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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-7, ISSUE-2 of IJIER*** which is scheduled to be published on **28th February 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 screensed 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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Blurring the Lines of Traditional Gender Roles among Qatar Young Generations

Noora Ahmed Lari
Social and Economic Survey Research Institute, Qatar University, Doha, Qatar

Abstract

How is traditional gender roles and values related to the young generations in the State of Qatar? In the last few decades, rapid socioeconomic development in Qatar has brought dramatic changes regarding the gender roles assigned to men and women. Research shows that geographical settings, economic status, and social and cultural structures are factors that might have great implications for attitudinal shifts among individuals, which can contribute, to the women empowerment process. We use nationally representative survey data from Qatari nationals to explore the relationship between gender stereotypes and young generation in Qatar. Findings indicate that the young Qatari generation is able to play an outstanding role in changing gender role stereotypes through their educational and cultural strength.

Keywords: gender roles, women empowerment, young generations, education, Qatar

Introduction

The conversation about gender has become increasingly louder with every passing year as people question traditional ideas pertaining to gender roles. Many have rejected the restraints posed by gender stereotypes while embracing the freedom to act and be themselves. The modern-day society no longer expects men to hunt and women to gather as conventionally done. Studies are increasingly showing that unlike in the past generations, gender is no longer used to define identity in the modern day. As such, the younger generations are no longer interested in adhering to the gender roles that were traditionally assigned to them instead they prefer to make personal interpretations of what gender means to them. Perhaps this is because they grew up at a time when both their mothers and fathers too almost equal responsibility in raising them up and therefore fostering an attitude that there are no inherently female or male roles in the society.

Qatar government has established several programs in education, health, employment and leadership to ensure greater gender equality and women's empowerment. These initiatives has greatly improved Qatari women's lives in many aspects and has slightly developed the gender discourse in Qatar society. Based on the developments taking place in the gender discourse, it is hard to deny the fact that the aspect of gender is indeed a social construct and not a subject of innate biological characteristics as traditionally claimed (Lindsey, 2015). Today, gender fluidity and androgyny have become the norm as gender stereotypes are regarded as outdated. Now the view regarding roles and responsibilities is more balanced and will continue

to be shaped by the current and coming generations. In this regard, the current paper supports the argument that the lines of traditional gender roles are blurring among young generations.

The remainder of this paper proceeds as follows. Relevant strands of literature are discussed, including studies in gender roles and feminism. However, the analysis concerns the changing attitudes towards traditional gender roles in the case of Qatar; which is discussed in some detail. The data and methods section describes the measurement of importance concepts and subsequent analysis. The findings demonstrate that results related to age demonstrate that traditional gender roles are blurred and that women empowerment is strongly supported by young and middle-aged adults.

Literature Review

In the homes, men and women are now embracing new gender roles which have done away with philosophies dictating what roles are meant for which person. Men and women are now sharing responsibilities in a manner that completely ignores the roles and behaviors that were established traditionally. Studies by the US Census Bureau show that during the time period 1989 to 2012, the number of dads who were stay-at-home, rose to 2 million up from about 1.1 million and projections showed that the numbers would continue to increase (Friedman, 2017). Lewis (2018) adds that results of a benchmark survey including 3, 5000 Americans show that women aged 29 and below are likely to demand jobs with greater responsibility just as much as men. A similar survey carried out in 1992 showed that at the time, while 80 percent of men aged below 29 wanted jobs with greater responsibility, only 72 percent of women of a similar age wanted those jobs. When a similar survey was done in 2008, women who claimed they did not increase responsibility cited reasons such as high pressure from work, high-level jobs and the concern of not being flexible enough to balance work and home responsibilities. The study also established that in 2008, young mothers did not mind taking jobs with more responsibility, unlike young women who did not have children. This further emphasizes the fact that unlike in the past when women had to stay at home to take care of their children until they got to the school-going age motherhood does not dim ambition for today's younger generation. While most women prefer to balance both work and family, some women have even given priority to their careers opting not to get married or bear children so that they can chase their dreams (Olah et al., 2014). This trend also shows that the career ambitions and expectations of millennial women are the same as those of their male counterparts and this is expected to continue in the coming years.

Apart from this, we have so many millennials today who prefer to be single moms juggling between work and acting as both mother and father for their children. In the past generations, single mothers were viewed as outcasts in society but today society has become more accepting of single mothers and even appreciates and praises them for their effort. Furthermore, while it was unheard of in the past for men to participate in childcare care and house chores, the young generation of men today are more willing to actively participate in childcare and house chores as their wives also work to supplement household income and more so in the past three decades. According to a 2013 study, just 1 out of 8 people still held the view that

there should be a separation of gender roles so that the traditional roles can prevail. Today, we see many stays at home dads who prefer to take on the paternal role staying at home full time as their partner works to pay the bills (Abrams, 2018). This is something that would never happen in the 1980s thus showing a total that has brought about major transformations in parenting.

Parents now have to adopt a genderless approach to parenting. The concept of gender-neutrality can be seen from the way babies' rooms are decorated in that parents prefer to use neutral colors. This is a deep contrast to the way it was done traditionally whereby girls' rooms were painted in pink while boys' rooms were painted in blue. Many parents are also buying their children gender-neutral toys. Even in the shopping malls, the pink and blue toy aisles are getting increasingly characterized by imminent obsoleteness and one does need to go to a girls' or boys' section to find toys instead they can find everything they need in the same section (Glasgow, 2015). This reflects the shift that society is taking towards blurring the gender lines and achieving gender equity. Many parents are now more open-minded to child rearing as they prefer to raise their children as individuals rather than as boys or girls hence totally ignoring the gender stereotypes. It is important to note that most people that grew up in the past generations who form today's older generation had their lives defined by the labels associated with being boy or girl (Abrams, 2010). Having been subjected to the same, perhaps this is what most parents are trying to avoid by ensuring that their children are not forced into the labeled boxes of boy and girl. Manufacturers have responded to these changes by modifying and innovating new products that more unisex in nature and responding in ways that would not have been dreamed of in the past. unlike in the past generations when some names were meant for boys and others for girls, today baby naming is neutral.

In education, the number of women getting enrolled in higher education has been increasing over the years. Traditionally, women were raised to believe that their place was in the home and therefore parents only invested their resources in educating the boy child. The fact that today both men and women are given equal educational and income opportunities shows that older generations are becoming more excepting of the blurring lines of traditional gender roles for the young generations (Abrams, 2010). While the G1 generation which was civically oriented is best remembered for their efforts in ensuring that men and women got an equal opportunity to go through high school, the millennial generation today is at the forefront of ensuring that women not only attend but also graduate from college and professional schools in greater numbers than men (Olah et al., 2014). Statistics indicate that as of 2006, 58 percent of the total number of students in college was women. More recently in 2016, projections indicate that women earned approximately 64% of the associate degrees, 60 percent of the bachelors', 63% earned Masters Degrees and 56 percent doctorate degrees. In all these categories, it is clear that more women than men are going through college to join the workforce. With these achievements, the resultant new generation of women is full of self-confidence and unlike their mothers and grandmothers who lived in the boomer generation, they do not regard their achievements as a competitive edge over men that may cause conflict rather as an opportunity to exploit their full potential (Lewis, 2018).

In the workplaces, many organizations that can be considered to be forward-thinking are now setting the stage for gender equality to prevail. As women become empowered and family needs get prioritized, the gender pay gaps are also becoming narrower. Men and women are now entering the workforce on an equal footing. Jobs that were traditionally male-dominated or female dominated are now characterized by gender neutrality (Andersen, 2014). The workforce now has more female pilots, doctors, lawyers and even military women which were originally meant for men. Similarly, there are many male nurses, caregivers, chefs and others working in the hospitality industries as well as other areas that traditionally meant for women. As young generations become the dominant force in the workforce, the need for economic self-reliance and sustenance has forced men to take careers that were traditionally meant for women like teaching and nursing. According to Winograd and Micahel (2013), most of the millennial women today are not willing to accept any form of restrictions emanating from the basis of gender telling them what they can do or how much they can achieve. Currently, the disparities that were previously very wide in the pay received by men and women are reducing. Data from the office of national statistics show that while the pay gap during the baby boomers generation was at 16 %, it is just 5% with the millennials and expected to continue reducing. These major developments in compensation can be attributed to the fact that the young generations are able to openly and confidently speak about pay and review data regarding their salaries online to establish if they are being compensated fairly (Andersen, 2014). Unlike for the older generations for whom it was considered a taboo to discuss their pay at work, young generations have done away with and totally disregard these norms.

The Case of Qatar

Qatar has experienced a boom in gas and oil in the 1950s, and this led to new socio-cultural and physical perspectives. The geographical and political climate in Qatar favours the advancement of women. The state needs to take advantage of the potential of all its citizens both male and female to build a stronger economy based on knowledge. The Qatar National Vision 2030 (QVN 2030) is a national document formulated by the leadership in Qatar. This document is a roadmap to social, human, environmental and political development of Qatar. The QVN 2030 advocates for a narrative that promotes modernization based on the traditions. Therefore, all government-sponsored initiatives and reforms will be sued to mold and design public spaces.

This document also provides the extent to which gender roles are being re-established. The goals documents in the QVN 2030 include providing women with new vistas. Advancement in education has led to increased participation of women in the job market. Qatar women's employment and education has been prioritized and they were approved a constitution that allowed them to hold public offices, vote and have equal rights as other citizens in Qatar. Women in Qatar have the highest rise in educational achievement and are attaining better education compared to the men (Stasz et al. 2007). There is an increase in the rate of employment among women of up to 36% (Al-Tamimi, 2016). Notably, this is the highest rate in the Gulf region, but it does reflect on the 88% of women in Qatar who attain higher education. Notably, 44% of the

women who have attained higher education but do not work have cited cultural reasons as an obstacle in engaging in professional development.

Additionally, women in Qatar are secluded to specific segments in the job market. Women in Qatar continue to occupy specific employments that are traditionally considered as female-oriented such as teaching or high-valued jobs such as medicine. Some occupations are considered to be less desirable or inappropriate for women. A large number of women study chemical engineering, and they choose to become professionals in their field because it is male-dominated and the work description requires many visits to work and the site. In addition, there are more female than male students pursuing political science but very few women occupy significant political positions (Al-Tamimi, 2016).

Therefore, the blurred lines of traditional gender roles are evident in Qatar society whereby women's engagement in the society can be perceived based on the mobility needs of women in the present day; this represents contemporary patterns in gender relation in the Islamic state. Individuals are now aware of the different ways through which categorization of gender is associated with a binary structure that is oppressive and bound to affect them later in life. This is a sharp contrast with the older generations where boys and girls, men and woman used to completely follow the gender roles.

Data and Methods

This paper uses a nationally representative survey data collected by the Social and Economic Survey Research Institute (SESRI) at Qatar University in 2018. The survey sampled Qataris, white-collar expatriates, and blue-collar laborers residing in camps. Analysis was restricted to Qataris as the theory deals primarily with citizens. Such restrictions are allowable given the sampling method. Sampling plays a critical part in any survey process since the ability to make any valid inference to the population, which is the target of the investigation, relies upon a rigorous sampling design. As previously mentioned, many studies have examined the activity without accounting for how may differ or otherwise. This study has the methodological advantage of examining key variables in a population-based sample that represents Qatari nationals as a whole.

The questionnaire was designed to collect all necessary information related to the study. The survey was programmed into a CAPI (Computer Assisted Personal Interview) system using BLAISE software. After the data collection, all individual interviews were merged and saved in a single BLAISE data file. This dataset was then cleaned, coded and saved in STATA formats for analysis of the data, including the ordered logistic regressions, marginal effects, and predicted probabilities discussed in the following section. The following discussion provides univariate descriptive statistics for variables used in the analysis.

The dependent variable is captured by responses to the statement, "it is a man's duty to exercise guardianship over his female relatives", on a one to five scale where 1 is strongly agree and 5 is strongly disagree. This particular dependent variable was selected for both theoretical and practical reasons.

Theoretically, this question captures support for men's authority over his female relatives. It implies that woman must have a male guardian, normally a father or husband, a brother or even a son. Thus, it evaluates male's power to make a range of critical decisions on female relatives' behalf to which they are traditionally relegated.

The positive framing of the question is not very desirable, as it does not reduce satisficing behavior in which respondents disproportionately agree with whatever statement is read by the interviewer out of a desire to please him or her. This behavior is a common problem in surveys around the world and has been shown to exist in Qatar (Gengler et al. 2016). In order to indicate that attitude towards gender role and decision-making has changed, respondents had to disagree with the statement given by the interviewer. Thus there is a danger of detecting falsely inflated levels of support for male's guardianship, since respondents who strongly disagreed (5) with the statement are considered most feminist.

The main independent variables used in the analysis were: gender, education, employment, marital status, number of children, and age. These variables have been cross-tabbed with the dependent variable to show how effective they are in relation to gender roles. Analysis showed that this measure correlates with other measures in the model in the expected direction and thus it is included in the final models reported below. Notably, the findings confirm that education contributes to women empowerment and lower dependency levels, so patriarchal notions such as women relying on men become somewhat outdated once women can also attend to their own needs and those of close relatives.

The survey also asked respondents several statements, which are related to making decisions in the home, male engagement in caring for children or other domestic work, violence against women, and women's freedom to access social media. Since theses assertions are a clear reflection of a patriarchal or male-dominated society's mode of thinking, which is currently rejected by much of the world's population. The theoretical argument is concerned with the way in which new gender roles can serve as a bridge to the outside world for women who otherwise have limited options for involvement in the public. As such, any of these statements asked in the survey, could serve the fact that the lines of traditional gender roles are actively blurred. In fact, the following results are robust to measures the level of support of these traditional roles.

Results and Discussion

The findings assesses that, in the perspective of public discourse, social norms in Qatar society promote gender inequality, such as those that encourage males to maintain control over the behavior of their female relatives. However, a new perspective about Qatar women is portrayed, as there is a dynamic change in the nature of female space in the household, controlled by several independent variables, as previously mentioned. Notably, three statements has been positively framed to capture participants' attitudes towards taking decisions in the home setting, male's guardianship over female relatives and boys' responsibility towards their sisters.

Evidently, male respondents expressed more agreement than females to statement that "a man should have the final word about decisions in the home" (69% and 59%, respectively). This was quite surprising, especially regarding the women, since this assertion is a clear reflection of a patriarchal or male-dominated society's mode of thinking, which is rejected by much of the world's population. Unsurprisingly, that most respondents agreed with the statement "it is a man's duty to exercise guardianship over his female relatives." This result is quite consistent across genders, and a positive correlation was found with the participants' education levels. Respondents that are more educated are more likely to disagree about men exercising guardianship over their female relatives. Those with undergraduate or higher degrees are less likely to agree with the statement (67%) compared to those who have vocational, high school, or other diplomas (75%) and who had not completed high school (83%). The opposite (i.e., disagreement) is also true (17%, 25%, and 33%, respectively). Guardianship includes several critical decisions in women's lives but the findings confirm that education contributes to empowerment and lower dependency levels, so patriarchal notions such as women relying on men become somewhat outdated once women can also attend to their own needs and those of close relatives.

