compost mass) is used by the microorganisms for biological functions, and the other part (in available form) is not used by the bacterial populations. Thus, it may be lost in the water that leaches through the pile, characterizing the leachate.

By means of principal component analysis (PCA), it was possible to identify that the reference areas have higher values of potential acidity and Al saturation (Figure 3), especially 1R and 2R (Table 2). Among the composting areas, 4C and 2C stand out because of the differences in TOC (Figure 3), compared to reference areas 4R and 2R, especially at depths of 10-20, 20-30 and 30-40 cm (Figure 2).

Conclusions

Composting in small scale systems with piles directly on the soil promotes the increase in pH values, TOC contents and base saturation, regardless of the time of use. It also reduces potential acidity and aluminum saturation, providing attributes that favor plant development. A large amount of Ca and K reaches a depth of 20-40 cm, which is highly desirable for removing chemical barriers that prevent root growth in the subsoil. The leachate, therefore, is a valuable agronomic tool for the management of subsurface soil chemistry.

Acknowledgements

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Influence of Globalization on National Education Policies in Nigeria

DR. PATRICK IBE
E-MAIL: ibe@asurams.edu
ASSOCIATE PROFESSOR OF CRIMINAL JUSTICE, ALBANY STATE UNIVERSITY, ALBANY,
USA

DR. ANGELA CHEKWUBE EKOH-NWEKE
E-MAIL: ekohangela@yahoo.com
SENIOR LECTURER DEPARTMENT OF EDUCATIONAL MANAGEMENT
(BUSINESS EDUCATION PROGRAMME)
COLLEGE OF EDUCATION
MICHAEL OKPARA UNIVERSITY OF AGRICULTURE UMUDIKE
ABIA STATE

DR. AUGUSTINE OBELEAGU AGU
E-MAIL: *augobele52@yahoo.com*
EDUCATION SOCIAL POLICY ADVISER, GRAND PRAIRIE TEXAS

Abstract

*Globalization is one of the most widely contested phenomena by scholars because of its complexity, elusive nature and attribution for its positive and negative outcomes. Historically, globalization and education are very inter-related. The process of globalization began as early as the fourteenth century or at least with emergence of capitalism in the sixteenth century which resulted in the creation in Europe and USA of national education systems. This process continued and resulted in the transfer of these national education systems by colonial powers on other nations, and eventually to the establishment of the globalization institutions and instruments (WB, IMF, UNESCO,UNICEF). This paper looks at the influence of globalization on National Education Policies in Nigeria. Our basic argument, is that Nigeria since the introduction of national system of education under colonialism, has always been a recipient of her education policies. The country has not been able to articulate an endogenous education policy. All opportunities (military to civilian, civilian to military) had always ended in the reproduction (expanding or contracting) of the existing policy. Nigerian education policy makers should try to domesticate globalization and related processes by purposefully interacting with globalization demands as policies are being formulated and implemented. The paper is presented according to the following themes/sections. **One is** conceptualizing globalization and coming up with explanations/definitions for a shared understanding of this concept. **Two,** is examination of the evolution of education policies under (a) colonial and (b) postcolonial settings. **Three,** is how to use education policies to make globalization more inclusive through indigenization of modern education policies.*

Introduction:

Globalization can be defined from political, cultural, economic, and even environmental perspective. The political dimension of globalization discusses political interactions around the world which began immediately following the II World War. The formation of such entity like the United Nations brought most of the world's independent countries together and it triggered off the fight for independent for African, Asian and Latin American countries. The economic aspect of globalization relates to economic interaction around the world and the movement of goods from one country to another. The cultural perspective looks at the movement of human beings from one country to another, while the ecological dimension investigates the aspect of things like, climate change, population growth, world food supply, and environmental degradation.   It is also very important to note that technology has played a very big role in globalization.   In some quarters some scholars have noted that globalization is another form of colonialism in which colonial consumer values reign most. Rizvi and Lingard (2000) noted that the emerging global culture, many fears, imposes the same cultural images, taste, and attitudes on everyone, everywhere. This idea is encapsulated in the ironic phrase "McDonaldization of the World". Bauman (1998) noted that, it is this diversity of reference that makes it impossible to define globalization in any straightforward fashion. So, while the term "globalization" clearly refers to both the intensity and the extent of international interactions, it does not stipulate the ways in these interactions occur, or indeed how interaction acquires significance in some contexts but not in others.   Further, there are multiple potential political readings and responses to the phenomena that these essays attempt to capture in relation to education.   Theses seek to work against any "naturalization" of the directions the world is taking within globalization.

History of Globalization:

Globalization has always been associated with trade.   The First phase of globalization might have started during the "Victoria Era" when the European started exploring the world for goods especially spices. One cannot talk about globalization without laying emphasis on trade. Karl Marx (1848) noted that "National differences and antagonism between peoples are daily more and more vanishing, owing to the development of the bourgeoisie, to freedom of commerce, to the world market, to uniformity in the mode of production and the conditions of life corresponding thereto---- the supremacy of the proletariat will cause them to vanish still faster…..In proportion as the antagonism between classes within the nation vanishes, the hostility of one nation to another will come to an end" Richard Cobden (1864) noted that "Free trade….., will act on the moral world as the principle of gravitation on the universe, drawing men together, thrusting aside antagonism of race, and creed, and language, and uniting us in the bonds of eternal peace"

The second phase of globalization which is always termed the "Keynesian era globalization" saw a rise in trade of manufactured goods between the industrialized economies of Western Europe, North America, and Japan Thomas (2017). The new trade involved an exchange between industrialized countries of manufactured goods for manufactured good. It is during this period that countries like Taiwan, South Korea, Hong Kong and Singapore joined the industrialized countries in exporting goods.

The third phase of globalization is called the Neoliberal globalization.   Thomas (2017) noted that Neoliberal globalization makes "barge economics" a reality.   The barge is built on a complex of organizational and technological change that rests on a legal and policy infrastructure which supports off-shoring and foreign out-sourcing of production.   Trade he maintained remains central because goods must cross borders, and hence the need for trade agreement.   However, barge economics is fundamentally different from conventional economics of trade.   The latter is about cross-border exchange of goods and services with immobile production.   The former is about creating flexible mobile international production networks configured on the principles of global cost arbitrage.

Globalization and Education

Education is the basic skill for promoting globalization.   It should be seen as a widespread systemic change in education.   It also calls for a shift in paradigm which involves attention to be paid in a mono-cultural to multi-cultural with emphasizes in school curriculum and its implications.   Some of the early educational globalization is the spread of global religions, like Islam and Christianity, which throughout the nineteenth century displaced the indigenous forms of schooling.   At this same time missionaries had brought what we call core Western ideas and practices to the world.   With education the colonialist has penetrated the world in so many ways.   Woodhouse (1987) claimed that people on the periphery are "mystified" by dominant ideologies, and willingly, even enthusiastically and without conscious awareness of implication, accept core Western learning thereby subordinate themselves to the world system.   Carnoy (2005) stipulates that globalization increases the demand for education, especially university education, and this increases pressure on the whole system for higher quality schooling, often producing perverse educational consequences, particularly from the standpoint of equity.

What we have seen around the world today as education, mass schooling of children, could be regarded as a first instance of globalization's impact on education, as many non-Western context traditional education had been conceived as small-scale, local community-based, and as vocational or apprenticeship education, and/or religious training (Reagan, 2000).   What happened early on is that in most of the colonialized countries we found formalized schools emerge for the first time for children of the elite and the children of the expatriates.   Due to globalization there was a massive change in standardization which of course with its colonial characteristic has little relevance to the cultures of the communities.   It was of course not intended for development as such but for foreign intervention and global empire maintenance or social control. (Babaci-Wilhite et al; 2006) is of the opinion that African education system is an example of curriculum that has been distributed from the top-down that is not helping students realize their potential and become empowered to change the future of their countries.   In this system, he maintained rather than providing classes in the student's native languages, instruction is given in French, English, Portuguese and Spain.

Jackson (2016) postulated that globalization as contemporary condition or process clearly shapes education around the globe, in terms of policies and values; curriculum and assessment; pedagogy; educational organization and leadership; conceptions of learner, the teacher, and the good of life; and more. Whereas, Besley (2012) maintained that other scholars argue that globalization major impact on education

has actually been the promotion of a thin layer of aspirational, cosmopolitan values among global cultural elites, who largely overlook the realities, problems, and challenges many faces.

Globalization and Education Policies Development

Globalization is the ongoing process of greater interdependence among countries and their citizens (Fischer, 2003). This inter-dependence materializes in increased international flows of goods and services, of financial funds, labour and ideas. The last aspect -increased international flows of ideas -is the most relevant one for human capital development. When it comes to education policies, it is important to consider the relevance of globalization for the international flow of ideas. Romer correctly emphasized that "globalization is driven by the gains from reuse of ideas" (Romer, 2010:94). In this sense, education policies take center stage because of their impact on individuals and societies capacity to adapt to the changes and to take advantage of the opportunities brought about by globalization. Rather than static comparative advantage aspects of globalization, the reuse of ideas that have been generated in other countries is what is most important for the process of development in a dynamic perspective.

The history of education policymaking in Nigeria is characterized by uncertainties, transitions due to changes in the global international relationships from colonial to post-colonial. In any of the contexts, the international flow of ideas remains paramount.   We argue that colonialism was a manifestation of the first and second stages of globalization (Victorian era and Keynesian era). This has guided the examination of the colonial education policies in Nigeria. The Neoliberal stage of globalization dictated the education policies of Nigeria for the post-colonial era .In both phases of globalization (Victorian/Keynesian vs Neo-liberal), the Nigerian nation state had to acquiesce to the pressures exerted by the various church organizations, the influential nation states and much later by international organizations. This seriously impeded and still impeding the capacity of the Nigerian state to develop its policies independent of any external influence and in favor of its citizens. Consequently, colonialism and post-colonialism (with the civilian/military swing) is the conceptual framework for looking at the globalization of educational policy making in Nigeria.

Globalization and Colonial Education Policies

The education policies may fall under the Victorian and Keynesian era. The colonial government had a hands-off policy on education development. This was dictated by the ideology of laissez faire that was selectively practiced. The basic objective of colonial economic policy was to stimulate the production and export of cash crops and encourage the importation of European manufactured goods (Stiglitz, 2002). Investment in human capital development was not a priority. The various Christian Missionaries had a free hand in the education enterprise. British colonial policies on education were formulated and implemented in Nigeria between 1882 and 1926. Prior to 1882, the policy was to leave the delivery of education services to the Missionaries (Christian and Muslim) and the private sector (Fafunwa, 2004).