Similarly, to the previous statement, the results were consistent with the statement that "boys are responsible for their sisters' behavior, even if they are younger than their sisters." The intensity of agreement increased with the individuals' levels of education, and the degree of disagreement rose with a decrease in the respondents' education ranging from less than high school, to vocational, high school or other diplomas to undergraduate degrees (77%, 57%, and 48% for agreement, respectively, and 23%, 43%, and 52% for disagreement).

Another area where the gender lines are blurring is in men's involvement in household chores. The statement was negatively framed as follows "I think it is shameful when men engage in caring for children or other domestic work." The data show that a statistically significant connection exists between the participants' level of agreement with this assertion and their marital status, regardless of their age, gender, or education. Respondents who had never been married make up the majority of participants who disagreed with the statement (84%). However, a significant number of married participants also disagreed (81%). Divorced and separated respondents were more likely to reject male engagement in caring for children or other domestic work — (65%) disagreed compared with those who agreed (35%).

The exact causes of this tendency are quite difficult to identify given that the percentage of participants who were married or had never married and did not support this assertion is higher than that of those who agreed. Although the respondents come from a patriarchal society in which such notions are not widely accepted, the results have not been have influenced by this notion. This shows increased receptivity to these changes as men spouses support their wives by helping with the chores at home and raising the kids when the wives are working by ensuring that their work schedules do not clash. Findings indicate that Qatar society is moving towards new gender roles where the two sexes are demanded for an ability to increasingly

blend work with other responsibilities and pleasures in life. Furthermore, governmental organizations should also take steps to provide a paid paternity leave for non-primary caregivers and to give them an opportunity to bond with their children when they are newly born and assist the mothers of those children through the recovery period when they are so delicate. Employees should put pressure on the government to implement programs on paid paternity and maternity leave across all the sectors to avoid favoring just one of the sexes.

Conclusion

Conclusively, Qatar society is male-dominated but it is clear that the lines of traditional gender roles are indeed blurring. This is evident in the workforce, in the homes, in schools as such; employers that hope to survive in the highly competitive modern day business environment know that they have no choice but to attract top talent from among the younger generations. This, therefore, means that they have to accommodate the demands made by today's younger generations whether it is in terms of doing away with the pay gaps, providing paid maternity and paternity leaves and creating opportunities that enhance blending of work and life spheres. Politicians who desire to win votes from the younger generations will have to be seen supporting policies aimed at achieving gender equity and eliminating the lines of traditional gender roles for them to get a positive reception from this group of voters.

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Comparison and Correlation of Dynamic Postural Stability Indices Obtained during Different Dynamic Landing Tasks and Footwear Conditions

Joseph L. Schmitza, e
Paul N. Whiteheadb
Matthew E. Darnella
Jonathan S. Akinsc*
Mita T. Lovalekara
Kevin M. Conleya
Takashi Nagaia,d

Authors' Affiliation:
aNeuromuscular Research Laboratory, University of Pittsburgh
bThe University of Alabama in Huntsville
cWidener University; *deceased
dMayo Clinic, Orthopedic Surgery
eDrexel University College of Medicine

Corresponding Author and Address:
Joseph Schmitz
5450 Wissahickon Avenue, Apt A-1022
Philadelphia, PA 19144
Tel: 717-357-3789
Email: jls854@drexel.edu

Abstract

Objectives: To compare the dynamic postural stability indices (DPSI) from two different landing protocols with normalized jump distance (NDP) and jump height (RWDP) and footwear conditions (barefoot and shod).
Design: Cross-sectional.
Setting: Research laboratory.
Participants: Twenty-five physically active adults (13 males/12 females, age: 22.1±4.2yrs, height: 178.3±11.1cm, weight: 75.6±19.4kg).
Main Outcome Measures: Subjects jumped off two feet and landed with their preferred foot on a force-plate. From the ground reaction forces, the DPSI scores in the anterior-posterior, medial-lateral, and vertical

directions, and the cumulative scores (DPSI) were calculated under two protocols and footwear conditions. Based on normality of data distribution, paired t-tests/Wilcoxon signed rank tests and Pearson/Spearman correlation coefficients were used to compare, and measure the relationship between the two protocols under two footwear conditions ($p<0.05$).

Results: There were mixed results for DPSI scores when comparing the two protocols. There were significant differences ($p=0.001–0.039$) and positive correlations ($r=0.660–0.870$, $p<0.001$) on the DPSI scores between footwear conditions during the NDP protocol while the RWDP showed no significant differences.

Conclusions: Different protocols and footwear conditions may impact DPSI scores. Therefore, a standardized protocol and footwear condition should be established for future studies examining dynamic postural stability.

Keywords: Dynamic postural stability, footwear, landing protocols

Highlights:

- The APSI and MLSI scores were significantly different between two protocols.
- The DPSI scores were significantly different between footwear conditions during the NDP protocol.
- A standardized protocol and footwear should be used when possible.

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Introduction

Postural stability can be defined as the ability to sustain the body in equilibrium by maintaining the projected center of mass within the limits of the base of support (Sell, House, Abt, Huang, & Lephart, 2012). Postural stability has been found to be influenced by three main systems: vision, vestibular, and somatosensory (Chaudhry et al., 2004; Riemann, Guskiewicz, & Shields, 1999). Postural stability can be divided into two categories: static postural stability and dynamic postural stability. Static postural stability is defined as maintaining steadiness on a fixed, firm, unmoving base of support (Riemann, Caggiano, & Lephart, 1999). Dynamic postural stability is defined as an individual's ability to maintain balance while transitioning from a dynamic to a static state (Goldie, Bach, & Evans, 1989). Dynamic postural stability testing using a single leg jump landing and the Dynamic Postural Stability Index (DPSI) is a growing area of investigation due to its proposed ability to detect differences between individuals with stable and unstable ankle joints during dynamic tests (Ross & Guskiewicz, 2003). Investigators have found multiple uses for the DPSI in the clinical and laboratory setting including injury evaluation, post treatment levels, and as a baseline test for ankle stability in athletes (Sell et al., 2012; Wikstrom, Tillman, Smith, & Borsa, 2005; Willems, Witvrouw, Delbaere, Mahieu, et al., 2005; Willems, Witvrouw, Delbaere, Philippaerts, et al., 2005). With these abilities, DPSI testing has the potential to be incorporated into clinical practices to aid in rehabilitation and as a preventative test to identify postural stability deficits.

There are two common single leg jump landing protocols that are quantified with DPSI: the Ross and Wikstrom DPSI Protocol (RWDP) (Ross & Guskiewicz, 2003; Wikstrom et al., 2005) and the Neuromuscular Research Laboratory DPSI Protocol (NDP) (Sell et al., 2012). These protocols are both single leg jump landing tasks but differ in jump height, jump distance, arm mechanics, and attention that may lead to a difference in DPSI scores (Heebner, 2015; Kerr, Condon, & McDonald, 1985; Santello, McDonagh, & Challis, 2001). A significant difference in scores makes DPSI results from varying protocols difficult to compare. It is important to have comparable data across the literature in order to build a strong base of knowledge regarding dynamic postural stability. Therefore, this study compared the DPSI scores between the RWDP and NDP protocols and establish the relationship between the two protocols.

Across the RWDP and the NDP, there is also no footwear recommendation. As for results, there have been studies completed in athletic shoes (shod) and studies completed barefoot during the postural stability testing. Footwear has been seen to have a significant effect on DPSI scores within participants (Whitehead et al., 2014). Participants have significantly different DPSI scores when they were wearing three different footwear: athletic shoes, military boots, and minimalist footwear during the NDP (Whitehead et al., 2014). With the significant effect of footwear on DPSI scores, it is important to standardize footwear across all dynamic postural stability testing in order to maintain comparability. However, it is nearly impossible to provide all participants with the same pair of shoes across all studies. One way to solve this issue and standardize the single leg jump landing protocols is to collect them barefoot. For these reasons, this study compared the DPSI scores between shod and barefoot conditions to establish the relationship between the two conditions.

Therefore, there were two main purposes of the study. The first purpose was to compare the DPSI scores between the RWDP and the NDP protocols and establish the relationship between these protocols. Understanding the differences and the relationships between two protocols may allow for a broader scope of knowledge and understanding in the area of dynamic postural stability. The second purpose is to compare shod and barefoot DPSI scores and establish the relationship between two footwear conditions. Understanding the effects of landing protocols and footwear conditions would allow for dynamic postural stability testing to be standardized and relatable to the current and future literature. It is hypothesized that both protocols and footwear conditions would result in significantly different DPSI scores (higher DPSI scores in the RWDP protocol and in the shod condition) while these protocols and conditions were highly correlated.

Methods

Subjects

An a priori analysis determined that a sample size of 25 would be sufficient for completion of data collection with a desired power of 80%. Healthy, physically active males and females between the ages of 18 and 35 were recruited for this study. Physically active was defined as engaging in 30 minutes of physical activity a minimum of three times a week. Participants had to be able to complete a jumping task. Interested persons were excluded from participation if they had sustained a lower extremity injury in the previous three months, a previous lower extremity injury which lead to 6 months or more of loss of function, a

history of surgery to the dominant limb, head injury in the previous two months, or any injury that could impede or prevent their ability to complete a jumping task.

A total of 25 participants (13 males and 12 females) volunteered for this study (age: 22.1 ± 4.2 years, height: 178.3 ± 11.1 centimeters, weight: 75.6 ± 19.4 kilograms). The average Sports Activity Rating (Noyes, Barber, & Mooar, 1989) was 90.0 ± 8.3. Each participant exercised at least three times per week. The majority of participants wore standard athletic shoes (11 out of 25) or running shoes (10 out of 25) for testing while the 4 remaining participants wore minimalist footwear. None of the shoes had been worn for greater than 3 years (0.8 ± 0.7 years). The self-selected footwear condition was utilized in order to most accurately represent previous studies which used the NDP or RWDP.

Procedures

Participants reported to the lab for a single, one-hour testing session. Before any data collection, participants were provided a copy of an informed consent document approved by the University's Human Research Protection Office. All demographic data was collected first. This included participant's age, height with a wall-mounted stadiometer (Seca, Hanover, MD), and weight with an electronic scale (Cosmed USA Inc., Chicago, IL). Additionally, Sports Activity Rating Scale (Noyes et al., 1989) and shoe information (types: athletic shoes, running shoes, or minimalist shoes; and the duration of having the shoes) was collected.

A piezoelectric force plate (Kistler 9286A, Amherst, NY) was used to collect the ground reaction force (GRF) data to calculate the DPSI score. The force plate was embedded in a custom-made platform, which allowed the subject to take off from a surface level to the force plate during jump landing tasks. A sampling frequency of 1200 Hz was used for force plate measures during the dynamic task.

All participants were given time to practice each jumping task until they were comfortable and able to complete the task. Participants completed three practice trials for each condition. The order of jumping tasks as well as barefoot and shod conditions was randomized for each participant in order to minimize any potential confounding of a learning effect. Limb dominance for all tests was defined as the limb that the participant would use to maximally kick a soccer ball.

The RWDP protocol was previously described in detail (Ross & Guskiewicz, 2003; Wikstrom et al., 2005). In this protocol, the maximum vertical jump using a Vertec vertical jump device (Sports Imports, Columbus, OH) was measured first under the shod and barefoot conditions. Three trials of maximum jump height were completed and the highest jump was recorded. After determining the maximum jump height, participants started from 70cm behind the center of the force plate. The Vertec device was placed in line with the center of the force plate at a height of 50% of the participant's maximum vertical jump. The participant jumped off two feet and touched the overhead Vertec marker with the hand on the same side as their dominant leg. They then landed on the center of the force plate with only their dominant foot. Participants gained their balance as quickly as possible and placed their hands on their hips when balance was attained. They were instructed to maintain single leg stance as steady as possible for 5 seconds upon attaining balance. If the participants failed to touch the Vertec marker, to land on the center of the force plate, or to maintain their balance for 5 seconds, the trial was repeated. Three successful trials were

collected for each condition, barefoot and shod, for a total of six collected trials using RWDP. The DPSI scores using the RWDP protocol have an excellent intersession reliability (ICC = 0.96) and low standard error of the measurement (SEM = 0.03) (Wikstrom et al., 2005).

The NDP protocol was previously described (Sell et al., 2012). Participants stood on two legs at a distance of 40% of their body height from the force plate, jumped toward the force plate, initiating enough height to clear a 30-cm hurdle, which was placed at the midpoint of the 40% distance. They then landed on the center of the force plate with only their dominant foot. Participants gained their balance as quickly as possible and placed their hands on their hips when balance was attained. They were instructed to stand as steady as possible for 5 seconds upon attaining balance. Jumps were recollected if any of the cancellation events listed for RWDP occurred with the exception of the touching of the Vertec marker. For NDP, if a participant did not fully clear the hurdle, the trial was recollected. Upper extremity movement was not restricted during the task. Three successful trials were gathered for each condition. The NDP has been shown to have a very good reliability and precision (ICC = 0.86, SEM = 0.01) (Sell et al., 2012).

Data Reduction

Demographic data was manually entered into a database on a personal computer by the principal investigator. For DPSI, data was reduced within Vicon Nexus Software and processed with a custom script in Matlab R2012a (The Mathworks, Natick, MA). The DPSI was calculated using GRF data in the x, y, and z directions collected by the force plate during a jump landing task. The DPSI is a composite score of the medial-lateral stability index (MLSI), anterior-posterior stability index (APSI), and vertical stability index (VSI) (Wikstrom et al., 2005). The MLSI and APSI were calculated by the mean square deviations of fluctuations around a zero point in the frontal (x) and sagittal (y) axes of the force plate, respectively. The VSI was calculated by assessing the fluctuations from the subject's bodyweight in the vertical (z) direction of the force plate. All stability indices were calculated using the first three seconds of GRF data following initial contact with the force plate. The average of three consecutive trials was used to calculate APSI, MLSI, VSI, and DPSI scores during each protocol and footwear condition.

Statistical Analyses

All variables were analyzed using SPSS (v23, SPSS Inc., Chicago, IL). Descriptive statistics (means and standard deviations) were calculated for all variables. All data was examined for normality using the Shapiro-Wilk test, and normally distributed data was analyzed using paired samples t-tests to compare DPSI scores between the RWDP and the NDP along with the differences between footwear. Data that was not normally distributed was analyzed using a Wilcoxon Signed Ranks tests to compare the scores. A Pearson correlation coefficient or Spearman correlation coefficient was used to determine if a correlation existed in the DPSI scores between the RWDP and the NDP, and also within protocol with different footwear. An alpha level of 0.05 was set a priori as a significance level for statistical analyses. Effect size (ES) and power of each comparison were also calculated using G*Power 3 statistical software (Franz Faul, Universitat Kiel, Germany).