The educational policies of the colonial administrators were directed using education ordinances. These include: 1882; 1887; 1916; and 1926 Education Ordinances (Fafunwa, 2004). The 1882 and 1887 Ordinances were meant to address the imbalance in the education system and to establish a substantial

amount of control on education activities of the missionary bodies. The main takeaways of the Ordinances (1882, 1887) were the creation of Education Boards and establishment of the grants in aid formula. The 1916 Education Ordinance was a response to the amalgamation of the colony and the Protectorate of South with Northern Nigeria (1914).

The British colonial educational policy did not mature until the 1920s when the Advisory Committee for Education in Africa was established, and the famous Phelps-Stokes Commission issued its reports (Dike, 1980). Drawing from the American experience in Negro education, the Phelps-Stokes reported, inter alia, (a) that the education of the African should be adapted to the agricultural, vocational, and other utilitarian aspects of the African environment; (b) that African education should be different from that of Western societies, but similar to that of the African Americans; (c) that the education given should be such that it does not create political "poison centers;" (d) that education should stress character development and the religious life of pupils . Africans rejected Phelps-Stokes policy with the argument that educational adaptation, meaning vocationalism, agricultural training and the like was an inferior education.

The above notwithstanding, a Memorandum on Education Policy in British Tropical Africa was dispatched to the colonies in 1925 as a basis for the British Colonial Education Policy. The Report of this commission enabled the British colonial administration to demonstrate increased interest in African education, which led to the issuance of the first educational policy in 1925(Dike,1980; Fafunwa, 2004). The policy consisted mainly of the recommendations of Phelps Stoke Commissions. Based on the Phelps Stokes recommendations, the 1926 Education Ordinance was enacted. The 1948 and 1952 Education Ordinances were merely elaboration of the 1926 Education Ordinance. While the 1948 Education Ordinance decentralized education administration by creating a Central Board of Education and four Regional Boards for the East, West, Lagos and North; the 1952 Education Ordinance enabled each of the newly created regions -Eastern, Western and Northern -to develop its educational policies and systems. The 1948 Education Ordinance was a milestone in British colonial educational policy in Nigeria, because it was the first educational legislation that covered the whole country. The 1952 Ordinance became the education law for the country.

The clamor by Nigerians for self-government resulted in two constitutional conferences which brought together Nigerian political leaders and the British colonial government between 1951 and 1954. The deliberations of the conferences resulted in the drafting of a new federal constitution in 1954. The Constitution contained three lists: (i) Exclusive legislative list (which contained items only for the federal legislation); (ii) Concurrent legislative list (items upon which both federal and regions could legislate); (iii) Residual legislative list (comprise items which are within the exclusive legislative competence of the regions). The regions exploited this constitutional provision and made regional laws of education. Education happens to be in the concurrent list raising the issues of federal and regional tensions in educational policy making.

From the review of the dynamics of colonial education policies, two things stand out. One, is that that the colonial educational policymaking was delivered through ordinances. The peoples of Nigeria were not fully involved in the policy making of the ordinances. These were imposed on the people without going through the processes of discussion and negotiation. Two, the colonial policy architecture laid the foundation for the tension between the demands for greater national unity of purpose and the desire for regional and local

control in education policy. n. These principles -technocratic approach and the tensions between unity and regional authorities in education -spilled over into the post-colonial dynamics of education policy making as discussed below.

Globalization and Post-Colonial Education Policies

The policies made were dictated by Neo-liberal principles. Neo-Liberalism is a theory of political economic practices that proposes that human well-being can best be advanced by liberating individual entrepreneurial freedom and skills within an institutional framework characterized by strong private property rights, free market and free trade. The role of the state is to create and preserve an institutional framework appropriate to such practices. The state must guarantee, the quality and integrity of money, security, legal structures, education, healthcare and others (Harvey, 2005:2). Nigeria was granted full independence in October 1960, as a federation of three regions (Eastern, Western and Northern) under a constitution that provided for a parliamentary form of government. Under the constitution, each of the three regions retained a substantial measure of self-government. Despite seeking to assert political and social autonomy, the leadership at independence found they had little choice but to operate within the colonial policy architecture. The Nigerian state because of many reasons that is beyond the scope of this paper, was to say the least very weak.   Six years after independence, the system gave way to successive military coups in 1966, followed by a three-year civil war and frequent military coups and changes of governments. The post-colonial educational policy making in Nigeria because of state weakness retained the colonial education principles and to a large extent influenced by Neo-liberal policies. This is examined under two categories -the civilian versus military regimes. Between 1960 and 2019, (59 years of independence), civilian regimes have effectively been in place for 29 years. Military regimes were in charge for 30 years. Neither the civilian nor the military had the capacity to transform the colonial policy making architecture

The First Democratic Republic (1960-1966)

As indicated earlier, the foundation of the Nigerian education policy making architecture was laid in the colonial era with Neo-liberalism principles guarding the education development.   During the first republic, the policy of decentralization of education as stipulated in the 1954 constitution continued. The regions developed their educational policies as they saw fit. With the introduction of UPE, the south (eastern and western regions), expanded on the educational institutions initially introduced by the Christian Missionaries. In the north, Qur'anic education was the preferred mode of education in the largely Muslim north amongst the rural communities. The non-Muslim communities in the north struggled quite a bit in accessing education. Most merely depended on what the Christian Missionaries could provide.

The First Military Interregnum (1966-1979)

Six years after Independence and three years after being a Republic, the Military seized power in Nigeria on 15th January 1966. The taking over of political power by the Nigerian military marked the beginning of the erosion of the decentralized regional based federalism. The military government began a process that transformed the relatively loose regionalized federal arrangement of Nigeria into one with a strong center. It promulgated Decree No. 34 of May 1966, known as the Unification Decree, which

abolished the decentralized federalism and introduced a unitary form of government. Six months into the first coup, there was another coup and a change in government in June 1966 that reinstated decentralized federalism; but silent on regionalism. The military was incapable of transforming the colonial architecture of education policy making. Between 1967 and 1970, very little in terms of education policy making happened. The country was busy with the civil war. However, in 1969, the National Curriculum Conference was convened which reviewed the educational system and its goals and identified new national goals for the country which would determine the future and direction of education in the country. The conference was the first national attempt to change the colonial orientation of the Nigerian educational system and promote national consciousness and self-reliance through the education process. One crucial shortcoming of the conference was that most peoples from the Eastern part of the country (then Biafra) could not participate in the conference because of the civil war. As a follow-up to the 1969 curriculum conference, the Federal Government of Nigeria in 1973, organized a seminar of experts to deliberate on a truly Nigerian national education policy. The report of the seminar after considerations by the States of Federation and other stakeholders was presented as the draft National Policy on Education. This marked the beginning of the end of the reproduction of the colonial education policy and the participation of Nigerians in the policy formulation. The policy was not introduced until four years later

However, policies of education were made through education edicts; a reminder of the centralized education ordinances during the early period of colonial involvement in education. In 1976, the Federal Military Government increased the states from 12 to 19. Each state promulgated an edict for the regulation of education. One crucial observation was that all the edicts had common features, such as state takeover of schools from private and voluntary agencies, establishment of school management boards and a unified teaching service. The implementation of these edicts brought the educational policy making under a unified central control. Furthermore, under successive military regimes, revenue administration and collection became increasingly centralized, and state/regional allocation was engineered at the discretion of the military government. Simultaneously, expenditure responsibilities and government functions also became centralized, with the federal government assuming the role of the engine of social and economic development in which education is a subset.

In 1976, due to increased revenue brought about by oil boom, the Federal Government of Nigeria in line with the Neo-Liberal principles of mass primary education, introduced the national Universal Primary Education Program and expanded access into tertiary education and increased the number of unity secondary schools in the country. The UPE program provided six years of primary education starting from six years of age for all students and aimed for 100% primary enrollment by 1981. One of the main objectives of UPE was to provide all children free primary education, and hence bridge the educational gap between and within states and regions.

A national policy on education was introduced in 1977. The Policy among others was geared towards addressing the problems of educational relevance to the needs and aspirations of Nigerians as well as promoting Nigeria's unity and laying the foundation for national integration. In order to achieve the objectives, the policy made education in Nigeria the Federal Government's responsibility in terms of centralized control and funding of education. The centralization was a departure from the later colonial and

the first republic policy of having education on the concurrent list that allowed more stakeholder participation in financing and policy making.

Furthermore, the National Policy of 1977, introduced the 6-3-3-4 educational system modelled after the American system of 6 years of primary education, 3 years of junior secondary school, 3 years of senior secondary school, and 4 years of university education (FRN, 1977).The first military government reinforced the technocratic approach to policy making. The policy making institutions, such as the constitution, parliament and the bureaucracy inherited from the colonial administration were either abolished (constitution and parliament) or weakened (the bureaucracy and civil society, including missionaries). Most of the actors in the policy making were handpicked by the military government. Logically, these were more accountable to the military government that appointed them than to the Nigerian people. The policy making processes were weak on discussions, negotiations and exchanges; but strong on compliance

The Second Democratic Republic (1979-1983)

The first military interregnum (1966-1979) in Nigeria was followed by the second republic; this time a presidential system of civilian government. The 1979 constitution put education back on the concurrent legislative list. This marked a swing of the pendulum back to the regional/state-based federalism; but this time the states were weakened from the experiences of the immediate past military governance. The constitution shared the responsibility for education among the three tiers of government - federal, states and local governments; while it gave the federal government more powers than the states in the areas of post-primary, professional, technological and placed university education under federal control. Primary education was to be a joint venture between the states and local governments, with local governments responsible for teachers' salaries. The provision for education in the 1979 Constitution, culminated in the first revised National Policy on Education that resulted in the National Education Policy (revised 1981).

It is important historically to note that the National Policy of Education (1977) has been revised four times -1981, 1983, 1998, and 2004 (FRN, 2004). However, the principles inherited from colonial education policies to a large extent continued influencing the policy directives. While the 1981 and 1983 revisions were done under the Second Republic, the 1998 revision happened under Second Military interregnum, and the 2004 revision took place under the Third Republic. The revised National Policy on Education (1981) changed the responsibility to finance primary education from the federal government to the states and local government. The main reason for the change was that the federal government could not cope with the funding of the national UPE programme because of decreased national revenue due to the oil glut in the 1980's. The inability of the federal government to shoulder the financial burden of the implementation of national UPE policy stalled the process. Consequently, payment of teachers' salaries and provision of educational facilities became difficult to do. Quality of education suffered and primary enrollment stagnated. In 1983, the National Policy on Education was again revised. However, this revision did not take effect because the Second Republic Democratic government was overthrown the same year. One of the problems of the Second Republic was its inability to alter the centralizing tendencies of military

rule which it inherited. The current Third Republic Democratic government has not done better in changing the centralizing tendencies from the military.