Results

Descriptive statistics of the DPSI scores between two protocols (RWDP and NDP) and comparisons/correlations are shown in Table 1. In the shod condition, the NPD had significantly higher APSI (RWDP: 0.100 ± 0.008, NDP: 0.137 ± 0.010, p = 0.011, ES = 3.416, power = 1.000) and lower MLSI scores (RWDP: 0.033 ± 0.006, NDP: 0.028 ± 0.006, p < 0.001, ES = 0.550, power = 0.752). There was a significant correlation on the VSI score (r = 0.416, p = 0.039) between the protocols.

In the barefoot conditions, the NDP had significantly higher APSI (RWDP: 0.101 ± 0.010; NDP: 0.135 ± 0.010, p < 0.001, ES = 3.409, power = 1.000) and lower MLSI (RWDP: 0.031 ± 0.006, NDP: 0.026 ± 0.006, p < 0.001, ES = 0.805, power = 0.971) and VSI scores (RWDP: 0.319 ± 0.030, NDP: 0.299 ± 0.035, p = 0.003, ES = 0.667, power = 0.877). There were significant correlations on MLSI, VSI, and composite DPSI scores (r = 0.302 – 0.578, p = 0.003 – 0.016).

Descriptive statistics of the DPSI scores between footwear conditions (shod and barefoot) and comparisons/correlations are shown in Table 2. Within the RWDP protocol, there were no significant differences between the footwear conditions (p = 0.074 – 0.694, ES = 0.080 – 0.373, power = 0.067 – 0.433). Contrarily, all DPSI scores in the RWDP protocol between the footwear conditions were significantly correlated (r = 0.420 – 0.807, p = 0.001 – 0.037).

Within the NDP protocol, all of the DPSI scores in the shod condition were significantly higher when compared to the barefoot conditions (p = 0.001 - 0.039). There were significant correlations between the shod and barefoot conditions (r = 0.660 - 0.884, p < 0.001).

Table 1. Comparisons and Associations Between the Two Jump Protocols: Means (SD)

Variables	RWDP	NDP	T-tests p-value	Effect Size	Power	Correlation	Correlation p-value
DPSI Scores while Shod							
APSI Score	0.100 (0.008)	0.137 (0.010)	0.011	3.416	1.000	0.273	0.187
MLSI Score	0.033 (0.006)	0.028 (0.006)	<0.001	0.550	0.752	0.151	0.470
VSI Score	0.327 (0.035)	0.317 (0.031)	0.189	0.270	0.254	0.416	0.039
Composite Score	0.344 (0.033)	0.347 (0.030)	0.654	0.382	0.072	0.382	0.060
DPSI Scores while Barefoot							
APSI Score	0.101 (0.010)	0.135 (0.010)	<0.001	3.409	1.000	0.477	0.142
MLSI Score	0.031 (0.006)	0.026 (0.006)	<0.001	0.805	0.971	0.302	0.016

VSI Score*	0.319 (0.030)	0.299 (0.035)	0.003	0.667	0.877	0.578	0.003
Composite Score*	0.337 (0.027)	0.330 (0.033)	0.143	0.245	0.209	0.569	0.003

*Nonparametric Analyses. DPSI: Dynamic Postural Stability Index, RWDP: Ross/Wikstrom DPSI Protocol, NDP: Neuromuscular Research Laboratory DPSI Protocol, APSI: Anterior-Posterior Stability Index, MLSI: Medial-Lateral Posterior Stability Index, VSI: Vertical Stability Index.

Table 2. Comparisons and Associations Between Shod and Barefoot Conditions: Means (SD)
Variables Shod BarefootT-tests p-value Effect Size Power Correlation Correlation p-value

Variables	Shod	Barefoot	T-tests p-value	Effect Size	Power	Correlation	Correlation p-value
DPSI Scores within RWDP							
APSI Score	0.100 (0.008)	0.101 (0.010)	0.694	0.080	0.067	0.455	0.022
MLSI Score	0.033 (0.006)	0.031 (0.006)	0.345	0.192	0.152	0.420	0.037
VSI Score	0.327 (0.035)	0.319 (0.030)	0.074	0.373	0.433	0.807	<0.001
Composite Score	0.344 (0.033)	0.337 (0.027)	0.090	0.353	0.395	0.786	<0.001
DPSI Scores in NDP							
APSI Score	0.137 (0.010)	0.135 (0.010)	0.039	0.437	0.555	0.884	<0.001
MLSI Score	0.028 (0.006)	0.026 (0.006)	0.016	0.521	0.706	0.660	<0.001
VSI Score*	0.317 (0.031)	0.299 (0.035)	<0.001	0.968	0.995	0.847	<0.001
Composite Score*	0.347 (0.030)	0.330 (0.033)	<0.001	1.071	0.999	0.870	<0.001

*Nonparametric Analyses. DPSI: Dynamic Postural Stability Index, RWDP: Ross/Wikstrom DPSI Protocol, NDP: Neuromuscular Research Laboratory DPSI Protocol, APSI: Anterior-Posterior Stability Index, MLSI: Medial-Lateral Posterior Stability Index, VSI: Vertical Stability Index.

Discussion

The purpose of this study was to compare and correlate the DPSI scores between two different protocols

(RWDP and NDP) and between footwear conditions (shod and barefoot). For the first aim, which examined the effect of protocols on DPSI scores, the hypotheses were mostly rejected as there were no differences in the composite DPSI scores between the protocols in the shod ($p = 0.654$) and barefoot condition ($p = 0.143$) while there was a significant correlation between the protocols in the barefoot conditions ($r = 0.569$, $p = 0.003$). For the second aim, which examined the effect of footwear on DPSI scores, the hypotheses were partially supported as the composite DPSI scores between the footwear conditions were significantly different ($p < 0.001$) during the barefoot condition but not in the shod condition ($p = 0.090$). The DPSI scores between the footwear conditions were significantly correlated ($r = 0.420 – 0.884$, $p = 0.001 – 0.037$) for both within the RWDP and the NDP protocol, supporting the hypotheses.

The shod DPSI values during the NPD protocol in the current study are similar to the shod DPSI values from previous studies with the NPD protocol (Pederson, 2011; Whitehead et al., 2014), supporting that procedures and calculations were properly executed. Previous studies on the DPSI values under the RWPD protocol had large variability (Liu et al., 2013; Wikstrom et al., 2010), making it difficult to compare with the current DPSI scores in the RWPD protocol. In the current study, the composite DPSI values during the RWPD were 0.344 and 0.337 in the shod and barefoot conditions, respectively. The current DPSI values during the RWPD protocol would fall somewhere between the values reported by the previous studies.

There were two common protocols to assess the DPSI in the sports medicine and rehabilitation literature (RWDP and NDP). To our knowledge, there have been no studies comparing the DPSI scores between different protocols. The current investigation aimed to see if small differences in these protocols such as jump distance/height, visual attention, and arm movements could result in significant differences in the DPSI scores. Previous studies have indicated significant influence of jump distance/height, visual attention, and arm movements in the literature. For example, increased jump distance would lead to increased landing demands, which would increase the vertical and anterior/posterior GRF (Heebner, 2015). As these GRF values are part of the DPSI calculation, it is anticipated that an increase in GRF would lead to increased DPSI scores. The average normalized jump distance for the NDP was 33 cm longer than the standard jump distance in the RWDP. Therefore, it was speculated that the DPSI scores were higher during the NPD. This contention was supported by the current results that demonstrated significantly higher APSI scores in the NDP when compared to the RWDP protocol regardless of the footwear conditions.

Higher GRF/APSI scores due to longer jump distance in the NDP protocol might have been cancelled out by other factors (visual attention and arm movements), resulting in no significant differences in the composite DPSI scores. In the RWDP, because participants must touch an overhead marker, participant's attention was focused on the marker more than the landing site in the RWDP. This was different in the NDP where participants were able to maintain visual attention on the landing site for the majority of the jump. The role of vision during dynamic tasks and balance has been investigated in the past. It has been demonstrated that proprioception and vestibular feedback cannot fully compensate for the lack of visual feedback during a landing activity (Santello et al., 2001). A lack of visual feedback greatly diminishes an individual's ability to balance, and as much as two times higher balance scores in the eyes closed condition were reported (Sell et al., 2012). Although the RWDP does not require participants to keep their eyes closed, the protocol likely causes attention to be away from the landing zone with focus being on the vertec. This

is seen in larger MLSI and VSI scores in the RWDP when compared to the MLSI and VSI values in the NDP protocols. The mechanics of the NDP also required a more horizontal jump over the hurdle compared to a more vertical jump to touch the overhead marker in the RWDP. The NDP mechanics may have lead to an increased APSI versus the RWDP mechanics may have lead to an increased VSI.

Another difference that might have influenced the results is different arm movements between protocols. In the RWDP, arm movements were restricted due to the requirement of touching the overhead marker with the hand on the same side as the dominant foot. The NDP had no arm movement requirements or restrictions. Previously, arm movements in vertical jumps increase the maximum takeoff force and decrease the landing impact (Shetty & Etnyre, 1989). There are limited studies investigating the effect of arm movements on the DPSI scores during single leg jump landing tasks. However, the restrictions on arm movements in the RWDP would increase DPSI scores due to limiting the ability of the arms to decrease the landing impact as compared to the free arm movement in the NDP. In short, one constraint (longer jump distance in NDP) is matched by two constraints (less visual attention and restricted arm movements in the RWDP), resulting in no significant differences in the composite DPSI scores between two protocols.

There were mixed results for correlations between the two protocols (not significant ($p = 0.060$) in the shod condition; significant ($p = 0.003$) in the barefoot condition). It was believed that the overall dynamic postural stability of each participant was a constant and the change seen in DPSI scores would be solely due to the differences in the protocols. With subjects as their own controls, the DPSI scores were expected to vary between protocols but be significantly correlated due to the constant nature of their dynamic postural stability. The current result in the barefoot condition supports this contention. Contrarily, although there was a trend ($p = 0.060$), there was no significant correlation between the RWDP and NDP in the shod condition. Because the shod composite DPSI score between the protocols had very low statistical power, more subjects might be needed.

For the second aim, the current study found that there was a significant difference between the shod and barefoot conditions within the NDP ($p = 0.001 – 0.039$). It was also found that there was a significant positive correlation between the shod and barefoot condition within the NDP ($r = 0.870$; $p < 0.001$). These findings are in accordance with a previous study investigating the DPSI scores, which reported a significant difference in DPSI scores between standard athletic shoes, military boots, and minimalist footwear (minimalist footwear being the lower DPSI scores) (Whitehead et al., 2014). A potential reasons that explain the significant differences between the shod and barefoot conditions is that subjects would alter landing technique to increase forefoot strike in the barefoot condition (Lieberman et al., 2010). The authors (Lieberman et al., 2010) reported forefoot landing lead to decreased GRFs, which are directly associated with DPSI scores. The current findings support this explanation as the barefoot condition had lower VSI scores, specifically in the NDP.

Interestingly, there were no significant differences in the DPSI scores between the footwear conditions during the RWDP protocol ($p = 0.074 – 0.694$). The current result was contrary to the previous study that has reported significant differences in the DPSI scores between the barefoot, athletic shoes, and minimalist conditions utilizing a jump-landing protocol with a standard jump distance (Rose et al., 2011). In their study, the barefoot condition resulted in the lowest DPSI scores that is similar to the study by Whitehead and

colleagues (Whitehead et al., 2014). When combining the results (effects of protocols and footwear conditions) of the current investigation, there is evidence that the two protocols were not significantly different; however, the NDP protocol was more sensitive than the RWDP to detect small differences caused by footwear conditions.

In the current study, there were significant correlations between the shod and barefoot conditions regardless of the protocols, supporting the hypotheses. When looking at the correlation values closely, the correlations between the footwear conditions within the NDP protocol had higher correlation values ($r = 0.660 – 0.884$) than the correlations within the RWDP protocol ($r = 0.420 – 0.807$).

Limitations of the current study should be recognized. One limitation was that participants used self-selected footwear. This decision was made in an attempt to best replicate previous studies using the DPSI which did not standardize footwear. Participants varied in self-selected footwear. This difference, though reflective of the previous literature, may significantly affect the DPSI scores. Second, females have significantly higher DPSI values than males (Wikstrom, Tillman, Kline, & Borsa, 2006). This effect could potentially influence the data but was accounted for as best as possible by recruiting and testing an even number of males and females. Also, due to the individuals serving as their own controls, the influence of gender differences in the current study would likely be small. Based on the current DPSI data in an athletic and young population of males and females, no significant differences were found in DPSI scores in either protocol or footwear condition. Third, a previous study has shown that balance decreases as age increases (Bohannon, Larkin, Cook, Gear, & Singer, 1984). No studies have investigated the effect of aging on either the NDP or the RWDP. If the significant change in balance with aging is also seen in either protocol, it could influence the data. The ages of the participants in this study was young and comparable to other studies which also utilize these protocols (Sell et al., 2012; Wikstrom et al., 2005). Therefore, the results in the current study are only generalizable to the similar demographics.

Conclusions

Varying footwear results in significantly different DPSI scores more so than varying protocols. Particularly, the DPSI scores between the shod and barefoot conditions during the NDP protocol were significantly different. When utilizing the existing literature or conducting new studies, if footwear was not controlled, ambiguous results may have been collected and analyzed, leading to inaccurate conclusions. Practically and clinically speaking, the DPSI could be assessed in the barefoot condition when used to examine the effects of surgery and rehabilitation. The barefoot condition provides a true control as all individuals completing the task can potentially complete it barefoot. Additionally, the NDP protocol might be advantageous over the RWDP protocol due to its sensitivity to detect small changes and the ease of testing (requires a 30cm hurdle rather than Vertec).

Conflict of Interest: None declared.

Ethical Approval: This research project was reviewed and approved by the University Human Research Protection Office. Prior to participation, informed consent was provided to subjects, and their consent was obtained.

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DESIRE ARCHITETURE: BEHAVIOR CHANGE THEORY

Ricardo Fontes Macedo, Liaria Nunes da Silva, Robelius De-Bortoli
Sergipe Federal University, Brazil

ABSTRACT

People can change their behavior and wants to change it rapidly to acquire the benefits. This generates a need for a behavior change theory connected with their desire and this can be mediated by a manager. Gamification is a process that guide a person to Flow experience througth intuitive identification of individual's gameful profile. Hence, this paper formulates the Desire Architeture Theory – a gamify process - which aims to acceletate the user behavior change based a user desire activation

Keywords: Desire; Behavior Change; Gamification; Interface; Feedback.

Human behavior theorists as Piaget and Inhelder (1995), Skinner (1972, 1982a, 1982b), Vygotsky (1996, 2001a, 2001b), and Wallon (2007) assert that behaviors can be modified. Each author describes human development and the behavior change process differently. Professionals can use these theories alone or combined to manage behavior change programs. Each theory takes its own time to achieve desirable behavior and has different results. In addition, the authors show that humans are able to change their behavior if they receive the appropriate stimuli, which highlights the importance of professional knowledge on behavior change theories. Furthermore, these professionals need a theory with a easy format which shows the way to user´s desire and motivation. Then, they can mediate a person's behavior change.