The Second Military Interregnum (1983-1999)

In 1983, the Second Republic was overthrown by the military. The 1983 revised National Policy on Education was cancelled by the immediate military government. In its place, the Federal Military Government promulgated several decrees to guide and regulate the management of education. The decrees include: (i) Decree No.16 of 1985, which set the benchmark for national minimum standards and the establishment of institutions; (ii) Decree No. 26 of 1988, which proscribed and prohibited the Academic Staff Union of Universities (ASUU) from participating in trade union activities; and (iii) Decree No. 36 of 1990 which revoked the proscription of ASUU, and other decrees. The National Policy on Education was again revised in 1998 in line with the stipulations of the Jomtien directives under a military regime. The Jomtien conference of EFA marked the rise of consensus at international level that education is the sole important element in removal of poverty, protection of children from ruthless labor and advocating human rights and democracy (Haddad, 1990). The conference compelled the participating countries with weak states to endorse the aims and targets of the policy. The government hoped to use education as a tool for promoting national unity and for the total development of the individual. The revised policy prescribed a Universal Basic Education (UBE) program, which is compulsory for all children in the country, given in the form of nine years continued education (6 years' primary education and 3 years junior secondary schooling). The policy among others dealt with the followings: (i) It raised the minimum standard for entry into teaching profession from Teacher Grade II Certificate to the National Certificate of Education (NCE); (ii) It proposed the provision of UBE in a variety of forms, depending on the needs and possibilities for all citizens; (iii) it introduced various programs like the Nomadic education for the education of the migrant ethnic groups such as the nomadic cattle rearing Fulani and Ijaw fishermen were introduced.

The Third Democratic Republic (1999-Present)

The emergence of a democratically elected government in May 1999, ended more than a continuous decade of military rule. The implementation of the 1998 revised National Policy on education started in 1999. Between 1999 and now, successive Nigerian governments, influenced by the global goals and commitments, such as Education for All (EFA) and MDG have initiated series of policies and programs aimed at improving access and quality of education. The National Policy on Education (NPE, 2004), Universal Basic Education (UBE) Law (2004), National Policy on Gender in Basic Education (2007) and the National Policy for Integrated Early Childhood Development (2007) were all geared towards ensuring that Nigeria meets its commitments on the globally agreed objectives to meet the learning needs of all children, youth and adults by 2015. The policies were championed by the collaboration between the Federal Ministry of Education, and other line ministries, International Development Partners, Civil Society organizations in response to global education reforms.

The return to democratic rule in Nigeria (1999) and the decisions of the international community at the World Education Forum (2000) to achieve EFA goals and targets changed the dynamics of educational policy making in Nigeria in two ways. One, which is internal, is that there was pressure by the state

governments to decentralize the administration of education in the country. Under the 1999 Constitution, education is under the Concurrent Legislative List. The Federal Government was expected to develop policies that ensure equal and adequate educational opportunities at all levels. The state governments were responsible for providing primary, post-primary, vocational, technical and other forms of education in their respective areas. The Local Government Councils were expected to participate in the respective state governments programms. The UBE (2004) Law reinforced the roles and responsibilities of the three tiers - federal, state and local council and added that the federal government's intervention under UBE Law shall only be assistance to the states and local government councils to ensure uniform and qualitative basic education throughout the country.

The second, which is external enabled international organizations such as the World Bank, UN agencies, and some bilateral organizations to be deeply involved in the policy dialogues to achieve educational targets and commitments. For example, the EFA movement in Nigeria was inspired by UNESCO/UNICEF/UNDP/WB efforts to support the country to achieve EFA and MDG education goals. Like most developing countries with the increasing impact of globalization, Nigeria started experiencing trans- nationalization of education policy making. The dynamics of educational policy making increasingly stopped being an exclusive affair of the nation state. Transnational institutions, to which the country and most nation states belong, are now the main contexts which define the major educational aims and targets such as EFA, MDG, and currently the Sustainable Development Goals (SDGs). It seems clear that for the most part, since the beginning of the 21st century, the Nigerian government like the states in most developing countries are largely pursuing common education policy agenda. The focus of educational policies by the Nigerian government was aligning its policies or approaches to the global policies.

Moreover, it is important to underscore that the trans-nationalization of educational policy making created space for the civil society in Nigeria to be increasingly involved in policy making. In the run-up to the World Education Summit in Dakar in April 2000, forty Non-Governmental Organizations (NGOs) with interest in education came together to form a national network named "Civil Society Action Coalition on Education for All (CSACEFA). One of the main objectives is to: contribute to the shaping of policies on education in Nigeria and provide a platform for dialogue. CSCEFA has forged partnerships with various national and international organizations in pursuance of its objectives. The civil society organizations have tended to work more closely with the International Development Partners because of funding; this has created some quiet tensions in the partnership arrangements.

Conclusion

In this paper, we have traced the development of education policy making in Nigeria over a period of several decades. It seems very clear that educational development in Nigeria was affected by globalization, specifically, by colonialism and Neo-Liberalism. Fifty-nine years after independence, Nigeria has not been able to transform its education system. The current education system is just an expansion of the colonial architecture. This is because the Nigeria State has historically been very weak. The state lacked the capacity to transform education; consequently, it had no option but to be responding more to globalizing processes rather than national needs. Through many twists and turns, the dynamics of educational policy making in

Nigeria has three main story lines. One, is that policy making in Nigeria has been mainly externally directed. The directive came initially through colonialism and secondly by trans- nationalization; both of which are phases of globalization. These happened because the Nigerian State was not in existence during colonialism and very weak during post-colonial era to deal with the demands of globalization in the 21ˢᵗ century.   The second story line is that the dynamics of educational policy making since independence has been that policies have always emanated from the top down raising implementation issues. The processes of formulating these policies were not participatory and inclusive enough. Contributions by stakeholders at the local government and community levels were minimal.

We will like to conclude that for educational policy making in Nigeria to be meaningful and effective, should start the journey from the bottom (schools, communities, local and state level institutions). The top down and externally driven approach to policy making that have dominated educational development had minimal impacts. A new approach to educational policy making that goes beyond statement of intent by policy makers as has been hitherto practiced is needed. The policy making which is very process oriented could be directed by the following logic: (a) identification of the various organizational operations that will impact on the policy; (b) assessment of policy needs and the policy options available to meet them; (c) resources to be directed at the organizational units likely to have the most effect. This process will reduce reliance on abstract solutions, making way for local knowledge and skill at delivery level. This calls for decentralization of educational policy making and a return to a loose federal system in which local and state authorities are paramount.

Recommendations:

Based on the literature reviewed, the following recommendations were proffered;

1. The education policy makers at all level of education should determine the skills, abilities, competences and attitudes required by the young and lifelong learners.

2. The education policy makers and curriculum planners should construct an adequate and appropriate global curriculum to enable learners have a solid education foundation that will equip them with what it takes to acquire a global based knowledge.

3. The education policy makers should develop an appropriate and relevant technologically mediated pedagogy to enable the learners to be technologically grounded and as well fit in and function appropriately in the technological globe.

4. The education policy makers should specify an established universal standard by which learning/education performance can be evaluated to enable learners align globally without being underrated.

5. To enhance a nation's productivity and competitiveness in the global situation, decentralization and the creation of a market in education should be employed by the education policy makers to enable government increase labor flexibility and create more autonomous educational institutions while catering for the demand for more choice and diversity in education.

6. The education policy makers should strive to develop knowledge-producing institutions and industries to enhance skills and abilities that will improve human capital.

7. Government should provide a ready supply of skilled labor by increasing the overall level of education in the labor force to enable them attract foreign finance capital.

8. Educational systems should strive to produce individuals for global competition, individuals who can by themselves compete for their own positions in the global context and who can legitimate the country and strengthen its global competitiveness.

9. The government should put into consideration these important forces; the globalization of economy, the commodification of knowledge and the retrenchment of the welfare state for the changes in higher education.

10. The government should implement these trends in restructuring higher education in Nigeria; a shift from elite to mass higher education, the privatization of higher education, the practice of corporate managerialism and the spread of transnational education.

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Environmental Aspects of Production Management of Services in The Amazon

Janaína Vieira Botelho. Business Management student for the degree of Bachelor at the Federal University of Rondônia (UNIR), Brazil. Collaborating member of the GEITEC / UNIR / CNPq, Brazil. E-mail: jana153adm@gmail.com

Usiel Marcos Pagani Ferreira. Management student for the degree of Bachelor at the Federal University of Rondônia (UNIR), Brazil. Collaborating member of the GEITEC / UNIR / CNPq, Brazil. E-mail: usiel.pagani@hotmail.com

Flávio de São Pedro Filho. Post-Doctorate in Management and Economics at UBI, Covilhã, Portugal. PhD in Management from USP, Brazil. PhD in Business Management from UAA, Paraguay. Professor of Production Management at the Federal University of Rondônia, Brazil. Permanent Professor at PPGA and PROFIAP at UNIR. Coordinator of the GEITEC / UNIR / CNPq, Brazil. E-mail: flavio1954@gmail.com

Fernanda Rodrigues de Siqueira. Business Management student for the degree of Master at the Federal University of Rondônia (UNIR), Brazil. Collaborating member of the GEITEC /UNIR/CNPq, Brazil. E-mail: fernanda4092@gmail.com

Ilton Monteiro Alves. Business Management student for the degree of Master at the Federal University of Rondônia (UNIR), Brazil. Collaborating member of the GEITEC /UNIR/CNPq, Brazil. E-mail: ilton.alves@unir.br

Anderson Emanuel de Freitas Cantanhede. Business Management student for the degree of Master at the Federal University of Rondônia (UNIR), Brazil. Collaborating member of the GEITEC /UNIR/CNPq, Brazil.   E-mail: anderson.cantanhede65@gmail.com

Abstract

Environmental degradation is one of the most discussed topics today, but organizations also consider it a source of competitive advantage. This study is qualitative and uses the Case Study Method. Data were collected in a pest control company located in Porto Velho, Rondônia, Brazil. As its main topic, it takes aspects of environmental management in a pest control company´s production process in the city of Porto Velho. Its specific goals are to (1) identify which tools and sustainable production methods are used by the company in its production process; (2) highlight the competitive advantages arising from the incorporation of aspects of environmental management in production processes; and (3) indicate the innovation process that best contributes to the improvement of the company´s environmental management. Assessing the environmental aspects of the company´s production management revealed satisfactory results. The

company is engaged in sustainable development and is gradually pursuing improvements to its methods of maintaining and conserving the environment. The subsidies mentioned allow the degree of sustainability demanded by contemporary society, which benefits from the environmental services offered. This study is a university´s research contribution to managers and stakeholders who want to learn more about the applicability of concepts of an environmental management system in pest control companies

Keywords: Amazon. Environmental Management. Sustainable Production. Innovation. Reverse Logistics. Competitive Advantage.