The society, through specialists, determines and/or suggests some appropriate and beneficial behaviors to population, adopting healthy habits, for example, preventing risk factors for some diseases (WHO, 1986, 2014). The concern is to attract and engage people in a behavior change without a successfull intrisic and extrinsic motivation management (Seligman, 2002). A technology, called Gamification, has been efficient in this aspect– the use of video games elements in non game context (Deterding and Nackle, 2011). Companies and Scientist use it to engage people in their desirable behavior (sales, health, education, etc).

Another factor is the behavior change speed, which benefits must be tapped quickly, depends on the connection of the behavior change program with the individual's desire. In other words, these activities and goals must have meaning for the user. Purpose stimulates the intrinsic motivation of the individual and has the power to involve people in long-term activities (Seligman, 2002). In addition, a fluid process of behavior change allows unconscious and pleasurable engagement (Csikszentmihalyi, 2009). Therefore, this research shows the Theory of Desire Architecture, which manipulates people's desire to accelerate the process of behavior change.

Desire Architeture Theory Description

Desire Architecture theory describes the process of accelerating behavior change by manipulating people's desires. The constructs of this theory are:

- Development Psychology
- Behavior change theory
- Motivation
- Feedback
- Gamification
- Desire Psychology
- Grupo Dynamics
- Self-efficacy

This theory is composed by 9 steps: 1. Manager Module; 1a. Behavior; 2. User; 3. Protocol Module; 4. Interface; 5. Activities Execution; 6. Datas; 7. Data Analysis; 8. Feedback; 9. Gamification (Figure 1). Following, a description of the theory steps is provided:

1. The Manager Module is the behavior change process moderator. Ex. Teachers; Company Director; Health professional, etc.

   1a. Behavior is a habit that the Manager Module wants the user change. Ex: healthy lifestyle, productivity, sharing things, etc.
2. User is a person who adopts the behavior proposed by Manager Module. Ex. young women, elderly group, obese population, etc. The Manager Module must know this user profile, such as culture, habits, likes and dislikes, etc.
3. Protocol Module is the process or methodology (evidence based) to execute the desirable behavior. Ex. health behavior change theory, physical activity program, task management methods, etc.
4. Interface is the place or enviroment of User and Manager Module interaction. Ex. Real places: canvas, wall design, notes, etc; Digital places: cell phones, social networks and apps. The User profile research will provide insights to define the best interface(s).
5. Activities Execution is the step where the Manager Module defines the type of tasks he will propose to execute the protocol (Ex: challenges, quizzes, missions, etc) and also establishes the rules: how the user can execute the tasks and validate them against the interface.
6. Data is the quantitative and qualitative indicator choosen to account the activities performed. Ex. number of monthly, weekly and/or daily actions accomplished, engagement percentage, number of support comments, etc.
7. Data Analysis is the step where the Manager Module defines how organize and interpret this data.
8. Feedback is the reinforcement furnished to users after they perform the activities. This feedback is based on Gamification. Ex. Extrinsic feedback: points, scoreboard, prizes, etc; Intrisic feedback: Badges, positive verbal reinforcement, etc.
9. Gamification is the process that determines the principles applied between step 3 and 8 (simple rules, meaningful goals and voluntary participation).

Figure 1 describes the Desire Architeture Theory steps. Firstly, the Manager Module defines how use the theory by identifying the users profile and needs inside their context. Secondly, The Manager Module chooses the behavior of the User´s change and the best way to execute it according to user´s desires - these have a demographic, cultural and social context which Interferes in the way their desires is satisfied. Then, the Manager Module chooses a evidence based Protocol Module adequated to users.

The Manager Module and user interaction happens in the Interface and is a cyclic process: Manager Module launches the activity; user comunicates the execution; Manager Module analyses and gives Feedback; and launches a new activity. The Interface has to be a place of easy and continued access for Users, hence the interaction must be immediate and with flow (Csikszentmihalyi, 2009). The number and type of Interfaces chosen depends on behavior, users and protocol complexity.

The Manager Module proposes activities to users perform in real life, like challenges, which need to be validated in the Interface, or he can propose activities performed inside the Interface, like quizzes. This cycle of actions generates numeric and categoric datas which the Manager Module should choose the indicators to analyse. After this interpretation, he creates the feedbacks to maintain the user motivated and engaged in the behavior. Furthermore, this feedbacks should be given with the right intensity and direction based on gamification principles.

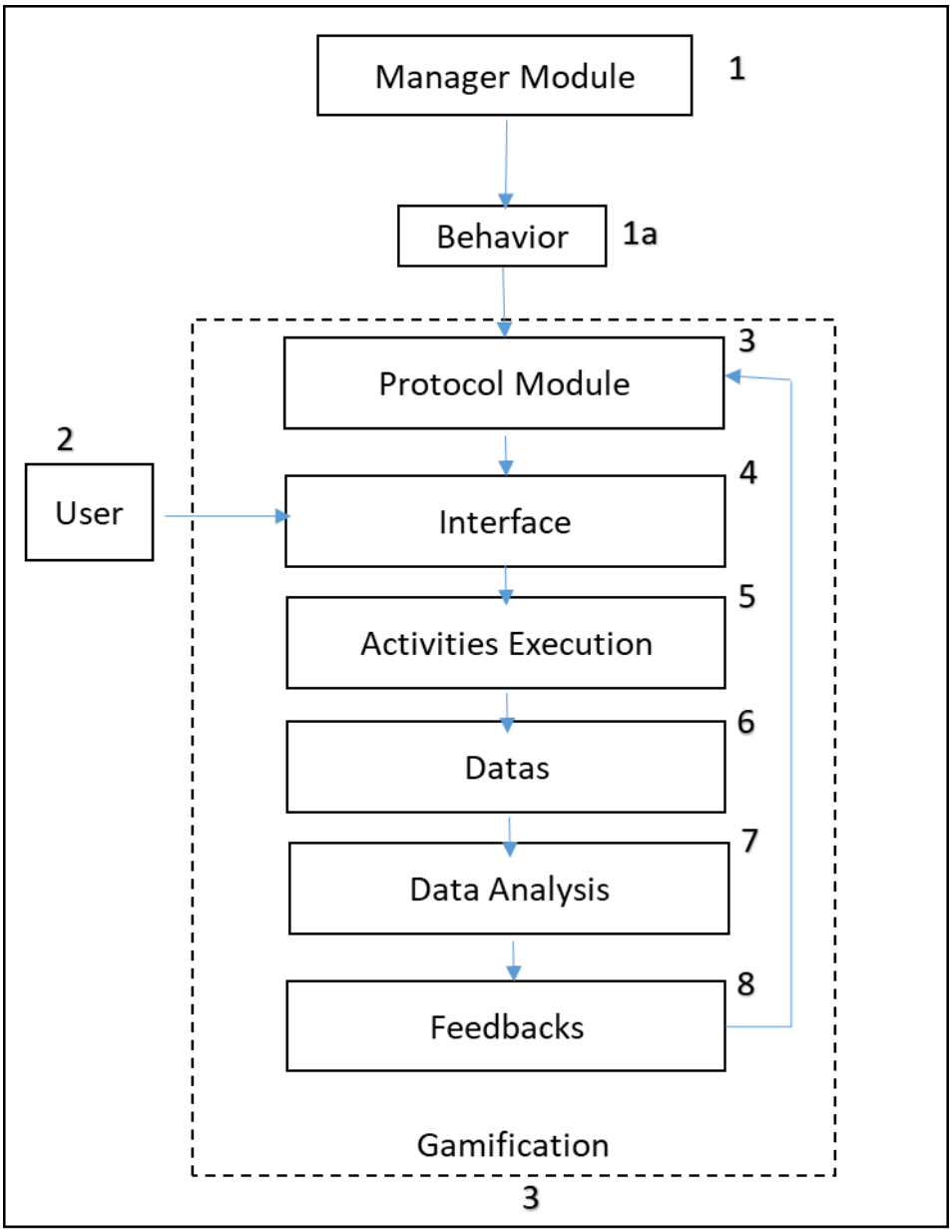

Figure 1. Desire Arquiteture Theory

Desire Architeture Theory Application

The Desire Architecture was applied in different environments and for different publics. Macêdo, Reis and De-Bortoli (2017), tested the theory with a healthy lifestyle promotion protocol (called Pura Vida) in 9 women aged 20-35 years. They formed groups of three by affinity and proximity. The Manager Module defined a social network (Interface) for each group interaction. In this, the Manager Module launched the challenges or quests of each day (Activities Execution), as well as, the Feedbacks for each activity performed by the participants. In one month of intervention, the participants engaged in the proposed Behavior and they reported that the opportunity to share and know their friends's habits motivated them.

Another example was the Desire Architecture Theory practical application with a graduation class. The Manager Module was the teacher of the discipline, who wanted to engage the students (Users) in a healthy

lifestyle (Behavior). The manager established as a Protocol Module the Pura Vida program - composed of physical, nutritional, social and mental activities. The appropriate means to interact and engage the students was a social network and the classroom (Interfaces). The manager communicated the challenges and quizzes (Execution of Activities) for the users within established rules. The Data generated at the interfaces were tabulated qualitatively and quantitatively in a sheet for later analysis. The interpretation of data (Data Analysis) and Feedbacks were made at the end of the day - points, scoreboard, levels and positive reinforcement. Furthermore, there were the immediate social and mental feedback created by the users when they shared the photos of their activities and commented about the colleague's performance.

In an experiment conducted in a coworking, the manager (Manager Module) wanted to engage the workers (Users) in preventive actions for the Burnout Syndrome (Behavior). The office manager chose the Burnout Syndrome educational program (Protocol Module) to be applied in a social networking group, and also verbal face-to-face communication (Interface). The proposed activities were daily challenges of practical day-to-day work activities (tasks validation with photos) and multiple-choice question forms (Execution of Activities). Thus, the manager collected the number of challenges met per day and quizzes answered (Data). After systematizing them in levels by points conquered, the manager increased the level of the challenges and the questions (Data Analysis). In addition, the manager provided positive verbal feedback in the group and encouraged the social reinforcement by the other coworkers (Feedback).

Conclusion

Therefore, a need generates a desire for change, but it is necessary to motivate people by directing them to the goal and aligning the intensity of the their effort to something that has meaning for them. Hence, the person will make an agreement or an alliance to initiate this change. After the sealed agreement, the manager must keep the participant motivated in the behavior. This motivation is managed through intrinsic and extrinsic feedback. To align and connect these actions in one cycle, the manager uses Gamification - which is a process that provides a positive flow of activity similar to that experienced in a video game. Thus, the Desire Architecture Theory is a process that reorganize this constructs to manipulate the user's desire to accelerate behavior change.

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Rhythm is a Dancer: An Essay about *Affectfulness* as a Parameter of Human Development

Helga Loos-Sant'Ana
Federal University of Paraná

René Simonato Sant'Ana-Loos
Independent Researcher

Aldemar Balbino da Costa
Federal University of Paraná

CORRESPONDING AUTHOR
Helga Loos-Sant'Ana
Main e-mail address: helgaloos@yahoo.com.br
Alternative e-mail address: helgaloos@gmail.com

55 (41)992144080
Rua das Araras, n. 5 Recreio da Serra, Piraquara, Paraná, Brasil
CEP. 83305-600

Abstract

This essay is an invitation to consider the possibilities of dancing as a process of education and human development. The intention of this theoretical work is to bring some foundations about how human development may benefit from dancing as a reference for constructing parameters based on affectivity and the search for existential self-realization. With this ambition, we explore the notions of human development, corporeity, affectivity, interaction, playfulness, arts and dancing. The primary foundation is the Theoretical System of Affectfulness and the respective concepts of Affectfulness and Psychic Cell. Further, we dialogue with other authors in order to expand the discussion. We support dancing as an artistic expression with the potential to extend individual's perception, balance and sensitivity. If experienced as an activity connected with the sense of harmony that gives us existential pleasure, i.e. if the dancers experience corporeity while willing to connect to the implicit needs of their bodies towards a rhythmic harmony, dancing may lead to discovery of the unfragmented essence of being, in consonance with nature and the universe. This is owed to the potential of dancing to outline affective-emotional parameters that may serve as models to be generalized to other interactional situations, contributing to nourishing a cycle of more positive and pleasant interactions.

Keywords: Dance. Human Development. Affectfulness. Corporeity. Rhythm. Self-realization.

Introduction

Human development and education are intimately related to the arts. Dancing is one of the most significative expressions of this phenomenon. The experience of dancing, and, with it, the notion of art, triggers our sensitivity, preparing us to see life with more inherent signification of our existential movement. Thus, life, one way or another, through paths not so clear to human cognition, delivers an infinite amount of perspectives. This introduces us to opportunities of realizing the existence of the diverse possibilities of being, the multiple available options of conflict resolution, and the reaching of the most harmonic states: what we translate as human development. Therefore, this essay explores *dance* as an instrument that may, depending of our relationship with it, offer parameters to build one of the foundations of *human development: affectivity*.

Knowledge, reflection and solutions about the diverse individual and social phenomena may be achieved through art in education. In its diverse forms, art considers human existence and its varied relations with its surroundings. It connects agents, observers and contexts; human condition itself. It pictures the world's dynamism in different languages, sensitizing, providing insights, affecting for the sake of transformation. Art works as an instrument integrating cognition and affectivity in order to balance the organism to the environment [1].

In this perspective, dancing is a form of artistic expression that integrates other forms of art, such as music, theater, literature, and visual arts. It may propose a specific language depending on the context, of course, such as jazz, modern ballet, contemporary, tap-dance, ballroom, folklore dances. Each style envisages peculiarities allowing uniqueness in expressing various rhythms and styles.

Regarding education, school has prioritized the knowledge developed and accumulated over the years. However, all information that is necessary and transmitted loses value if the recipients do not know how to use it. They must acquire such pieces of information, recombining, reorganizing and transforming them. Nevertheless, the concretization of this process requires nourishing open and flexible minds. This is when art helps develop this openness and flexibility of thoughts, resulting in individuals capable of using knowledge to improve reality. Art in itself is knowledge, and practicing it requires knowledge of other areas. Though, the possibility of signification of all knowledge abstracts a domain of the *cognoscent subject* who practices it with their full sensitivity [2], which, in turn, arises through affectivity [3].

Therefore, this essay seeks the connection between the arts, human development and education. In this sense, we must urgently consider that interaction and affectivity are intrinsically related, and that educational experiences that include themes like dancing are indispensable.

After all, without affective exchanges, the existential sense towards the extension of cognitive development is lost. It should be noted that human development is not exclusively cognitive development. Human development is the entire process involving also affectivity – the way we affect the world around us, and, at the same time, are constantly affected by it –, which is present since one's birth and will follow along one's entire life. Thus, affectivity occurs in relations, and only through them, one may transform oneself, evolve and extend one's cognition, within a socioaffective process.