1. INTRODUCTION

Sustainability has become a significant requirement of organizations, which demands practices that are increasingly committed to preserving the environment. Sustainability involves technology, which can provide help environmental management to develop, enabling production processes to improve, become more efficient and can simultaneously preserve the environment through the search for ecologically wholesome products and services.

Based on this premise, Silva (2019) suggests the creation of processes to facilitate the return of packaging to the production chain and the reduction of consumption during manufacture, reusing inputs already used. However, even though most entrepreneurs must limit their costs, it brings better results for the organization, as well as the environment, to consider the elements that create cleaner production and reverse logistics. Among these results, more profitability and an improved organizational image stand out, since consumers have gradually come to valued actions aimed at the preservation and conservation of the environment.

Granting the importance of developing green products and services in the production chain, here we seek to answer the following question: how can environmental management contribute to practices related to the production process? To answer the question, this study has as main goal to evaluate which are the features of environmental management in a pest control company´s production processes in the city of Porto Velho; the specific goals of the study are to (1) identify which tools and sustainable production methods are used by the company in its production; (2) highlight the competitive advantages arising from the incorporation of elements of environmental management in its production process; (3) and indicate the innovation process that best contributes to the improvement of the company´s environmental management. In the present paper, with its topics and subtopics, this introduction is followed by a theoretical and conceptual review; next come the methodology adopted for the preparation of this document, the results, according to the objectives outlined, the conclusion and the references that support the research.

2.   THEORETICAL-CONCEPTUAL REVIEW

The evolution of today's society occurred through three major events. The first was the emergence of agriculture, the invention of the plough marking the initial technology of the era. The second is represented by the industrial revolution, with the invention of the steam engine, followed by the combustion engine, the division of labor, Henry Ford's assembly line and the ideas of Frederick Taylor, which mark the period

of mass manufacturing. The third era is distinguished by the beginning of digital and hi-technology development, the post-industrial society and current knowledge. This journey of development and scientific progress has made major impacts on the environment.

In addition, Pereira (2019) identifies that, in the last forty years, the world has undergone the kind of technological transformation that no other generation has been able to witness. Scientific and industrial knowledge has led the world to great transformations, directly intervening in the use of natural resources, in the production of consumer goods and in the increase of disposables to the   detriment of environmental health. At the height of industrial development, there was an accelerated disposal, resulting in garbage accumulation, which resulted in environmental degradation, the proliferation of disease and rapid climate change.

2.1 Concepts of an environmental management system

The environmental management system (EMS; SGA in Portuguese) is a structure which emphasises the sustainability of as industrial production process, according to Silva (2019). It is, therefore, a set of guidelines adopted to implement an environmental policy that, in addition to improving the environment, adds quality to the company's products, services and processes.

If such a system is to be implemented, whether in industry or commerce, the organizational activities that may impact on the environment must be mapped to establish its control and propose in the institution's environmental policy methods of minimizing or overseeing this impact. Therefore, when a company adopts an effective environmental management system, raw materials that still have some use are reused and introduced in recycling programs that reduce the amount of inappropriate waste for disposal. These processes are seen by Schirmann (2019) as ways to avoid waste which can also reduce water and energy consumption.

2.2 Concepts of tools and methods of sustainable production

The attitude taken by a manager in analyzing the impact of his production process on the environment encapsulates a systemic view of the performance of his/her organization in society. It is in this context that one can highlight the choice of the tools and methods that best conserve and maintain natural conditions to assess which environmental aspects are acknowledged in the production of goods and services. For this, Sales, Gouveia, Ruzene and Silva (2017) recommend that each organization should adopt the method that best meets its needs and that establishes links with the operational objectives and goals that determine its characteristics of its production.

2.2.1 Concepts of cleaner production

Cleaner production means manufacturing products – including the use of water, energy and raw materials – with the least possible generation of pollutants and waste,. To make this process feasible, technical, economic and environmental feasibility studies are carried out in order to evaluate, select and, finally, implement the best methods and solutions for the production management, acting at the strategic points where failures occur. In addition, there is also the implementation of P + L continuity measures to support

the activities developed or to insert new alternatives and projects for sustainable production, with the objective of maintaining the organization's cycle of continuous improvement. In this regard, Schirmann (2019) points out that cleaner production is a tool that works to reduce the impact of the production process; it gives manufacturers a chance   to improve the processes of production, and contributes to the reduction of direct and indirect costs and the consumption of inputs in the performance of the company's main and secondary services.

2.2.2 Concepts of product life cycle and reverse logistics

The concept of product life cycle is closely linked to all stages of the production process, encompassing studies about how they relate to each other, to the environment and what are the social, environmental and economic impacts that are generated in the entire production chain. Thus, it is a complex system that takes into account the production of raw material, its processing and all distribution and disposal logistics. The so-called reverse logistics is introduced in disposal. Reverse logistics is an area of Logistics, whose purpose is described by Lira (2018) based on promoting the return of rejected products or at the end of their useful life to their place of origin, seeking to solve the problem of solid waste disposal in the environment and contributing to reduce pollution and waste.

2.3 Concepts of competitive advantage in sustainable production

The implementation of the environmental management system was seen in the past as a costly process, applicable only to large companies. However, small businesses are gradually discovering and demonstrating that being socially and environmentally responsible has become a significant competitive advantage for them too. Dal Forno (2017), for example,   finds that sustainable management, while representing a challenge for companies, opens the   door to new business and growth opportunities, providing benefits to society, the environment and the organization from the savings generated and the preservation of the resources used.

The most enduring practices related to environmental health are the adequate collection and disposal of waste; the efficient use of water and energy, raw materials and supplies; and the choice of certified product suppliers. As a result, the quality of products, services and processes rises significantly. Other results are verified by Lira (2018), showing that the company also gains in consumer preference, because this behaviour strengthens the brand's reputation in the face of competition. These elements imply that the environmental management system is a fundamental tool in the strategic planning of organizations that work for success and survival in the market.

2.3.1 Concepts of innovation and technology for sustainable production

According to Pinsky and Kruglianskas (2017), innovation is an action or act adopted by industries to contribute to organizational survival through new technologies and processes that generate new products and services or improve existing ones. Given an increasingly globalized market, with unstable economies and fierce competition, advances in technology in favour of the environment have been changing the current production processes. The largest companies in the world value sustainability as a lever for the organizations' strategy, and no longer treat it as an element outside the process.

Two types of innovations focused on sustainability are discussed by Sales et al. (2017): innovation as an incremental change, in which only the improvement of existing processes occurs; and radical innovation. The latter is the most challenging of the sustainable innovation models, causing total and integral systemic transformation and reinventing defective business models conceived from no economic perspective.

2.3.2 Environmental concepts in an pest control company

The disorder of urban growth and the lack of basic sanitation is accountable for a significant increase in vectors and pests that transmit diseases, such as rats, cockroaches, flies, and mosquitoes, among others. In this regard, Silva (2015) extends the capacity of pest control companies to combat the most diverse types of urban pest by devising control techniques and methods that use chemical agents safely without jeopardizing the health of the population and the environment. When handling chemicals with a high toxic content, professionals must be aware of their performance and the consequences arising from negligence, not to say malpractice, in the development of pest controls. For this reason, companies should train the agents who perform such services to reduce their unnecessary use of highly toxic pesticides. Their techniques should identify strategic points for applying specific products for each pest, in order not to contaminate the soil or rivers and other sources of water.

Another important point in the development of pest control services addressed by Silva (2015) is the disposal of pesticide packaging and containers. Packaging requires the application of reverse logistics, since it cannot be reused but if disposed of carelessly represents a risk to the environment and the health of the population. This being the case, pest control companies must use a flowchart to guide their activities in a safe and ecologically sound way, aiming at greater use of products with the least possible environmental impact.

3. METHODOLOGY

This is a study of environmental management, investigating the production processes of a pest control company in the Amazon region. To address its aims, the study began with a bibliographic review, tackling concepts related to the introduction of environmental management in production processes as its theoretical basis. The central approach consisted of field research in a pest control company to collect data for analysis. This task was overseen by researchers, and reflects the qualitative character of the investigation. It has explanatory bias, based on observing, recording and interpreting the facts presented, together with the variables involved in the phenomenon.

3.1 Method

The method is the key in conducting research. For this research the Case Study Method was used, defined in Merriam and Tisdell (2016) and in Yin (2005) as an empirical investigative practice by detailed description and analysis of a contemporary phenomenon delimited to a specific body of theory and concepts. Confirming the views of the authors, the documents obtained from the bibliographical collections of works on environmental management supported the evaluation of the environmental elements identified in the pest control company, which constitutes the unit of analysis of this research. Thus, the methodology

presented here converges towards Creswell's (2010) advice to incorporate supplementary data independently of the investigative task before, during or after data collection, starting from the utilitarian data.

3.2 Procedures

The instruments used to carry out the research in the city of Porto Velho / RO, consisted of a semi-structured interview and inspection of places on the pest control company's premises in order to identify the resources available for carrying out the pest control works. Among these resources, the equipment and chemicals used were considered, as were the procedures and techniques for limiting environmental damage from the company's work. Through this process, a flowchart was developed to describe the pest control process, making it possible to compare the company's procedures with the sustainable management practices highlighted in the theoretical-conceptual body.

The flowchart sought to cover the initial inspection of the site, passing to the identification of pests, the method of performing its services, the chemical control that involved the manipulation of active principles (in this case the pesticides) and the return of the product packaging used by the industry. This process allowed the research to meet its established objective, because it was able to thanks to the identify and propose innovations and improvements that would preserve and conserve the environment. The detailed description of the methodological procedures adopted is shown in Figure 1, followed by Chart 2.

Figure 1 – Execution stages of the Case Study
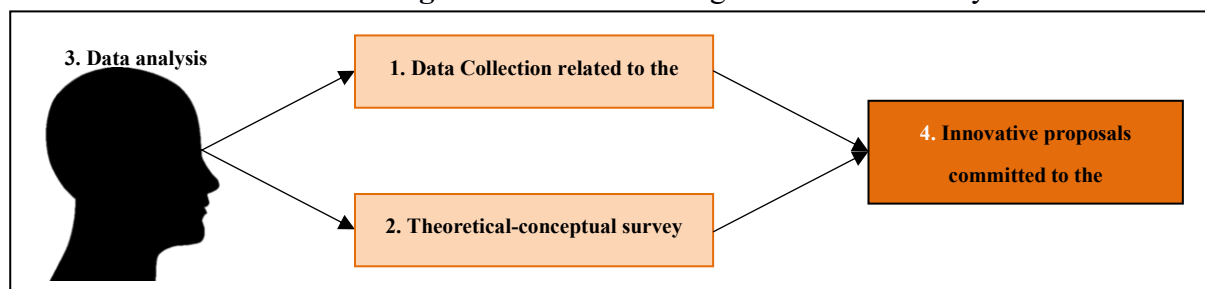
Source: the authors.

Chart 2. Description of the execution stages of the Case Study

Elements	Description
1. Data Collection related to the object of study	1.1 Description of the practices carried out in the pest control company, based on interviews and on-site inspections, in order to describe the operating process in a flow chart.
2. Theoretical-conceptual survey about the EMS	2.1 Survey of data about the environmental management system, highlighting elements of credible data arising from the preparation of the report.
3. Data analysis	3.1 Evaluation and interpretation of the information collected in the unit of analysis and subsequent triangulation of data, comparing it with the information from the environmental management system.

4. Innovative proposals committed to the environment	4.1 Presentation of proposals for innovation and improvement of pest control practices, based on the principles of environmental preservation and conservation

Source: the authors.

4. ENVIRONMENTAL ASPECTS OF THE MANAGEMENT OF SERVICES IN A PEST CONTROL COMPANY IN PORTO VELHO

Company K is a multinational company that has operated in the field of pest controlling since 1938. Working in more than 66 countries, with 300 units spread around the world, the company is a world reference in pest controlling and one of the best-known companies in the city of Porto Velho / RO. The company offers services based on specific diagnosis for each segment, be it industrial, commercial, medical, in supermarkets, or in educational or residential institutions. It controls and monitors pests such as rodents, cockroaches, ants, termites, fleas, flies, mosquitoes, spiders, scorpions and moths. Its services use several methods; they include environmental preservation and the reduction of inputs in the production process.

4.1 Identification in the production process of tools and methods of sustainable production

According to the manager, the methods adopted by company K aim to provide maximum efficiency with the least impact on the environment, guaranteeing the safety of workers and customers. For this, the organization developed a programme called TEPS (Truly Elite Protection System), which has one of the most advanced systems for preventing, controlling and monitoring urban pests. The programme seeks to serve the corporate sector that engages in food processing, warehouses, food and beverages distribution centres, the pharmaceutical industry and supermarkets.

The pest controlling process begins by evaluating the facilities of the place to be pest controlled, where a programme of integrated pest management – MIP in Portuguese – is then implemented. After each visit, customers are given monthly information and a trend analysis , identifying and reporting on the insect behavior detected in the light traps and indicating the monthly percentage of rodents detected by devices; the aim here is infestation control and the non-indiscriminate use of pesticides. The pest control process carried out by the company under study is shown in Figure 2, followed by Table 3.

Figure 2 – Company K pest control process flowchart
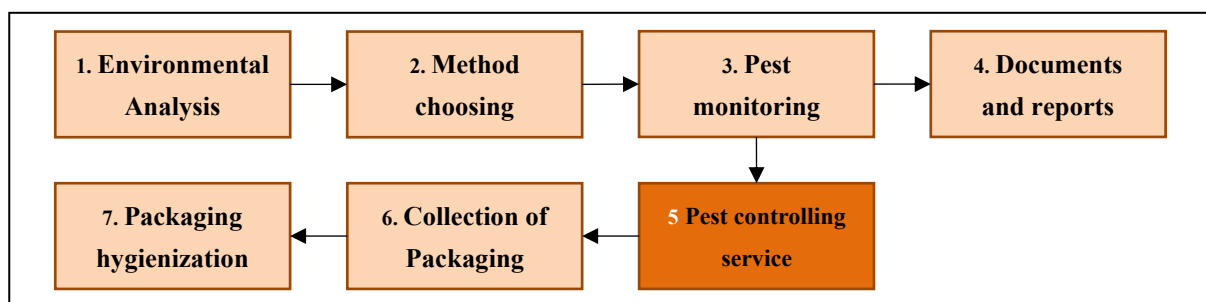
Source: the authors.

Chart 3. Description of the pest control process flowchart

Elements	Description
1. Environmental Analysis	1.1 Technical visit to assess the site in order to select the best techniques, equipment and products to use.
2. Method choosing	2.1 Identification of the most effective method for pest control, including the choice of equipment and most appropriate products.
3. Pest monitoring	3.1 Analysis of potential risks, products used, reports of pest observations and other factors of technical action in the environment, seeking to minimize possible chemical and biological contamination.
4. Documents and reports	4.1 Provision to customers of monthly information and analysis of trends, listing the services performed; passing on information to facilities and corrective actions, if required.
5. Pest controlling service	5.1 Delivering the pest control service, applying the methods, products and equipment established in the planning that was based on the analysis and monitoring of the environment.
6. Collection of packaging	6.1 Collection of packages used during the pest control service in order to clean and store them in an agreed place before returning them to the industry.
7. Package cleaning	7.1 Cleaning of packages in a specific container, so that the water consumed in washing can be reused; the minimizes waste and contamination of the environment by chemicals.

Source: the authors.

As noted, company K cleans the packages used in the pest control process before returning them to the industry. This meets the cleaner production approach presented by Schirmann (2019), since the water used to wash the containers is reused to dilute other products. The sink adapted for the reuse of water consumed for this purpose is shown in Figure 3.

Figure 3 – Sink adapted for water reuse

Source: the authors.

Other sustainable practices are developed by the company in compliance with the criteria of reverse logistics and recycling, as discussed by Lira (2018). When the packages are collected and taken back to the industry, company K receives an environmentally friendly seal. The collection of pesticide packaging is shown in Figure 4.

Figure 4 – Collection of pesticide packaging

Source: the authors

Since the handling of chemical products can be highly toxic, it is obviously important for professionals in environmental pest control work to be aware of the results of mis-handling these products. To avoid any such thing, company K provides its employees with raining and skills. The training helps to reduce environmental risks and extend the medical control of occupational health, as well as convincing trainees of the danger and risks to health that surround their work. The training is focused on respecting employees' health and safety, tied to the maintenance and preservation of the environment, with the

respective aims of preventing work accidents and environmental damage. Figure 5 shows the handouts that describe the training and qualifications offered.

Figure 5 – Handouts for employees´ professional training
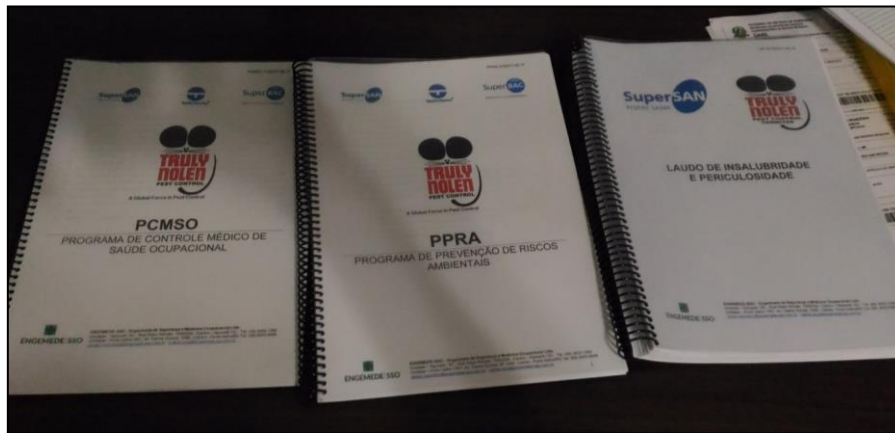
Source: the authors.

It appears that in all pest control processes urban pest controlling techniques are developed to meet the criteria based on ecological control and natural pest mortality factors set by Integrated Pest Management - MIP. This method seeks to reduce the damage to public health and the environment caused by the use of chemical pesticides. To this end, the company uses devices and tools to combat natural pests, such as glue traps for insects; pheromone traps for warehouse pests; light traps for flying insects; and indoor and outdoor rodent monitoring devices.

4.2 Competitive advantages of incorporating aspects of environmental management into the production process

The advantages of the company under study of adopting environmental management in the production processes are diverse. Among them can be highlighted the savings in the inputs of water and electricity and the mainly chemical products used to control pests. By adopting techniques that reduce or eliminate the use of pesticides, company K saves more and at the same time ensures greater safety for its customers. Its processes aim to protect the environment and comply with national safety standards. Among the current regulatory measures, the technical norm for pest control companies from the National Health Surveillance Agency - ANVISA (2000) stands out.

According to the entrepreneurs of the evaluated company, customers feel more confident about hiring their pest control services due to the low consumption of pesticides used and the lower toxicity of their products. The biggest concern of customers is the waste that can be generated during this process and its effect on the environment, causing a risk of contamination to soil and the water in domestic wells. From this standpoint, the advantages of incorporating the aspects of environmental management observed by company K are not limited to the financial sector alone, but also affect the safety and health of its professionals and customers. This contributes to a favourable image of the institution, raising the brand name and generating institutional, social and environmental value. The results presented by the company corroborate the findings of Lira (2018) by reinforcing the view that a company which adopts the aim of

sustainable production has greater visibility among its competitors, since it is a competitive differential to consumers who are increasingly concerned with the welfare of the environment.

4.3 Innovation that contributes to the operational improvement of an organization´s environmental management

Although company K has had years of experience in the field of urban pest control and already has incorporated several measures in respect of the environment, it constantly seeks to implement new sustainable practices in its organizational structure. One of them is the development of a laboratory in Porto Velho / RO to study the specific behaviour of pests and their effect on the urban environment. This environmental innovation will require the hiring of a professional biochemist in order to study the stages of pests' reproduction, maturation and infestation, in addition to identifying better techniques for fighting them with the least possible impact on the environment.

As Pinsky and Kruglianskas (2017) point out, the adoption of technologies in the production process helps to improve services, benefiting the environment, generating savings for the company and contributing to the institution's reputation in the community. The laboratory is an initiative of the company to secure the best possible performance in the control of urban pests by developing innovative and more efficient methods of pest control, aimed at reducing or eliminating highly toxic chemical agents, ensuring greater safety to customers and mainly avoiding contamination of the ecosystem, especially in the city of Porto Velho / RO and its surroundings**.**

5. CONCLUSION

The present study sought to demonstrate the satisfactory production methods in use in the workplace of company K, thanks to its environmental management. The development of a specialized analysis system, seeking to cause the least possible damage to the environment from the entities that hire the service and from   the analysis of insects and pests, demonstrates how greatly concerned the organization is with good production practices aimed at sustainability. Consumers are increasingly looking for organizations that are mindful of the environment; they want to stop buying products and services from companies that do not adhere to this emerging preoccupation. Therefore, the reuse of waste, the recycling of products, the monitoring of the evolution of environmental issues and the promotion of new environmentally less polluting technologies have made company K one of the largest in the   field of pest control. Thus, the environmental management system, in addition to maintaining and preserving the environment, also guarantees for the organization a competitive differential advantage. This study may be of use to managers interested in providing   services that impinge on the environment in general, especially in such fragile settings as the Amazon.