Justification and Goals

Interest in the theme *dancing*, as explored here, which has been triggering insights that serve as bases for this essay, has been motivated mostly by (a) curiosity about why people dance; (b) interest regarding the real role of dancing in human development; (c) discomfort with the current social and scientific paradigms supporting education.

The premises assumed in order to guide the argument developed here are as follows:

1. Socioaffective development of an individual depends on the interactions experienced with their surroundings;
2. Interactions are estimated by the cognoscent subject as from their sensitivity;
3. The pleasure (or displeasure) of the affectivity experienced in the interactions is the primary principle of a personal, subjective parameter to the path towards human development, which is objectively shared with others;
4. The interactional paradigm is most appropriate in order to comprehend human development, even in atypical circumstances;
5. Affectivity provides for human development;
6. The arts clearly allow for the pleasure of knowledge (of oneself and of the world), and for the appearance of creativity;
7. Art is directly related to education and human development;
8. Dancing experiments and ludically promotes the existential pleasure;
9. The pleasure experienced by dancing may improve a parameter of affectivity that may provide for human development;
10. Dancing is an artistic expression that extends an individual's perception and balance, as well as their sensitivity.

In this perspective, it is our intention to present foundations in order to answer the following question: *How may human development benefit from dancing as a reference to building existential parameters based on affectivity and the search for self-realization?*

By assuming the importance of the arts in an educational context and in life in general, we support the need of more reflections, as well as scientific works, questioning the current paradigmatic path of prioritizing "reason above emotion". Essentially, arguing for a more balanced perspective between these two instances comprised by the human condition. Since sensitivity is the propellant of art, a greater valuing of the arts tends to aid a fuller human development.

Thus, we intend to raise indicators to support the notion that dancing, as an instrument of educational and human development, has an active role in the process. In doing this we intend to stimulate research in Human Sciences with the goal of, in a greater scale, reaching a better understanding of the true role of education and how to reach appropriate parameters to support human development.

As such, we may also think of strategies to obtain policies prioritizing the arts, attempting to provide more accessibility to the artistic experience to society as a whole. This will be possible if the arts have a more significant role in the teaching-learning process. By heightening the arts as a fundamental piece of education, an attempt to reach more effective results of human development would directly

contribute to society as a whole. As observed by Pombo [4], we must perceive the value of emotionality – non-fragmented; rather, together with all other aspects of the individuals – integrating the arts egalitarianly into education. And, in this process, recognize the value of the diverse forms of art, such as dancing.

Specifically, this essay intends to use premises of the *Theoretical System of Affectfulness* (TSA) [5], [6], [7] and dialogues with other authors to gather elements to answer how human development may benefit from dancing as a reference to building existential parameters based on affectivity and the search for self-realization

Accordingly, the following topics cover considerations about key, indispensable concepts for understanding this perspective.

Human Development

We propose to contemplate the idea that self-realization and human development are intimately related. The humanist stance in Psychology was developed in opposition to psychanalysis and to behaviorism. It credits development to each individual's intrinsic potential and the interactional possibilities that expand and update this potential. Carl Rogers and Abraham Maslow, contemporary humanist authors who wrote their most important theoretical contributions between the 1950s and 1970s, believed in the potential of self-updating and self-realization, supporting that human nature is essentially constructive and reliable. In fact, according to those authors, the same principle applies to all living beings, since positive forces towards health and growth permeate the natural dynamics, being intrinsic to every organism. Therefore, the trend towards development is paramount to the life project of any organism, which will seek methods to preserve and value itself.

In this line of thought, such trends towards health and balance are facilitated by complete, genuine interpersonal relations, that are mutually accepted and do not constitute obstacles to self-knowledge and self-realization. Rogers [8] states that if one is able to affectively understand the other's feelings, one will also understand one's own. Thus, one is able to turn to certain virtuous directions, walking towards self-realization as one advances to maturity and real and full socialization.

Abraham Maslow denotes the value of the process involving the path to self-realization. In order to become self-realized, one must experience motivations related to the many levels of necessity, starting from physiological, through safety-related needs, social needs and finally needs related to esteem. Further, one must accept and invest in one's own motivation for growth, as an exciting and rewarding process. That is, self-realization happens through experiences of interacting with the world that provide sense, abundance and value to life, aiming for growth and preservation of integrity. The author argued against anything that closes doors or limits possibilities. Maslow [9] explained:

> (...) the adaptation to this world becomes indispensable, for example, the proof of reality, the knowledge of this world's nature, the learning of differentiation between this world and the inside world, the learning of the nature of people and society, the learning to hide from what would be dangerous, the learning of the parts of the world that are gratifying and those that are dangerous or useless to satisfying necessities, the learning of approved and allowed cultural paths to

> gratification and the gratification techniques. (...) The world is intrinsically interesting, beautiful and fascinating. Exploring it, manipulating it, interacting with it, contemplating it, enjoying it, are all motivated kinds of action (cognitive, motor and aesthetic necessities). (p. 221).

Self-realization and self-actualization imply to experience the world and oneself intensely, with full concentration and absorption. It is to make every experience true, allowing oneself to truly, rather than potentially, exist. An individual in process of self-realization is in line with their own intimate nature, paying attention to what happens within themselves, as well as in the world, turning each choice into an option for growth and development.

The interactionist author Lev Vygotsky [3], in turn, notes that human development includes biological maturation, socialization, development of motor and psychological functions, and the diverse learnings one is exposed to along one's life, provided by the social and cultural experience. These functions do not occur in isolation, since the development of one dimension constantly interacts with the others. This author lived and wrote his works in the first half of the 20th century, and his most relevant writings to psychology of learning and human development arose especially between the 1920s and 1930s. From him, we gather a very relevant concept for this essay: that human development is propelled by learning, and that the teaching-learning process we usually call "education" happens everywhere and all the time, as one learns through social interactions, thus building oneself and one's knowledge. Developmentalist concepts were created by Vygotsky especially in the final phase of his life. Generally, however, this author had a multidimensional view of human development, considering it from the most specific and narrow perspectives (microgenetic) to some with extended reach, such as phylogenetic, which reports to the history of human development. In all perspectives, he referred to the notion of development as "self-actualization exercise for interactions", as described by Sant'Ana-Loos [10] in his analysis of Vygotsky's scientific project.

Vygotsky's interest in human psychology resulted from his experiences with the arts, having focused in the role of aesthetic experience on development. This fact is particularly interesting for this essay. For Vygotsky [11],

> (...) art "works" with human feelings and artistic works embody this activity. Feelings, emotions, passions are all part of the works of art, but they *are transformed* with it. Much like an artistic procedure triggers the metamorphosis of the raw materials; it may also trigger the transformation of feelings. The meaning of this metamorphosis of the feelings is that they reach above individual feelings, becoming generalized and social. As such, the meaning and function of a work of poetry on sadness is not that of transmitting the sadness of the author; rather, to express this sadness in a manner that in mankind may be found something new, a higher, more human truth. (p. 6).

In this regard, through its own aesthetic experience and playfulness, art infiltrates the relation between education and human development, unveiling new possibilities to individuals and to society, working in several perspectives of development. We will further elaborate on this argument, specifically

related to dancing as an art form.

For the Theoretical System of Affectfulness (TSA) and its Monist approach, the view of the whole and its dynamic relation with the parts (units) that compose it is thought of as a relation of interdependence with the workings of the elementary unit that constitutes the foundations of the human psyche, designated in this theoretical perspective as *Psychic Cell*. Through this psychic logic of development, one acquires the skill of "affecting and being affected" and of developing, that is, building resources to take part in the most diverse possibilities of interaction. Regarding the Psychic Cell, the authors of TSA [6] explain:

> This denomination is inspired by its constitution in three dimensions correspondent to those of a biological cell (nucleus, cytoplasm and membrane). Those support the Gestalt of diversity that exists in every human psyche. Together, the three instances constitute an organicity of the mental process that support the existential administration of the sensitive and thinking "I" that reports to its condition of being, at the same time, a biological, psychic, social, affective, rational and universal entity. (p. 67).

Therefore, we have the psychic processes known as *identity* (as the basis of the Configurative Dimension), *self* (as the basis of the Recursive Dimension), *extended resilience* (as the basis of the Creative Dimension), thus composing the *Triadic Unit* that builds the basis of the human psyche. Through a fourth dimension, *alterity* (as the basis for the Modulating Dimension), the basic unit interacts with the human world. These dimensions and their respective processes are interdependent, and, at the same time, complementary. In this dynamic of the Psychic Cell there is also a meta-dimension that may emerge through the development of the aforementioned dimensions. It is responsible for the functional and structural homeostasis of the psyche: the *True I* (or *Complete Language*). Kloeppel [12], writing one of the first works based on the TSA, explains this meta-dimension of the Psychic Cell:

> A "big I", capable of harmonizing itself with the world through the Complete Language; a universal being in relations with the other ("I"-"other"), a full and true "I", obtained by efficient efforts in maintaining relations of alterity. As highlighted by the authors of TSA, the fifth dimension is essentially a meta-dimension, a dimension combating the nullifying entropy by achieving totalizing energy, through the promotion of pro-homeostatic thought. It corresponds to looking at the world and at the "other" by containing in itself the same responsibility as when looking to "I". In this regard, the "other" also becomes a "big Other", a capitalized Other. It is by reaching this level of interactions with oneself, with others (people) and with the world (things, ideas, other beings, etc.) that one may reach homeostasis, a condition of harmony in interactions. (p. 79).

The essential psychic structures – resilience, identity, self and alterity – may arise sequentially or even be interrupted in their healthy development, leading to problems of self-regulation, and, therefore, of behavior. The balance between these instances is necessary for one's complete development; that is, one

must open up in order to homeostase interactions, in all levels or dimensions. Between individuals: I and the other; between subjectivity and objectivity; between ideas (abstract) and materiality (empirical). We observe a frequent forking in existence, one that incurs in dualisms or polarizations, commonly lead to interactional and existential conflicts, distorting human development [10].

This essay presents the need to approach the psychological processes from an "extended" perspective: without the polarizations and dualisms between the cognitive and affective-emotional scopes. Further, between conscious and subconscious, or corporeal and mental, as supported by Luna, Loos-Sant'Ana, Sant'Ana-Loos and Silva [13]. It supports that human development may be guided by the search of self-realization, where potentials and learnings are equally valued and balanced towards health – psychic, social/interactional, and corporeal.

Corporeity

Diversifying experiences is very important for cerebral plasticity, as indicated by Kolb and Whishaw [14], because new and diverse experiences extend neural networks and create new neurons. The authors suggest that one way to stimulate the brain is to place individuals in environments offering some sort of experience involving corporeity, activating the sensory or motor pathways. In the supporting experiment, they compared animals restricted to living in cages to same-species animals encountering diverse experiences in complex places. The results showed diverse experiences to lead to alterations in different neural systems, especially those experiencing complex places.

In this regard, this essay notes the importance of an approach to human development that place corporeal experiences in similar esteem to learning of scientific knowledge from a cognitivist bias. Thus, from a limited group of possibilities valuing corporeity in the scope of Psychology and Education, we must credit Alexander Lowen, developer of the mental-corporal psychotherapy known as Bioenergetic Analysis in the 1970s. This author has studied and written about corporeal expression since the 1950s, having psychotherapy as his focus for over 60 years of his life [15].

Lowen [16] supports that "pleasure is the conscious perception of the body's rhythmic activity" (p. 201). In his book "Pleasure: A creative approach to life", he explains that rhythmic movements are present in nature as a whole, as well as in involuntary activities of our body (breathing and heartbeats, for example). Thus, voluntary activities guided by conscience constitute the medium that allows for elaborate expressions, such as dancing, working, and singing, among other corporeal manifestations. Conscious activities such as these are often pleasant; that is, there is an intrinsic relation between rhythm and pleasure. If a motor activity is rhythmic, that is, there is synchrony between the internal movement patterns of an individual and the external models, feeling is pleasant. Conversely, if an activity is performed mechanically, with excess priority given to demands external to the body, it becomes painful [16].

The author also elucidates that one may find sensorial pleasure in stimuli that harmonize with the rhythms and tones of one's body. One must, however, be inclined to receive pleasure, i.e., one must search for it and be open to it. For example, one may be pleased by listening to one's favorite song in a given moment. Conversely, the same song may be unpleasant if one is trying to concentrate on a demanding activity.

One may evaluate pleasure or lack thereof by observing how people move or perform their daily activities. In order to feel pleasure or assess the pleasure of another, one must identify with one's body and its search for rhythm. Rhythm is pleasure and vice-versa. It is the healthy and natural functioning form of organisms. As one improves one's coordination of body movements, they become rhythmic and, almost always, a source of pleasure [16]. The author also explains that individuals are capable of changing rhythm as their excitement varies. Therefore, since they are creative beings capable of opening themselves to new possibilities, individuals may merge complex rhythmic patterns in order to increase pleasure and happiness.

Rhythmic, spontaneous activities are undervalued in a society focused on the ideas of reward, success and perfection. Lowen [16] states that, normally, what one believes one knows, ideas usually arisen only from intellectual learning, contradicts one's sensitivity, and in the conflict between corporeal and mental perspectives, one tends to rely excessively on knowledge and deny one's affective and spontaneous comprehension. The author demonstrates this through the observation that while everyone recognizes the importance of inner peace and pleasure to our integrity, in order to obtain power (something of great value in our world), people often sacrifice everything else. For symbols of power, money and success, one will often forget what is essential: pleasure and affectivity [16]. To accept that such behavior is detrimental to human development and well-being of life in society, to pleasure and intimate affective interactions, we must evidence the value of corporeity – the rhythmic necessities of the body. Only then may we fully promote the balance of the Psychic Cell, the psychic unit of human development. In doing so, we may grow towards self-realization.

Affectivity

The notion of *affectivity* ought to be extended beyond a mere notion of decorum in relations, because foremost it involves the quality of relations and interactions we experience in the world, i.e. how we affect them and are affected by them [7]. Feelings and emotions are consequence of the impact felt by us, at an internal level, from these interactions. Therefore, feelings and emotions are subsets of affectivity. This is a Monist approach to understanding affectivity.

The *Theoretical System of Affectfulness*[1], suggested by Sant'Ana-Loos and Loos-Sant'Ana [5], [6], [7], aims at better understanding the relation between mankind and nature, including the notion that mankind is also a product of nature. The authors support the idea that all human phenomena occur in a systemic perspective, connected to further elements of reality. Through this perspective, affectivity is a set of phenomena that manifests along with encounters, interactions established with other things in the world, whether human or not. For the authors, "all that exists is a result from the kind of affectivity created by interactions" [17] (p. 115). Thus, the existence and movement of any being or object affect its surroundings. This extended concept of affectivity intends to surpass traditional definitions because it harnesses the deep ecology of the universe, turning affectivity intimately dependent on the rhythm established in the most varied interactions as the fulfilling phenomenon of pleasure and existential sense.