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Continuing education as a Laboratory Management tool associated with Scientific Advice with a focus on quality and patient safety in the pre-analytical phase

Luiz Alexandre Pereira

Faculdade Quirinópolis

Quirinópolis, Goiás, Brazil

luizalexanndre@yahoo.com

Andréia Broisler Pavan

Sarstedt of Brazil

Porto Feliz, São Paulo, Brazil.

andreia.pavan@sarstedt.com

Vinicius Cardoso-Brito

Federal University of Bahia (UFBA)

Salvador, Bahia, Brazil

viniciusbrito_ssa@yahoo.com.br

Silvio de Almeida-Junior*

University of Franca.

Franca, São Paulo Brazil

silvioalmeidajr@yahoo.com.br

Abstract

The quality process is increasingly evident within health institutions, for standardization of processes, improvement in the profitability of protocols and patient safety. This work brings case reports in a medium-sized hospital in the northeast of São Paulo, Brazil and confronts the data with the literature on continuing education and the scientific advisory process by outsourced companies. It is possible to observe that, when closely monitored by the scientific advisory of the company Sarstedt do Brasil, good results were obtained in the pre-analytical phase, always relying on continuing education and the process of measuring factors through indicators, which is already indicated in literature. In short, the quality process is a long way and must be followed day after day while education is the only tool that can be used for this to happen and without a doubt, the help of a qualified scientific advisor assists this process.

Keywords: Laboratory**;** Laboratory Medicine; Education; Sarstedt; Scientific Advice.

1. Introduction

The provision of health services has as main objective to guarantee doctors and their patients a quality and safe care (Pedrosa & Cardoso, 2011; Saccucci et al., 2017). In these services, two basic components of quality are implicit, namely the operational, which corresponds to the process itself, and the perception, which is the way customers view the service offered (Plebani, 2009). These two components can be evaluated through quality indicators and recognition by obtaining certifications or accreditations, thus allowing internal comparisons or between companies that offer services with the same characteristics, facilitating decision-making by managers and professionals (Plebani, 2010).

The denomination of quality is something that is growing within the hospital area and mainly within clinical laboratories, which include the reception, screening, transport and carrying out laboratory tests (Plebani, 2017). An important factor to be evaluated and avoided is laboratory error, which is defined as a failure that occurred in any part of the cycle, whether in its request, interpretation and even by the professional's reaction to the reported result, or for any complication that generates an inappropriate result or misinterpretation of the test performed (Don-Wauchope & Kavsak, 2016).

The quest to reduce errors is continuous, which makes the Scientific Advisory a tool for improving the quality and safety of the entire laboratory process (Lee, 2019). In view of the processes presented, this work aims to highlight achievements made in a medium-sized hospital in the interior of São Paulo, in Brazil and to confront with a brief bibliographic review, highlighting some improvements and Scientific Advisory projects applied to the pre-analytical phase in order to demonstrate its applicability in the identification and reduction of errors, helping to expand the patient safety vision and impacting techniques both at the business and health level.

2. History of Brazil in its concern with laboratory quality

In Brazil, the concern with quality in the health area comes from the 1930s, with the creation of the Hospital Inquiry Form, by Odair Pedroso, in São Paulo, for the Hospital Assistance Commission of the Ministry of Health (MH) (Feldman et al., 2005). In this, the minimum standard of hospital organization included an organized clinical staff, administrative and nursing staff, radiological and physiotherapy services, clinical laboratory, morgue, pharmacy and auxiliary services (kitchen, laundry and disinfection) (Feldman et al., 2005; Plebani, 2010).

Laboratory medicine can be considered as a pioneer sector in the medical field to promote and introduce the concepts of quality. In the 1960s, Barnett and Tonks started studies on biological variability, which was improved by Harris and Fraser in the subsequent decades. In the 1990s there was a global consensus on the objectives of quality and its specifications in the clinical laboratory environment (Plebani, 2017). Thus, the concepts of Quality Control, Quality Assurance and Total Quality Management were defined (Lee, 2019).

In 1999 the National Accreditation Organization (ONA) was created, with the main objectives of heating up the implementation of a permanent process of improvement in health care, encouraging services to reach higher quality standards. In 2001/02, the National Health Surveillance Agency (ANVISA) officially recognized the Brazilian Accreditation System through Resolution No. 921/02 and signed an agreement with ONA for technical cooperation and training of personnel, which also counted on the participation of

several entities, such as the Brazilian Society of Clinical Pathology / Laboratory Medicine (SBPC/ML) (Feldman et al., 2005; Rafael & Aquino, 2019).

SBPC/ML had a fundamental role in the implementation of quality concepts and laboratory accreditation, since, in its founding in 1944, it already had in its statute as one of its objectives, the establishment of standards for carrying out the different laboratory exams (Rafael & Aquino, 2019; Vieira, 2004). During the 1970s, he proposed to review and adapt to the Brazilian reality the practices of the American College of Pathologists (CAP), through the Brazilian Journal of Clinical Pathology, published by SBPC / ML itself. In 1977, together with Control Lab, SBPC / ML launched the Medical Laboratory Excellence Program (PELM) and in 1998 created the Clinical Laboratory Accreditation Program (PALC), which was revised in 2004, 2007 and 2010 (Vieira, 2004). PALC opens a pathway for Brazilian laboratories to continuously improve quality, through audits carried out by peers, that is, by laboratories, providing opportunities for exchanging technical knowledge between auditors and auditees (Vieira, 2004, 2005).

3. Pre-analytical phase and its errors

The laboratory process is classically divided into three stages of execution: pre-analytical, analytical and post-analytical (Plebani, 2006). The pre-analytical phase corresponds from factors prior to the performance of tests (such as prescription, preparation and orientation of the patient, collection, identification, storage and transport of samples) until the moment of their analysis (Costa & Moreli, 2012).

According to Westgard and Darcy (Westgard & Darcy, 2004), the results of laboratory analyzes are responsible for 65% to 75% of the information relevant to medical decision. Thus, the search for improvements in this sector is of fundamental importance, requiring a thorough analysis of the different processes involved in carrying out the laboratory examination, including technical, organizational and administrative aspects, in addition to identifying deviations and proposing more assertive and efficient interventions (Souza et al., 2020).

Each laboratory step has sources of errors. However, the pre-analytical phase can include up to 70% of laboratory errors. Such misunderstandings can cause discomfort to patients, delay in therapeutic conduct and loss of credibility of the laboratory with the medical staff, in addition to reducing revenues and increasing costs. Due to its high percentage compared to the other two phases, a specific and differentiated view of quality management must be taken at this stage. However, the constant implementation of technologies and scientific advances, the realization and execution of action plans and measures of continuous improvement are modifying these frequencies. (Plebani, 2017; Plebani et al., 2011).

We can include among the errors that occurred in the pre-analytical phase, for example, the inadequate collection of samples, errors in the interpretation of the medical request or identification of the patient, loss of the medical request as well as tubes, sample taken from a member with an intravenous infusion route , empty tubes, no loading of the request in the system and sample without refrigeration (Carraro & Plebani, 2007), registration failures (Plebani, 2009), repetition of venous punctures (Kirchner et al., 2007), exam repetition rates (Plebani, 2010) and contamination rate of blood culture and urine culture (Kirchner et al., 2007).

Many of these errors are difficult to assess, control or improve, as they are mostly extrinsic to the laboratory

environment (Ak, 2004; Rafael & Aquino, 2019) and can be associated with professional turnover, negligence and even inefficient training (Lippi, 2009; Plebani & Lippi, 2009), mainly because it is a phase with low automation and, consequently, greater involvement of manual tasks. For these reasons, the laboratory's quality system requires discipline and organization at all stages of its processes.

4. Scientific Advisory actions applied to the pre-analytical phase

Technological evolution was one of the main levers that allowed the implementation of modern quality concepts in the clinical laboratory. However, the new practices resulted in an increase in the overall cost of the entire laboratory process, which was not always accompanied by an increase in remuneration for paying sources. On the contrary, clinical laboratories, particularly in Brazil, began to suffer strong pressure from the supplementary health service providers, in order to drastically reduce the costs for carrying out tests (Junior et al., 2019; Mosel & Gift, 1994; Westgard & Darcy, 2004). Data presented in table 1 demonstrate the effectiveness of the Scientific Advisory work with laboratories.

Tabela 1: Example of Scientific Advisory projects applied to the Pre-Analytical phase: with the methodology applied, as well as the results and impacts observed.

Methodology	Results and impacts
Monitoring blood collection and training employees when they start at the company, as well as recycling every three months.	Decrease in new venipuncture indicators and increase in continuing education indicators. Positive impact to the patient and financial to the laboratory.
Accompaniment of collection not only in the laboratory, but in the entire hospital network and collection points.	Multidisciplinary professionals with knowledge of material and technique used to perform the work. Decrease in indicators of new venous punctures due to newly hired employees. Greater patient safety and positive financial impact.
Training and validation of arterial collections by biomedical.	Decreased the waiting process for nurses to perform arterial collections by biomedicals, improving patient safety, especially COPD, who constantly collect blood gases. Decrease in complaints indicators for these reasons.
Performing venous blood gas collections with requests for multiple exams. Monitoring to identify changes in collections with and without tourniquet.	Validation of venous blood collections in blood gases for lactate dosage with and without the application of a tourniquet, decreasing expenses with material, repetition of exams and increasing the safety of the patient who only undergoes a single collection.
Monitoring of advisor in the sector of patient reception, conference of requested exams, choice of materials, volume of tubes, waiting time for clot retraction and centrifugation.	Camp of the pre-analytical phase, from the conference of request for reception, patient care, organization of material, location of venous access, order of tubes, as well as collection and homogenization. Decrease in indicators of registration errors, patient safety with reuse indicator and hemolysis index.
Monitoring the centrifugation and transport process from CACU's to CAPU	Validation of transport of biological material from CACU to CAPU as well as stability of transported material, directly impacting the process of hemolysis indicator and new venous collections for these reasons.
Validation of collections in tubes with smaller volumes to identify reproduction of results compared to tubes with standard volumes.	Validation of EDTA microtubes in volumes of 200µl and 600µl vs. 2.6mL and its impact on the diagnosis in terms of final volume, blood / anticoagulant ratio, release of reliable results and safety of the assisted patient.
Continuing Education to decrease hemolysis indicator results.	Training of 143 employees to reduce the rate of hemolysis due to collection error from 1.22% to 0.48%, with the help of managers and collaborators for better safety of the assisted patient.

Source: Author.

COPD - Chronic Obstructive Pulmonary Disease; CACU - Clinical analysis collection unit; CAPU - Clinical Analysis Processing Unit; EDTA-Ethylenediamine tetraacetic acid.

Tools can be used to assess, measure and correct non-conformities within the pre-analytical phase. The PDCA cycle (plan, do, check, act) (Fukui, 2012), consists of planning as the first stage, in which it is the moment to study the feasibility of a new project or process (Hanawa & Momo, 2019). The second stage, the execution, comprises the operationalization of the project, with the establishment of structures, responsibilities and communication channels. In the third stage, or verification, there is the checking and monitoring of the established process, where problems or non-conformities not foreseen in the planning phase can be identified. Finally, the fourth phase, or action, ends the cycle with corrective actions and critical analysis of the new project, to define its implementation or not in the organization (Demirel, 2019). Other methodologies similar to the PDCA used within the laboratory area are DMAIC and FMEA. In the first, the initials, in English, refer to definition, measurement, analysis, improvement and control, while FMEA means analysis of failure modes and their effects (Subriadi & Najwa, 2020). The Fish Skeleton, Fishbone Diagram, or Ishikawa Diagram, in honor of Professor Kaoru Ishikawa, who built the first cause and effect diagram to explain to some engineers in an industry how the various factors of a process were inter-related (Lira et al., 2017).

The Scientific Advisory actions are used to monitor laboratory tests, correlate results, methodological adaptations, systems implementation, technical and scientific updates, research and market evaluation with the purpose of reducing errors, improving the quality of the process and better commercial performance. Table 1 summarizes the methodologies used by different authors to assess the impact of improvements made and Scientific Advisory projects during the pre-analytical phase, focusing on the percentage or results found in each survey. (Junior et al., 2020; Song et al., 2015; Sunyog, 2004).

5. Final considerations

In view of the above, the phases within a clinical laboratory must be conducted in a serious manner, as even the smallest errors can have major implications, especially in the patient's health and in the costs themselves. For this, methodologies that focus on the assessment of risk factors, identification of sectors or activities with a high potential for errors, carrying out plans and implementing these plans, as well as continuous professional training must always be taken into consideration in clinical laboratories. The methodologies applied with the Scientific Advisory can assist a lot in the identification and resolution of problems, consequently making the client and health professionals have confidence in the results of the laboratories and the laboratories have a better profitability.

6. Acknowledgement

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Psycho-Situational Path Model of Ambidextrous Preparation for Quality Aging in College Students

Nonthacha Chaitawittanun

Ph.D. Candidate. The Graduate School of Social and Environmental Development.
National Institute of Development Administration, Thailand

Professor Dr. Duangduen Bhanthumnavin
Associate Professor Dr. Duchduen Emma Bhanthumnavin
National Institute of Development Administration, Thailand

Associate Professor Dr. Kosol Meekun
University of Phayao, Thailand

Assistant Professor Dr. Narisara Peungposop
Assistant Professor Dr. Saran Pimthong
Srinakarinwirot University, Thailand

Abstract

During the period of old age, everyone wishes to have good quality of living. However, only the ones who have been well-prepared at the younger age could make this wish comes true. This study aims at investigating the psychosocial antecedents of the preparation of quality aging based on ambidextrous approach. Samples were 489 undergraduate students. Path analysis with latent model revealed a good fit. The findings revealed that psychological latent trait (future orientation and self-control, need for achievement, mental health, and core self-evaluation) and situational latent variable (perceived modeling, social support, and social norm) directly affected the preparation for quality aging (present quality of life, knowledge acquisition, and knowledge usage) via the psychological latent state R^2 of 0.606 latent (attitude towards preparation, and locus of control of preparation) with the. Discussion and implications are offered.

Keywords: Quality Aging, Ambidextrous Behavior, SEM

1. Introduction

World aging population are rapidly increasing. In general, it would increase from 963 millions in 2017 to 2080 millions in 2050 which could be more than 100% of acceleration rate. The same trend is forecasted in Thailand. Two years ago, there are about 11.1 millions Thai elderly (16.73%) [1]. It is projected that by the year 2036, it could increase to 30.0% of the population [2].

It is normally admitted that numerous persons got struggles in many aspects when become near old, such as technology [3]. Good quality of living is one of everyone's top wishes for the final period of life. To make this wish come true, early preparation is one of the keys. In order to success in life such as a good career, becoming famous athlete or singer, a person has to get well preparation and continues active until the goal is achieved [4].

Back to the basic question of what causes a young person to behave and get into an appropriate habit at present to ensure future successful aging. One of several strategies for success and survival of organizations could be used for individual in this preparation, that is ambidextrous strategy in terms of exploration and exploitation [5]. Thus, this study aims at investigating the pathways from the psychological characteristics and situational factors as the antecedents of the preparations of quality aging in undergraduate students (or young adults) forty or more years awaits them.

2. Literature Review

The interactionism model [6] was employed as a conceptual framework of this study which suggested the directions of the relationships among several types of independent variables and the dependent variables.

2.1 Preparation for Quality Aging: Variables and Operational Definitions

Preparation is defined by WHO [7] as an action of individual or family or community in having sufficient knowledge, training and important supplies for living. The actions of preparation can be done in several strategy.

Ambidextrous strategy in social and behavioral science has been widely known in organizational and leadership studies [5] [8]. This strategy was adopted in other fields such as environmental innovation (b), attitude change [9] and education [10] but still few studies have been found at individual level.

In current study, this strategy was used as a concept to create three dependent variables. First, the exploration strategy concept was used to create knowledge acquisition for preparing for quality aging. It involved the actions of searching, findings, studying, or observing good role model to get proper information on preparation for quality aging. Second, the exploitation concept was used to create two variables, namely, knowledge usage for preparing for quality aging, and present quality of life. These two variables involved being ready to use the obtained knowledge experience knowledge experience and lead to their application (Exploitation) which is means evaluate the new situations making decision, changing behavior or sharing the knowledge. Ambidextrous (Exploration and Exploitation) behavior in dangerous or threating events or future unavoidable conditions, such as getting old. The ambidextrous strategy can be used at present a well as ambidextrous actions for future holes. Using knowledge (Exploitation) is as a good habit at present for quality of life in health behavior and safety living.

2.2 Psychological States Relates to Preparation for Quality Aging : mediator variables

In this study, two psychological states were in focused. Attitudes toward preparation was based on three aspects, namely, cognitive, affective, and behavioral intention [11]. Attitude was found to be significantly related to several desired behaviors including inquiring behavior [12] and academic oriented behavior

[13]. Locus of control in terms of state variable based on Rotter's theory [14] was positively related to undergraduate behaviors, such as locus of control of study and absorption behavior in studying [15], locus of control in conducting research and research performance [16]. Thus, attitudes and internal locus of control on health and safety are expected to be the important antecedents of preparation related behavior. In addition, these variables are expected to mediate between personality traits and situational variables, on the one hand, and the preparation behavior on the other hand. These hypotheses obtain strong support from the research results based on the theory of reasoned actions [17] and the Thai psychological theory of moral and work behavior [18]

2.3 Situation Relates to Preparation for Quality Aging

There were three situational factors in this study. First, role modeling is one of the important external factors. According to Bandura's Social Learning Theory which indicates that, most of the learning process of desirable behaviors comes from observing the exemplars. Several previous studies also revealed the congruent findings that having good role model or social influence related to many desirable behaviors, e.g., preparing for study behavior [19] and technology usage [20]. Second, social support from significant others in terms of emotional, informational, and material support is also another important factors [21] [22]. Previous studies found that social support was positively and significantly related to desirable behaviors in undergraduate students, e.g., study engagement behavior [23], buying behavior [24]. Third, expectation from others, as social norm, is another vital factor affecting behavior. In undergraduate students, it was found that social norm has effect on many behaviors, e.g., social media responsible communication behavior [25]

2.4 Psychological Trait Relates to Preparation for Quality Aging

In this study, four psychological traits were investigated as the antecedent of the preparation of quality aging. First, future orientation and self-control, based on [26], involves individual's ability to project the positive and negative consequences of his or her own actions, and one's controllability to achieve goal as planned. Previous studies revealed the positive relationship between this psychological trait and its desirable behaviors [27] [28], especially exploration and exploitation [29]. Secondly, individuals with high need for achievement [30] usually set high standard, put more efforts, and do not easily give up in doing to achieve the goal. Thus, it can be hypothesized that need for achievement is positively related to preparation of quality aging. Thirdly, mental health is one of the psychological characteristics reflecting important abilities, such as, learning, managing, and maintaining good relationships with others. Mental health persons tend to have effect on quality of life of college students (e.g. [31]).   Finally, core self-evaluation persons tend to think positively, have high confidence and high self-esteem [32]. In previous studies, core self-evaluation was related to life satisfaction (e.g. [33]; [34]) which leads to quality of life.

3. Research Methodology

3.1 Samples

Five hundred undergraduate students in junior level from three universities in Thailand were asked to filled out questionnaires. Only completed data from 489 undergraduate students were used. Of these numbers, there were 134 male students (27.40%) and 355 female students (72.60%) with the average age of 21 years, average allowance of 5,045 Baths (≈ USD 180) per month.

3.2 Measures

The four groups of variables in this study. Most of the variables were measured in the form of summated rating. Each measure consisted of 7-15 items. Each single item was accompanied by 6-point rating scale ranging from "absolutely true" to "absolutely not true". Item discrimination (t-ratio) and item-total correlation reflecting item quality, and test's confirmatory factor analysis reflecting construct validity, as well as, reliability for each measure were presented in Table 1.

The first group was dependent variable group of preparation for quality aging. It consisted of three variables based on ambidexterity approach [35] [36], namely 1) Present quality of life (QL) referred to four important dimensions of quality of life (physical, mental, social and environmental) (e.g., [37]; [38]). 2) Knowledge acquisition (KA) defined as student's exploration or searching for information to prepare oneself for good quality living, e.g., searching for information on health eating, how to co-living with others, how to lower stress, how to set environment for better living. And 3) Knowledge usage (KU) involved the exploitation of acquired knowledge of solving health problems, quality living.