Through the Theoretical System of Affectfulness, the authors expect to reclaim the role of human

[1] References to the recently redubbed *Theoretical System of Affectfulness* may be found in previous works as *Theoretical System of Expanded Affectivity* or *Theoretical System of Extended Affectivity*.

sensitivity: affectivity, emotions, and feelings. It focuses on equating the partaking dimensions in each situation, albeit the dimensions may vary according to each scale. However, all constant instances of reality should in some measure contribute to the equation, according to a Monist stance. Therefore, reality should be investigated starting from the sense of the interactions it comprises. The simplest idea of *Affectfulness* is to dynamically balance the analysis of how a being that seeks to establish and solidify itself while balancing itself to reality, affecting the world and being affected by it.

As a consequence of this affectivity found in all perspectives and scales of reality, emotionality is one of the primary domains that constitute mankind. Simply because in a world with so many interactions and ensuing effects (as in the result of affections), distinct emotions lead to the observation of certain events, while others go unnoticed. A fearful individual, for example, observes different things than a calm person. Something similar occurs with every emotion. Thus, one should notice that affectivity may lead to different emotional states, and that those are generated not only by the individual; rather, they are influenced by the myriad of interactions happening in their surroundings, be it directly or indirectly. As these interactions are experienced, the play of effects may trigger multiple transformations. Since interactions are considered by all theoretical backgrounds mentioned in this essay as essential to an individual's development, in their absence, the possibilities of "being" are limited in all scopes encompassing human beings. What each individual Psychic Cell will consist in will depend on the experienced affectivity and the type of ensuing emotionality, as well as how these effects will be processed and will contribute to generating vital psychic resources.

Sant'Ana, Loos and Cebulski [17] support rationality to be affectivity itself, but arranged in a human manner: the resultant from existential sense crossed against extended reality. In such light, the historical defense of cognitive supremacy to the liability of affectivity, as those are two facets of the same phenomenon, configured by the affects sensed, perceived and processed by each individual. "This premise may eventually contribute to educational thinking by (re)integrating affectivity and cognition, contradicting the current practice that excessively privileges rationalist education." (p. 110). The authors identify that the combination of arts, philosophy and psychology may contribute to integrating (or reintegrating) affectivity to cognition. In this manner, whenever an individual makes themselves available in this evolution of thinking, feeling and acting, they will ultimately affect other persons in their own development.

Interaction

As previously announced, comprehending affectivity includes comprehending the quality of interactions between individuals, as well as between these and the other elements of the world. Hence, the Theoretical System of Affectfulness assumes as premise that investigations of any theme always be in consonance with understanding the whole and its relation to the parts, its connections and reciprocal contributions. I. e., requiring observations not only of the "outside" or "beyond", but rather also of the "inside" or "within" of phenomena, converging them in an equation that may only be fully appreciated from a panoramic perspective, with the assistance of a meta-theory [5], [12].

Drawing on opportunities provided by interaction, *Affectfulness* (as an outline for human development) emerges as a possibility of learning about the parameters guiding our existential sense.

Perhaps the most important of these parameters if pleasure, true pleasure, which is conductive to wellbeing. When interactions arise in an orderly fashion, that is, *rhythmically harmonious*; when corporeity and all other dimensions composing the beings are valued, beyond the mechanistic sense imposed by excessive rationalism (which became cognitivism), the possibilities for self-realization are extended. Then, the arts become fundamental for building parameters of existential sense, those conductive to human development in its best form.

Playfulness

Playfulness is a way of attaining great possibilities of "being": the full, rhythmic, melodious human being, in harmony with the powerful forces of the universe. It is a possibility to envision and reach skills often not accessible in the concrete and "serious" life. By means of roleplaying and imagination, one may awaken human creativity and unveil possible worlds [18].

The scope of playfulness reaches power capable of transforming individuals, by giving their own bodies possibilities of transformation. In playful situations the body is more easily stimulated, awakening desire and pleasure. Furthermore, playfulness grants the possibility to experience something innovative, not crystalized in the commonplace interactions, leading to learnings that may expand the existential sense. Porpino [19] describes it as exposing the organicity that inhabits the bodies. A body that presents itself as playful and affective possibilities.

Pleasure is the foundation of a happy life. The creation of a playful atmosphere is indispensable so that a child can fully embrace playing and may then manifest creative impulses. Adult creativity emerges from the same source, resulting from the desire for pleasure and from the need for self-expression. Pleasure grants motivation and energy for a creative approach to life. Every creative act begins as an excitation of pleasure. Aside from providing motor force to the creative process, is also the product of this process. Without pleasure there is no creativity, and without a creative attitude towards life there is no pleasure [16]. Meanwhile, Vygotsky [20] highlights that playing is responsible for the sociocultural development of individuals, as it is through varied playful activities that a child is introduced to cultural and social aspects of its community. Besides, for Vygotsky, fantasy and imagination are ultimately serving affectivity.

Accordingly, we support in this essay that playful and artistic activities have an extremely important role in human development, both in corporeal and psychological senses, as explained by Sant'Ana-Loos [10]:

> One could say that while an individual learns to interact with the symbolic world, especially when it is coated with playfulness and happiness, they slowly become more capable of transmuting existential dimensions: to "jump" from a point of view to another without dissolving, learning to go back to themselves and, simultaneously, through alterity, to acquire from the experience with the other something to help them grow, develop, expand. (p. 229).

In order to obtain knowledge about all the things, one must use all creative possibilities, transforming oneself while being transformed by one's deeds. Thus, one is humanized by the practice of

action-reflection, sensitivity and projection, by the proficiency of imagination and creation, consolidating everything into something a concrete or intellectual product [21].

The dynamic process of learning in integral human development comprises the need for the consciousness of a corporeity that demands playfulness and pleasure in order to favor an individual's creative processes. Because of this, we criticize the lack of emphasis on playful and artistic activities in education. After all, playfulness and the arts can and should "[...] be agents of insertion in ethics, the search for human happiness, which is meaningless without the affective and emotional perspectives that distinguish the living of the species." [10] (p. 227).

Dance and Art

Regarding the notion of human development, Sant'Ana, Cebulski and Loos [22] report that we live in a paradigm that prioritizes essentially materialist matters, as opposed to matters of human relations and sensitivity, such as ethics and the arts. They observe that art subtly permeates the dawn of development, including connections to affective and emotional aspects of human condition, which, in turn, is externally coated (in the concrete reality) by cognitive instrumentalization.

A complete education demands a paradigm capable of valuing the uniqueness of mind and body, of the psychic and material processes, of seriousness and playfulness. Granting a way of jointly developing them is indispensable if we intend mankind to finally synchronize with the many possibilities offered by nature and by the universe as a whole. Artistic and playful activities offer in their essential aspects, such as imagination and fantasy, greater possibility of regulating and equating social-affective development of individuals. Hence, teaching-learning processes may significantly benefit from the constantly affective and playful nature of the arts, and, specifically, of dancing. Imagination and fantasy are intrinsically related to human emotions and their motivations.

Cebulski [23] clarifies that in artistic processes imagination grants access to reality from a different perspective than that of scientific knowledge. The arts warrant the synthesis emotions, which go through a reorganization and an occasional depuration. Still, through this effort to "escape reality" in an activity with relate independence from consciousness, in an aura of playfulness, the arts may present themselves, since it is their nature to be an "alternate reality", a more intense one, a hyperbole elaborated from a different view. Thus, one obtains a consciousness filled with new, progressively complex and enrichened possibilities of reading the concrete world, in whose bases the motivating forces of imagination that build the existential sense may be found.

The arts, in making themselves present through *dancing*, may allow the germination of several of the possibilities exposed in this essay. As explained by Gil [24], "dancing operates some genuine experiments of this ability of the body to manage itself, creating a laboratory where all possible managements are tested". Likewise, Porpino [19] supports: "artistic productions of dancing unrest, deconstruct, trespass what has been previously built, and may trigger the appearance of new forms of thinking, new attitudes and new points of view, occasionally reinforcing and occasionally rejecting previous actions." (p. 95). Hence, the artistic process involving dancing, may, in fact, be considered an educational process.

Rocha and Almeida [25] agree that dancing has great educational potential, not only to express ideas, feelings, emotions, or even philosophical, social or political principles. It also goes beyond overcoming stress, daily conflicts or easing tensions. They explain that through its human domain-integrating essence, dancing is capable of leading an individual to (re)discovering its corporeity and sensibility: the language of the dancing, talking body.

One must understand, however, that the act of dancing will not, by itself, solve problems or spread magical solutions. The dance and the involved persons must be playfully contextualized in the arts. Individuals must risk exploring corporeity, transcending the many impervious barriers erected along the history of mankind. They must be willing to connect to the implicit needs of their bodies, heading towards rhythmic harmony, where movement leads to discovery of the unfragmented essence of being.

Dancing retrieves this sense of being in the world "wholly". It acts as a model to be generalized to other aspects of life. Dancing is playful, but here we support that it may become a parameter to "complete living". The pleasure felt when dancing should be sought in other aspects of life, as self-realization is the key to becoming a full person; and, therefore, one of the bases to human development.

Final Thoughts

The preface of Karenine Porpino's book "Dance is Education" [19] has been written by Maria Conceição de Almeida. From it, we draw the following statement:

> In fact, education may be conceived as an aesthetic experimentation of human condition in its multiple dimensions, which assumes experiencing pain and happiness, foreignness and familiarity. Easing the experiencing of porous, open, unfinished identities in permanent reorganization is to rehabilitate a culture of movement, another way of stating our corporeal inscription into the world. (p. 13).

We find Almeida's words fortunate, as, we, likewise, support the necessity of openness to development and self-realization. In this process, we highlight the role of education and dancing (by offering opportunity for aesthetical experimentation) may eventually have in mankind's evolutive process. We would, however, allude not only to our "*corporeal* inscription into the world", but, rather, to an "*existential* inscription into the world", i.e. the necessary integration of body and mind and of those with the world's essence, since this essence is in some form inscribed into all of us.

We consider dancing to be an artistic expression that extends the perception, balance and sensitivity of individuals. If our assumptions are correct, dancing, if experienced as an activity connected with the sense of harmony that gives us existential pleasure, may help to outline affective-emotional parameters that serve as models and foundations to our development as human beings. Once in possession of such parameters, one may reveal the ability to generalize the emotional experience felt in the successful situation of dancing and actively search for experiences of such feelings in other contexts, or even attempt to create situations that may provide such experiences. In this cycle, we may be able to sustain more harmonic interactions and more positive feelings in relations between people, and between them and the

rest of the universe.

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Child Abuse and Its Implications for Sustainable Development in Nigeria

ONYIDO JOSEPHINE AZUKA (PhD)
DEPARTMENT OF EDUCATIONAL FOUNDATIONS
FACULTY OF EDUCATION, UNIVERSITY OF PORT HARCOURT
azukaonyido@yahoo.com

VAREBA GIOBARI PATRICK
DEPARTMENT OF EDUCATIONAL FOUNDATIONS
FACULTY OF EDUCATION, UNIVERSITY OF PORT HARCOURT

ABSTRACT

The menace of child abuse has remained a challenge to the development of the child and the country. This has consequential implications on the sustainable development of the country in entirety. Nigeria as a nation has an estimated fifteen million children engaged in one manual labour or another and this negatively impacts the development of the populace and society in general. This paper has identified child labour, physical abuse, child neglect, child marriage, female genital mutilation, molestation and emotional and psychological abuse as types of abuse and established that poverty, cultural and religious belief, poor implementation of child protective regulations as factors encouraging the propagation of these condemnable acts particularly in developing countries like Nigeria. The paper stress that children are the future generation and hold the key to development as leaders of tomorrow as such, how they are tackled by every society reflects the level of development of any country as such, importance must be placed on tackling this menace quickly. The study amongst a number of measures recommends that qualified persons be employed to handle the affairs of children to prevent exploitation, molestation and neglect, government should establish more orphanage homes as well as finance aid non-governmental organizations financially in their quest to enlighten, rehabilitate and empower victims and children, in addition, NGOs should provide accurate data on victims and perpetrators of these acts.

Key words: Child Abuse, Development, Sustainable Development

Introduction

Over years, every society has continuously been challenged by cases of child abuse. Although the form of abuse has changed over time, these continuous cases of child abuse have implications on the sustainable development of the child and the country in general. The repercussion of this abuse on sustainable development suggests that the perpetuation of these hideous acts denies the child the pleasure of developing at his/her expected rate of growth but rather is forced to experience mental, emotional and physical challenges.

In Nigeria this, child abuse has continued to be a menace in every society and this can be attributed to the economic situation that has seen families compromise the future of their children in a bid to survive as well as the failure of legal means established by the government to protect children (Bass, 2004)
This indicates that the regulations that have been setup to guard children are not effective which tends to impact the sustainable development of the child as well as the implication it has on the economy of the country.
Proponents highlight that the Nigerian constitution of 1999 guarantee certain basic rights to children although there is no differentiation between the rights of children and that of adults however, they (Nigerian citizens) are supposed to enjoy these privileges and rights (Iguh & Nosike, 2011). According to Olusegun & Idowu (2016) these rights include: "the right of life, the right to dignity of the human person, the right to a fair hearing, the right to conscience and religion, the right to peaceful assembly as well as the right of association and freedom of movement". Particularly, under section 17 (3) (f) children ought to be guarded against mistreatment and moral and material neglect. Furthermore, section 18 (1) offers that the government ought to make sure that its polices offer equal and sufficient opportunities for education at any point in time. According to Matrimonial Causes Act Cap 220, 2010 Section 71 (1) "in proceeding with respect to the custody, guardianship, welfare, advancement or education of children of a marriage, the court shall regard the interest of these children as the paramount consideration".

Upon taking into careful consideration, the High Court looking at the best interest of the child will consider a number of factors which includes: the age, the wishes of the child, the sex of the child as well as emotional and medical factors. In addition, Section 70 of the MCA grants on the court a suitable application, the power to make orders for two types of maintenance namely maintenance per se and maintenance pending the disposal of proceedings in favor of a spouse or children of the marriage. The African Charter on the rights and welfare of the child 1999 additionally, offers that child ought to be guarded from every form of torture, mental, physical or sexual abuse or any treatment that is degrading or neglective in nature (Owolabi, 2012). The Child Right Acts of 2003 stipulates that children must be guarded against child betrothal, child marriages, unlawful sexual intercourse, child labor, unlawful custody and narcotics use (UNICEF, 2007). Nonetheless, in spite of the numerous provisions which have been placed to guard the rights of children they still faces all forms of discrimination, abuse, cruelty, violence to mention but a few (Nwokoro & Burchi, 2011).
Scholars have highlighted that the rise in child abuse in Nigeria can be linked to the adoption of the structural adjustment programme in the late 1980s by the Nigerian Government (Okafor, 2010). This economic policy though intended to boost the economy lead to the devaluation of the currency of the country and a subsequent slide in economic performance, standard and quality of life amongst Nigerians. This rise in poverty affected the ability and capability of citizens to be attain education, feed themselves as a result of rise in poverty and unemployment as well as protect their children from abuse thereby encouraging child labour, early child marriage, kidnapping and emotional and mental abuse (Okafor & Amayo, 2006; Okafor, 2010; Mahato & Dhakal, 2015). Nevertheless, it is important to highlight the importance of parents being present in the development of a child as they have a say in determining if the

child will experience abuse. Proponents opine that parents should create opportunities to spend time with their child so as to offer them guidance and supervise their actions and decisions. As such, parents need to train and educate their wards and not be reliant on only the formal educational system of education. Children ought to be taught about the dangers that conversing with strangers portend and the need to be cautious and vigilant even amongst people they are familiar with (Olusegun & Idowu, 2016).