Table 1. Item and measurement quality

Measure	No. of items	Range of t-raito	Reliability (α)	Confirmatory Factory Analysis						
				χ^2	df	p-value (p>0.05)	RMSEA (≤0.06)	CFI (≥0.95)	TLI (≥0.95)	SRMR (≤0.08)
1. Present quality of life* (QL)	16	2.77-5.49	0.65	71.76	87	0.88	0.00	1.00	1.12	0.06
2. Knowledge acquisition* (KA)	12	2.73-5.79	0.69	28.39	38	0.87	0.00	1.00	1.09	0.06
3. Knowledge usage (KU)	9	2.17-4.96	0.65	22.62	22	0.42	0.01	0.99	0.99	0.05
4. Attitude towards preparation* (AP)	12	4.94-8.52	0.84	56.84	47	0.15	0.04	0.97	0.95	0.06
5. Locus of control of preparation* (LP)	9	2.86-6.90	0.67	17.78	17	0.40	0.02	0.99	0.98	0.08
6. Perceived modeling* (PM)	14	4.46-8.48	0.81	73.40	63	0.17	0.04	0.97	0.96	0.07
7. Social support* (SS)	15	2.45-8.52	0.71	46.10	44	0.38	0.02	0.99	0.99	0.79
8. Social norm* (SN)	7	2.78-4.85	0.68	10.30	11	0.50	0.00	1.00	1.01	0.40
9. Future orientation and self-control (FS)	11	3.82-7.05	0.70	50.30	39	0.10	0.05	0.95	0.93	0.07
10. Need for achievement (nAch)	12	2.88-7.68	0.75	48.58	47	0.40	0.01	0.99	0.99	0.06
11. Mental health (MH)	12	5.45-8.68	0.86	41.10	44	0.59	0.00	1.00	1.01	0.05
12. Core self-evaluation (CSE)	12	2.02-3.24	0.79	37.68	40	0.57	0.00	1.00	1.01	0.07

Note: * Constructed or adapted by the researcher.

nicely to other. The second group was psychological state. It consisted of two variables, namely, 1) Attitudes toward preparation (AP) referred to three dimensions of cognitive, affective, and behavioral intention [39] [40] of preparation for quality aging. And 2) Locus of control of preparation (LP), based on Rotter [41] defined as the belief of internal locus of control in exploring and exploiting knowledge for preparation for quality aging.

The third group was situational factor. It consisted of three variables, namely, 1) Perceived modeling (PM) referred to the recognition of actions from significant other (e.g., family members, relatives, friends) for self-care for preparation for quality aging (e.g., eating healthy food, concerning of physical and place hygiene). 2) Social support (SS) referred to the report of receiving emotional, informational, and material support from significant others to reinforce the preparation for quality aging. And 3) Social norm defined as the perception of what significant others (e.g., celebrities, senior students, superstars) accept to do, think what should be done, or being a role model for preparation for quality aging (e.g., practice yoga regularly, refrain from drinking too much alcohol, live their life dangerously).

The final group was psychological trait. It consisted of four variables, namely, 1) Future orientation [42] and self-control [43] (FS) referred to ability to foresee what will happen according to one's act, and self-regulation. 2) Need for achievement (nAch) referred to McClelland's theory of motivation [44]. 3) Mental health (MH) defined as displaying low stress, and emotional stability. And 4) Core self-evaluation based on [45]. of self-esteem, generalized self-efficacy, neuroticism, and locus of control.

3.3 Data Collection and Criteria for Path Analysis

Junior undergraduate students in universities were asked to answer questionnaires during January to March   2019. Questionnaires were tried out with another similar group of 100 university students in Early January 2019. To investigate the direct and indirect influences of the antecedents of preparation for quality aging, path analysis were performed. The fitted model should meet at least three out of five of the following criteria, i.e, 1) The chi-square test of model fit (χ^2) should not be significant [46]. 2) The Root Mean Square Error of Approximation (RMSEA) should be less than 0.50 [47]. 3) The Comparative Fit Index (CFI) should more than 0.95 [48]. 4) The Tucker-Lewis Index (TLI) should be moving toward 1.00 [49]. and 5) the Standardized Root Mean Square Residual (SRMR) should be less than 0.50 [50].

4. Results

Intercorrelation matrix and basic statistics of the variables in this study were shown in Table 2. The correlation coefficients among the variables ranged between 0.119 (p<.01) to 0.692 (p<.01)

Table 2. Intercorrelation matrix and basic statistics (N=489)

	Variables	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12
1	QL	64.91	7.30	1											
2	KA	51.00	6.69	.490**	1										
3	KU	39.17	5.26	.389**	.692**	1									
4	AP	50.51	8.03	.252**	.439**	.394**	1								
5	LP	33.15	7.16	.328**	.316**	.180**	.450**	1							
6	nAch	51.56	6.75	.242**	.461**	.429**	.505**	.318**	1						
7	FS	48.74	7.48	.223**	.375**	.395**	.580**	.331**	.648**	1					
8	MH	40.67	10.49	.389**	.208**	.125**	.227**	.468**	.119**	.197**	1				
9	CSE	48.30	7.32	.461**	.427**	.328**	.422**	.445**	.554**	.508**	.533**	1			
10	PM	52.84	9.46	.339**	.294**	.210**	.304**	.339**	.291**	.295**	.267**	.382**	1		
11	SS	59.25	9.15	.341**	.319**	.267**	.502**	.434**	.430**	.442**	.283**	.474**	.422**	1	
12	SN	27.74	5.31	.246**	.182**	.152**	.405**	.427**	.412**	.447**	.210**	.364**	.319**	.548**	1

Note * p<.05, ** p<.01

The results from path analysis (Figure 1) revealed the good fit findings (χ^2 = 34.704, df = 26, p-value = 0.1182, RMSEA = 0.026, CFI = 0.996, TLI = 0.991 and SRMR = 0.028). The results (Table 3) indicated that the psychological trait and situational latent variables directly affected the preparation for quality aging latent variable, as well as indirectly affected via psychological state latent variable. Furthermore, it was found the additional path between the psychological trait latent variable to the situational latent variable.
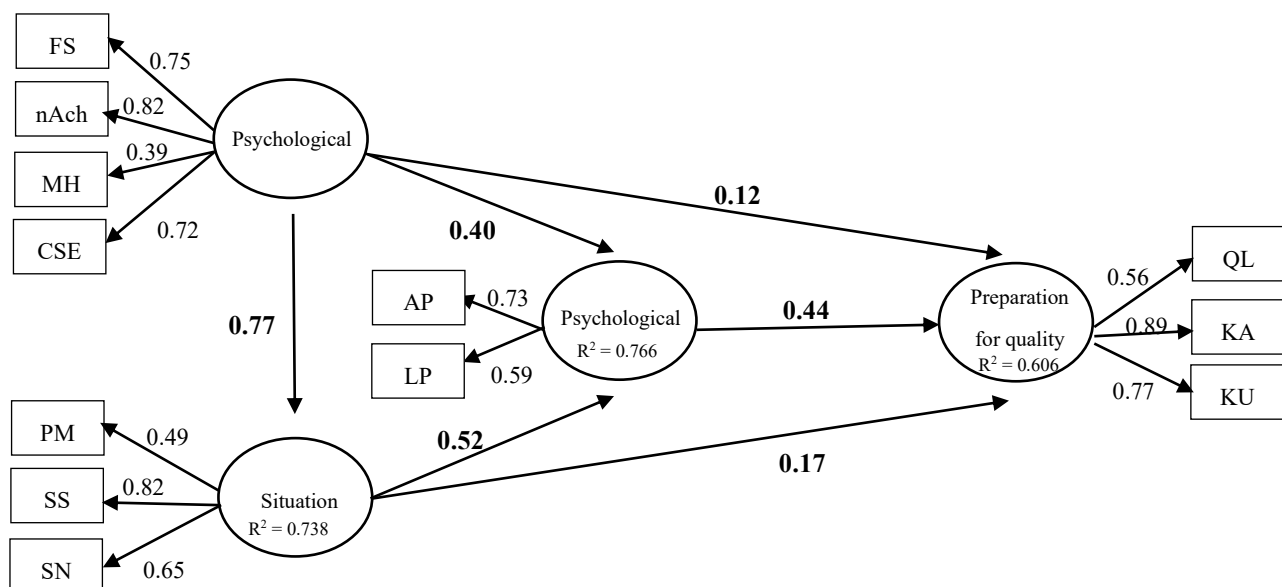

Figure 1. Latent path model of preparation of quality aging in undergraduate university students
Note: all coefficients are significant.

Table 3. Direct and indirect effects of psychological traits, situational factors, and psychological states on preparation for quality aging

Antecedent latent variables		Outcome latent variables								
		Situation			Psychological state			Preparation for Quality Aging		
		TE	DE	IE	TE	DE	IE	TE	DE	IE
Psychological state	b	-	-	-	-	-	-	0.310	0.310	-
	S.E.	-	-	-	-	-	-	0.000	0.000	-
	β	-	-	-	-	-	-	0.443	0.443	-
Trait	b	0.651	0.651	-	0.519	0.423	0.096	0.455	0.092	0.363
	S.E.	0.072	0.072	-	0.551	0.119	0.432	0.073	0.047	0.026
	β	0.779	0.779	-	0.830	0.421	0.409	0.615	0.124	0.491
Situation	b	-	-	-	0.664	0.664	-	0.356	0.150	0.206
	S.E.	-	-	-	0.147	0.147	-	0.046	0.000	0.046
	β	-	-	-	0.562	0.562	-	0.4.3	0.170	0.233
	R^2	0.738			0.766			0.606		

5. Conclusions, Discussion and Recommendations

The findings from this study supported the Interactionism model of Endler and Magnusson [51]. Furthermore, it was found the direct effect from psychological trait latent variable to situational latent variable which the original model did not indicate. Many recent studies in Thailand found this similar result [52] [53] [54]. This accumulating same finding from many studies suggested and confirmed that situational factor could play as mediating role between psychological characteristics and psychological states, as well as, between psychological characteristics and behaviors.

It should be appointed out that "situational variables" (PM,SS,SN) were self-report measures. Both real conditions as well as the perception or awareness of the respondents can be expected to come into play. The standardize coefficients in each measurement model show that need for achievement is the strongest psychological trait, while social support represented situational factor. Attitude towards preparing for quality aging is a strong contributes of mediator. The measurement model of the "preparation for quality aging" was contributed the most by "knowledge acquisition (or exploration of knowledge). On the other hand, the variance of the preparation for quality aging was accounted for 60.60% by "psychological state" or mediator more than by the "trait" or the "situation" latent variables.

According to the measurement model for preparation for quality aging in undergraduate students, it was found that KA had the highest factor loading, followed by the factor loading of KU. The least factor loading was QL. These similar findings of the first two highest loading was in the recent study using variables from

ambidexterity approach [55]. Foreign studies [56] [57] were also found the positive relationship between motivation and ambidexterity. SS from family and peers was the highest loading of situational factors that directly and indirectly affect the preparation for quality aging latent. Numerous previous studies indicated that SS was related to desired helping behaviors [52].

Based on the findings in this study, the immediate action is to persuade these undergraduate students to be aware, more concern, and ready to seek for new and advanced information for use their current informational and resources for better current quality of life. Furthermore, need for achievement, and social support should be promoted in these students to increase the desired behaviors.

For future studies, the multigroup of this model comparing students in various biosocial background, e.g. living-non-living with elderly students, high-low GPA students, and science vs. social science major students, could yield valuable body of knowledge for preparing these young generation for future quality aging.

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