It is estimated that 218 million kids aged between the ages of 5 and 17 across the world are engaged in child labour in one form or another and this expose them to hazardous chemicals, working conditions and accidental that is detrimental to the mental and physical development of a child (UNICEF, 2008).

According to a report, the population of people living in poverty is 650 million children whereas, about 130 million children do not have access to education. This according to Rapatsa (2016) has devastating implications for sustainable development of the country.Furthermore, it is estimated that about 250 million children are engaged in labour across the world (Okafor, 2010).

Scholars are of the opinion that this abuse of the child is detrimental to the development of the society (Bass, 2004; Oloko, 2004). They opine that culture, religious, poverty and low socio-economic status to mention a few are factors that influence the perpetuation of this acts. These determinant account for Asia and Africa having more than 90 percent of the child employment in the world (Rau, 2002; Ruwanpuraand Rai, 2004; Okafor, 2010).

The Concept of Child Abuse

The meaning of child abuse has generated various definitions. According to (Safiyyah, 2017) child abuse is the psychological, physical or sexual abuse or exploitation of a child or group of children particularly by a parent or caretaker. Oloko (2004) child abuse is the act or failure to react on the part of a parent or caretaker on events that may lead to death, devastating psychological, mental or physical abuse or exploitation. Child abuse can also be referred to carrying out something or failure to do something that result in harm to a child o puts a child at risk of harm (Gupta & Aggarwal, 2012). It refers to any action that is emotionally, physically, socially or morally harmful and dangerous to the child and has the potential to interfere with their education. As such, child abuse comprises any form of mental or physical maltreatment, sexual exploitation or negligent attitude for commercial or exploitative reasons that lead or have the potential to impact the health, development or self-esteem of the abused with regard to the relationship between the guardian and child.

Sustainable Development

Sustainable development is developed on the ideologies of human rights that is structured on regard for self-esteem and worth of human beings that seek to guarantee freedom from fear and want. It seeks to magnify the choices of everyone regardless of being male, female or a child in present and future generations whilst safeguarding the natural systems that everything relies upon. Sustainable development seeks the needs of the present without jeopardizing the capability of the future generations to meet their

needs (Anderson, 2002). According to Owolabi (2012) it is the establishing ontop of the past for a better today without handicapping the prospects of the future.

Therefore, sustainable development comprises anything that nature and humanity needs to maintain existence presently and futuristically. In order for sustainable development to happen in any country, the value system of the citizenry ought to be one which encourages an excellent social process with regard to political and economical participation in terms of allocation of resource. It ought to be regarded as a broad concept that inculcates apprehensions for jobs, the surrounding and the economy. According to Sciberras (2015) it embodies integration, comprehension and acting on the complication links that exist between the society, environment as well as the economy.

Categories of Child Abuse

1. **Child Neglect:** Child neglect has been described as "a failure to provide basic needed care for the child such as shelter, food, clothing, education, supervision, medical care and other basic necessities needed for the child's physical, intellectual and emotional development" (Olusegun & Idowu, 2016). There are numerous categories of neglect which include; medicinal, mental and intellectual. Neglected children tend to have intellectual, physical, social, emotional and growth challenges. They are usually withdrawn, experience malnutrition and susceptible to numerous fatalities due to the lack of "caregivers" at critical moments.

2. **Female Genital Mutilation:** This practice is entrenched into the traditions and cultural beliefs which has been a way of life for several years. Female genital mutilation according to the World Health Organisation (WHO) is a "procedure that involves partial or complete removal of the female external genitalia or other injury to the female genital organs for non-medical reasons" (WHO, 2014). This practice has proved difficult to eradicate as a result of the belief that FGM enhances pleasure for men, discourages promiscuity, enhances fertility and fosters cleanliness (Okeke et al, 2012). All forms of FGM have immediate health implications for the bearer. This is according to a report by UNICEF, which highlights that the pain and infection the child is exposed to as a result of the cutting of the nerves and sensitive genital tissues can lead to shock, uncontrollable bleeding and in worse case scenarios death (Olusegun & Idowu, 2016). Reisel & Creighton (2015) highlights that the long term complications of FGM include: infertility, urinary challenges, genital scarring, obstetric complications as well as psychological effects.

3. **Child Labour:** This refers to any form of physical activity that has the potential to impact on the health and moral development of a child as well as expose them to risk. Child labour can be referred to as any work that is mentally, physically, socially or morally harmful to kids as well as any activity that deprives the child the chance to attain education. Some of these kids are most involved in agriculture and are charged with planting, clearing, picking the crops as well as tending to the livestock. In urban areas they work as shoe shiners, brick carriers, drug peddlers and vendors (Adeyemo, 2016).

4. **Emotional and Psychological Abuse:** This abuse refers to the continuous mental maltreatment of a child that impact severely on the mental and emotional development of the child. Scholars have highlighted that emotionally maltreated and maligned children are exposed to attitudes and behaviors that have undesirable impacts or are deprived of the love, care and affection they require and as such they are mentally distressedbased on social as well as scientific standards (Kara, 2004). Gervis (2012) postulates that child who experience constant humiliation, rejection and shaming in most cases view themselves as useless and not capable of being a success.

5. **Kidnapping:** This involves the "unlawful detention of a person or group of persons by force or cohesion within an undisclosed location most times to get ransom. Scholars have identified the impact kidnapping has on victims and family members mentally and emotionally (Ebigbo, 2003; Olusegun & Idowu (2016). Kidnapping violates the rights of the victims to freedom of movement and exposes them to inhuman and degrading treatments. Olusegun and Idowu (2016) identify that kidnapping can be classified into kidnapping for the purpose of extortion, kidnapping for religious, political or ideological purpose, kidnapping for the purpose of sexual exploitation and kidnapping as a result of family disputes.

6. **Physical Abuse:** This refers to "the non-accidental application of physical force towards a child that causes harm to the child." it encompasses subjecting the child to inhuman circumstances, physical torture under the excuse of correction or anger. It may result in either permanent or temporal damage to bones, brain, tissue or organs.

7. **Molestation:** This refers to the employment of force or enticement to carry out sexual activities with a child. postulates that the child may or may not be aware of the reasons behind these activities and may involve physical or non-physical contact activities comprising of rubbing, kissing as well as foundling with a child genitals, inappropriate conversations with a child regarding sexual exploits and activities. Scholars have highlighted that lifelong implication of these activities varies in symptoms.

Impact of Child abuse on Sustainable Development

Due to economic situations, children are being increasingly been sent out b their guardians to hawk, work as domestic servants, vulcanizers, welders for example, with a view to contributing to the income generated by the family (Tade, 2010). Piler (2004) postulates by saying that parents have an obligation to provide an enabling and safe environment for their kids in order to facilitate personal growth and wellbeing. However, the negligent attitude of parents has allowed children to be easily abused, particularly sexual abuse. Guardians that send their female children on errands during late period of them day, give them goods to hawk, abandon them in the hands of housemaids for several hours or allow them freedom to choose their clothing and way of living expose them to the risk of being abused by pedophiles. As this negligence and

in some cases deliberate act has detrimental effects on the personal growth of these kids and has the potential to jeopardize sustainable development being that children are the future of any nation.

In addition, as a result of this predicament that sees the child abused by working at a tender age, the children are exposed to possible accidents, harmful individuals such as pedophiles, kidnappers and drug peddlers. Ebigbo (2006) opines that child abuse acts such as child trafficking has seen children engage in underage sex, thereby exposing to the child to the risk of sexually transmitted diseases. This consequently poses a threat to the sustainable development of any country because the increase in prevalence of STDS for children has the potential to reduce the average life expectancy of that society thereby disrupting sustainable development. According to Olaitan & Amos (2016) parents also marry off their daughters at an early age in most cases to improve the economic conditions of the family without considering the impact it will have on the child emotionally and physically in terms of early child bearing, dropping out of school and impaired development. physically abused children experience various undesired consequences, ranging from soft tissue injuries to death from unknown causes, loss in memory, growth retardation, speech delay, social withdrawal, limited friends and peer relationship, academic challenges, suicidal tendencies as well as interpersonal cognitive, emotional and behavioral problems (Ebigbo, 2006; Okafor, 2010). As such, it can be deduced that as a result of child abuse acts such as child labour, child trafficking, female genital mutilation, prostitution, child marriage and parental negligence to mention a few exposes children to STDs, deportation, rape, poor living standards, illiteracy academic failure, drug abuse, suicidal tendencies and trafficking as well as crime and these have serious developmental impacts on the society such as increase in crime rate, strain on the health sector, unqualified youths, low income per capita and poor national image to mention but a few.

Factor Affecting the Effectiveness of Laws on Child Abuse

In spite of the numerous legal instruments employed both internationally and national to prevent the abuse of children, children continuously face numerous forms of child abuse. This can be linked to a number of factors which include:

- Inefficient Implementation of Laws and policies

There are a number of laws and policies that have been stipulated to protect and guide issues relating to child abuse. Nevertheless, laws are only effective in situations where they appropriately imposed and effected by the relevant bodies. Poor implementation has caused a “wide gap” in the objectives and outcomes which is a mockery of the enacted regulations and policies. In the case of Nigeria, this can be partly attributed to the non-adoption of the Child Rights Act of 2003 (CRA) by all states in the federation. Ojo (2014) opines that in states that passed the CRA, insufficient commitment has been shown by relevant bodies in the implementation of its provision and this has consequently encouraged the propagation of this menace of children.

This can be linked to the financial burden that will be required to enforce the provisions of CRA. In order for the CRA to be implemented CRA effortlessly and effectively, the provision of facilities such as schools and court facilities as well as manpower which include; magistrates, law enforcement officers states, employees of non-governmental agencies and judges will have to undergo training regarding child

protection laws, processes and the appropriate channels to seek redress. Scholars opine that there also operational bottlenecks that are associated or experienced in obtaining justice through the judicial system in situations when the guardians are the culprits of these abuse. This is as a result of the fact that the child is dependent on their guardians for judicial relied as such cannot take any legal action themselves. In addition, the duration and time constraints associated with a litigation process deter people from speaking up and reporting cases of abuse (Mishra, 2000; Ercelewa and Nauman, 2001; Piler, 2004 and Owolabi, 2012; Olusegun & Idowu, 2016). According to Olusegun & Idowu (2016) justice may fail to be gotten through the process of judicial process due to technicalities which sometimes lead to the offender winning the case. These therefore does not discourage offenders from carrying out abuse as a result of the fact that due to numerous technicalities which include insufficient evidence, there is an assumption that the can get away with any action they take.

- Lack of Awareness

It is notable that abuse towards children has continued to be rampant this can be linked under reporting by victims and families of victims. According to Abamara (2016) this under-reporting stems from lack of awareness that has encouraged by certain cultural beliefs and practices that infringe on the rights of the child and consequently encourage abuse. Ojo (2014) proposes that a significant number of persons in the society are unaware that this cultural practices are infringements on the rights of the child and seen as abuse as a result of the cultural acceptance of this practice. Buttressing this view Owolabi (2012) establishes that numerous cultural beliefs and practices that are harmful to children particularly girls have been practiced over time. For instance, female genital mutilations, early child marriage, tribal marks, tattoos which are seen as a part of their culture and practice. Hence, it must be highlighted that cultural justification of numerous abuse that are linked with cultural practices and the sheer unwillingness of victims in this case children, to speak out concerning the abuse they have experienced has proved endemic to the sustainable development of the child and the nation at large.

Strategies to address abusiveness of the child for economic development

Scholars across the world have agreed that children are the future leaders of tomorrow (Power, Serle & Willmot, 2011; Agu, 2013). As such, how they are handled will determine the level of advancement of any country. Child abuse therefore needs to be tackled swiftly before the implications become uncontrollable. Eze (2013) highlights that, child abuse must be handled through the enforcement of regulations, policies and enlightenment and empowerment. In addition, extra effort should be put in to safe guard children from genital mutilation, child labour, neglect, molestation, child marriages as well as other forms of abuse. To guaranteed effectiveness of these regulations as well as reduce the prevalence of issues surrounding child abuse which include corruption, poverty, cultural attitudes, poor enforcement of regulations as well as attitude of guardians need to be looked at.

It must however, be highlighted that public awareness is essential with regard to regulations surrounding child abuse, its implications and the requirements of compliance. Regulations encouraging child abuse in whatever scenario ought to revised to set solid basics for the fight against child abuse (Badoe, 2017).

Guardian, schools and non-governmental organizations should collaborate as efforts of the government will not produce results if other stakeholders are not included or not in collaboration.

Conclusion

This paper recognizes that children are the future of any nation and if any objective nation is determined to develop and advance there must be provisions in place to protect and encourage the development of these citizens. However, it highlights that child abuse poses a serious developmental and health challenge for countries across the world and has seen an increase in the population of children experiencingone form of abuse or anotherwhich range from child labour, kidnapping, molestation, sexual exploitation to mention but a few. This abuse has caused them to develop withdrawal tendencies and attitudinal challenges that may be permanent or temporal thereby endangering the sustainable development of the child and society they find themselves. This paper further highlights that, the legislations and laws introduced to protect the rights of the child have faced challenges in implementation as a result of factors such aslack of awareness, financial constraints, cultural beliefs.

This paper concludes therefore that for any well-meaning country to experience sustainable development there is need for issues surrounding child abuse to be tackled urgently in order to reverse the ugly trend of child abuse.

Recommendations

- Efforts should be made to establish more and better equipped orphanages and homes for children to safeguard homeless children and orphans while showing them sufficient affection and attention.

- Qualified and experienced employees should be employed to take charge of the affairs of the kids to curb maltreatment, negligence, exploitation.

- Government should encourage NGOs by financially assisting them in raising awareness through building capacity, abuse and rehabilitation centers, empowerment programmes such as vocational training.

- NGOs should encourage and collaborate with relevant authorities particularly the government in providing substantial data, information and ideas on how to tackle child abuse menace.

  The National and states house of assembly should review the child right act legislation with a view to cubing child abandonment and abuse.

- The living standards of the citizens should be improved so as to discourage child labour and child marriages.

- Sensitization campaigns should be carried out to enlighten the populace on the impact and effect of child abuse and negligence.

- Children should be educated on safety strategies to employ to detect and avoid pedophiles and kidnappers.

- Stiffer penalties should be introduced for abuses with a view to deterring future perpetrators.

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Intellectual Property in the Brazilian Agricultural Sector: A Case Study of the Inter-University Network for the Development of the Sugar-Energy Sector (RIDESA)

Márcia Brito Nery ALVES
Graduate Program in Intellectual Property Science – PPGPI
Federal University of Sergipe – UFS – São Cristóvão/SE – Brazil
marcia.bna@gmail.com

Ana Eleonora Almeida PAIXÃO
Graduate Program in Intellectual Property Science – PPGPI
Federal University of Sergipe – UFS – São Cristóvão/SE – Brazil
aepaixao@gmail.com

Abstract

Intellectual property is a legal device that guarantees the individual or legal entity the protection of their creations, be they products or processes, covering copyright, industrial property and sui generis protection, modality in which the plant variety property rights are included. In this sense, this paper analyzes the intellectual property rights in the Brazilian agricultural sector, through a case study of the Inter-University Network for the Development of the Sugar-Energy Sector (RIDESA), by raising data related to research, development and protection of sugarcane cultivars, designated by the prefix Republic of Brazil (RB). In order to do so, a brief historiography of the evolution of legislation on the subject, the conditions and consequences of Brazil's adherence to international agreements such as "Trade Related Aspects of Intellectual Property Rights" (TRIPS) and the convention of "International Union for the Protection of New Varieties of Plants" (UPOV), as well as, a survey about the emergence and role of RIDESA as a collaborative innovation network was also carried out. As a result, it was possible to conclude that the issue of intellectual property rights on cultivars is multidimensional and suggest the need for creation of functional and consolidated models of knowledge management in collaborative innovation network. Among the elements and factors constituting the crisis in the Brazilian sugar-energy sector, mainly on the basis of the varietal census for the states of the northeast region (especially the state of Alagoas), it was possible to point the importance of RIDESA in the context of overcoming crisis of the sugar-energy sector through innovation.

Keywords: Intellectual Property; National Service of Protection of Cultivars (SNPC); TRIPS; UPOV; RIDESA.

1. Introduction

The Inter-University Network for the Development of the Sugar-Energy Sector (RIDESA) is formed by 10 Brazilian federal universities: Federal University of Alagoas (UFAL); Federal Rural University of Pernambuco (UFRPE); Federal Rural University of Rio de Janeiro (UFRRJ); Federal University of Sergipe (UFS); Federal University of Mato Grosso (UFMT); Federal University of Goiás (UFG); Federal University of São Carlos (UFSCar); Federal University of Viçosa (UFV); Federal University of Paraná (UFPR); and Federal University of Piauí (UFPI). The Network focuses in the technological development of sugarcane, especially in the new varieties research, with 79 research bases, and more than 300 partner private companies, producing ethanol, sugar and energy. Currently, the varieties launched by RIDESA correspond to more than 60% of the sugarcane planted in Brazil. One of the main differentials of RIDESA is related to its presence in all sugarcane producing states. This presence occurs through partner universities that maintain research centers in all producing regions.

Based on a theoretical configuration focused on intellectual property and collaborative innovation, this paper analyzes the performance of RIDESA as a function of the collaborative environment and partnerships, which, in the last decades, have been implementing new levels of innovation capacity and levels of organization in network. The results obtained translates into increased competitiveness, knowledge management, new skills, greater efficiency and better control of costs for the sector, uncovering from the academic point of view, a fertile field for the production of knowledge.

The state of Alagoas is a special Brazilian state for RIDESA, being considered the starting point of the Sugarcane Genetic Improvement Program, since it has a germplasm bank with more than 2000 genotypes. UFAL is the direct responsible for the maintenance of this bank, from which, a great exchange of genetic material is established for the research and exchange of experiences between the researchers and other partners, being therefore a very important node of sustentation of the topology and functioning of the network as a whole. The program has had a direct impact not only on the development of new sugarcane cultivars, but also on the production of knowledge, with a large number of master's dissertations and doctoral theses completed and in progress, as well as patent registrations .

UFAL, as seen, besides being an indispensable partner of RIDESA, has sought to develop actions through its Nucleus of Technological Innovation (NIT) based on innovation in all segments of science and technology, having as a legal basis for its operation, federal laws like the law n. 9.279, of May 15, 1996 (rights and obligations related to Industrial Property); law n. 9,609, of February 19, 1998 (protection of Intellectual Property of computer program and its commercialization); law n. 8,974, of January 5, 1995 (use of genetic engineering techniques and releases into the environment of genetically modified organisms); law n. 9,456, of April 28, 1997 (protection of cultivars) and other similar legislation and its updates.

In recent years, several patents have been awarded to researchers in the state of Alagoas, which is a consistent proof of the importance of the research work that being done. In this context, the following patents registered in the National Institute of Intellectual Property (INPI) are highlighted: PI-0306525-1 (System for the production of ethanol with microorganisms immobilized in sugarcane stalks and process for immobilization of micro-organism in sugarcane stalks); PI-0306524-3 (Configuration of fermenters in

series for the production of ethanol with immobilizers microorganisms in corn cob); and, PI-9300474-5 (Process for the production of ethanol with microorganisms immobilized in sugarcane stalks; a system for producing ethanol; a process for the immobilization of microorganisms in sugarcane stalks; and, a process for the immobilization of microorganisms in sugarcane stalks).

Finally, the academic and socioeconomic relevance of this research is related to the role and importance of the sugar-energy sector for the development of the country as a whole and the need to establish the intellectual property issue in terms of strategic value and as part of a good collaborative innovation process in which RIDESA is a notorious case and, therefore, the *locus* par excellence of this research.

2. Literature Review

2.1 Intellectual Property in the Brazilian Agricultural Sector

The issue of intellectual property rights in the Brazilian agricultural sector involves a systematic and comprehensive conceptual framework of the main factors that go back to the organization of the agricultural research since the 1970s, investments in research and development in the sector, the current state of technical knowledge and technological aspects, as well as the research infrastructure, taken as fundamental variables to the establishment of the initial conditions for innovation.

With the rapid advancement of biotechnology and advances in plant breeding, the protection of intellectual property rights in the agricultural sector has become a determining factor for the success of Brazilian agriculture. In this context, since its establishment in 1992, the National Agricultural Research System (SNPA) has played a key role both in the public sector and in the private sector, supporting decisively the innovation systems in the sector.

The presence of the public sector in genetic improvement, whether through the Brazilian Agricultural Research Corporation (EMBRAPA) and other state agricultural research organizations, or through universities and research institutes, was fundamental for the definition of guidelines and strategies for development of agricultural research in the country, within a strategic vision, guided by actions and goals that would culminate, at present, with what is observed in terms of development of the agricultural sector and national agribusiness.

In a historical context, the Law of Protection of Cultivars (LPC), the "Trade Related Aspects of Intellectual Property Rights" (TRIPS) and the adhesion of Brazil to the convention of the "International Union for the Protection of New Varieties of Plants" (UPOV) are presented as strategic frameworks for the articulation between intellectual property in the Brazilian agricultural sector and national technological development. The characteristics of the Brazilian genetic heritage and the strategic importance of developments in the biotechnology sector are equally determinant, especially when analyzed in light of the Biosafety Law.

From a conceptual point of view, the need for a reflection on the role of the National Plant Protection Service (SNPC), especially in view of the specificity of the *sui generis* protection of plant varieties, taking into account the particularities of obtaining plant variety property rights, especially in what distinguishes

in relation to patents, leading to a necessary analysis of the current state of the debate about the constitution of the right of royalties on cultivars, for example.

2.2 The Public Sector and the Agricultural Research in Brazil

In view of the progress in research and development (R&D) in the national agricultural sector since the 1970s, mainly related to the genetic improvement of plants, it became fundamental that the country ensure intellectual property rights related to the development of new cultivars. Freitas (2006), in this sense, considers the differences in R&D among "developed nations", where new developments in the sector are in the hands of private institutions, in relation to Brazil, where, according to the author, appear to focus on public institutions. The author concludes by stating that one of the reasons for this phenomenon results from the difficulty of the State to ensure the rights provided in the legislation to the breeders of the new cultivars (Vieira Filho, Vieira, 2013).

Carvalho (2003) analyzes the cultivars protection in Brazil through the incorporation of protected cultivars in the seed market, the institutional dimension of legislation management, as well as research and development in plant breeding, emphasizing the relevant role of intellectual property on innovation systems dynamics in agriculture. It also analyzes EMBRAPA and other institutions with which it has a partnership, in order to understand the broader scenario of its role through the SNPA for the development of the agricultural productive sector.

The author warns of the need for capacity building of institutions that deal with plant breeding, regarding the issue of legal protection of intellectual property. One of the hypotheses defended is that "mechanisms for the protection of intellectual property are fundamental for the organization and coordination of agricultural research and can strengthen the institutionality of public research" (*ibid*., P.2). The author also analyzes the EMBRAPA, in the process of innovation in the agricultural sector, through the systematization of agricultural research, as well as the recognition of the strategic importance of intellectual property rights. Carvalho; Salles-Filho; Paulino (2007, p. 24) point out that "the institutional articulation promoted by EMBRAPA, organizing partnerships aimed at the development of new proprietary varieties […] are examples of how it is possible to treat intellectual property as an element of interaction".

The relevant role played by the public sector over the last decades, whether through partnerships aimed at consolidating innovation systems in the agricultural sector or through adherence to international agreements such as TRIPS, justifies too much the success of Brazilian agriculture. The author, in this sense, presents a relevant data when affirming that "the public sector of plants improvement has more than 80% of the activities related to improvement of plants, and more than 90% of the qualified personnel working in public research institutions" (Freitas, 2006, p.42).

Intellectual property plays an important role in defense of prerogatives of rights holders on new cultivars, representing an important stimulus to innovation in the agricultural sector, be it in the genetic improvement of plants or in the development of transgenic plants. In this context, Yamamura (2006) analyzes the regulatory frameworks related to the research, development, production and trade of transgenic plants, at a national and international scale, correlating them to the policies of incentive to innovation in the Brazilian agricultural sector, with a view to better exploitation of local potentialities.

At the national level, the author emphasizes the importance of the Industrial Property Law, the Cultivars Protection Law, the Biosafety Law, as well as the Provisional Measure on Access to Brazilian Genetic Heritage, lamenting that "lack of internal consensus can lose the accumulated experience in genetic improvement; leads to loss the opportunity that the country has to increase its activities through modern biotechnology and to get a slice greater than 1%, which is the current value, in international trade "(*ibid*., p.108).

In analyzing the contemporary trends related to intellectual property in agriculture, Carvalho (2003, p.17) concludes that "the strategic management of intellectual property assets and the intellectual property as an incentive for innovation and complementarity between fields of rights protection, are of particular relevance". In addition, Carvalho; Salles-Filho; Paulino (2006, p.337) adds that "intellectual property enables a process of coordination between agents that are articulated to use fragmented knowledge and owned by various economic agents." In general, many authors defend the public sector, emphasizing its historical importance in the consolidation of innovation systems in agriculture that allowed great advances in terms of both agricultural research and economic development in Brazil.

2.3 Intellectual Property in Agriculture

The national legislation on intellectual property has undergone numerous transformations since 1991, still under the government of Fernando Collor de Mello. One of these changes is directly associated with Brazil's accession to the UPOV convention. According to Bassi (2012, p.13), “despite having a long history of granting intellectual property rights [...] Brazil had not yet provided any form of crop protection until the mid-1990s, with the option of joining UPOV”, as a consequence of the approval of the 1997 Cultivars Law.

The 1996 Patents Act (succeeded by the 1997 Cultivars Act) was a decisive step in the broad spectrum of changes in intellectual property rights that would take place since the 1990s. The peculiar characteristics of the variety of plants grouped under the *sui generis* label, was accepted by TRIPS as a model capable of meeting the specificities of the cultivars protection.

In this sense, Bassi (*ibid*., P.11) reaffirms that "with regard to the *sui generis* protection of plant varieties, it is generally stated that the model offered by UPOV is a suitable form of protection to comply with the requirements of TRIPS." Regarding UPOV's positioning in relation to the *sui generis* system, Yamamura (2006, p.104) emphasizes that the organization is struggling to become "officially recognized as the promoter of the *sui generis* system of protection referred to in the TRIPS text "(Yamamura, 2006, p.104).

The UPOV system admits two versions that are in force at the same time, one from 1978 and another from 1991. Francisco (2009) performs a comparative analysis of the regulatory system versions and alerts that both are in force concurrently in countries with different commercial interests, possibly in contrast. This situation has been analyzed and debated by the TRIPS Council. In both UPOV system versions, the author highlights critical elements related to legal aspects related to the obligation of remuneration due to the use of transgenic cultivars, both nationally and internationally, seeking to understand transparency in the rules on the formation of obligations, royalties, and damages.

The existing conflicts arising from the application of both UPOV regulations simultaneously to groups of signatory countries with such diverse socio-economic and technological development characteristics need a definitive solution, and this condition will only be possible to the extent that legal contrasting aspects to be pacified by mutual agreement. Among the many conflicts that can be verified, Carvalho; Salles-Filho; Paulino (2007, p.13) highlights one of the problem situations in the UPOV texts. According to the authors, "the 1978 UPOV Review there was an indication that protected varieties should be distinct, homogeneous and stable, with the exception of the farmer and the breeder." While "the 1991 UPOV Review had added the requirement for the variety to be new".

In view of the possible legal problems that the present situation of UPOV regulations suggests, Francisco (*Ibid*., 282) warns that the coexistence of two current texts, with divergent points of view on critical points of cultivars protection, implies that the same facts or legal acts can have different classifications for the member countries of the treaty, depending on the text of UPOV to which this country is bound, "constitutes a serious problem for international relations, especially among member countries".

2.4 The strategic dimension of cultivar protection

The modernization of the economy is strongly based on new knowledge related to the emergence of the intellectual property system and constitutes the background of an essential debate for the development of the biotechnology innovation systems, in Brazil, suggesting the need of a conceptual analysis and more in-depth legislation on the subject (Vieira et al, 2010). The case of the cultivar protection legislation, understood as *sui generis* intellectual property, is an example that indicates the need for a deeper analysis of interpretative misunderstandings, given the possible economic consequences.

The dichotomous condition that places, on the one hand, the regulation of intellectual property as a more comprehensive legal system, and, on the other, legislation that aims to meet the specificities of the protection of plant varieties, constitutes a striking feature of the search for a technical definition, but also legal aspects of the particular characteristics of plant variety property rights, in relation to the legal mechanisms for the intellectual property rights, as a whole. According to Vieira et al (*Ibid*., P. 344), a circumstantial issue is to have a clear definition of whether it is a patent or a cultivar. According to the authors "there is a common area in the regulation of intellectual property. [...] However, Brazil opted for the *sui generis* legislation for the protection of cultivars, as a basis for the regulation of plant biotechnology.

Based on SNPC data, Carvalho; Salles-Filho; Paulino (2007) point out that the protection of plant varieties and the recognition of the rights of breeders are part of a strategy based on the articulation between intellectual property and national technological development. The authors argue that the reorganization of public research related to the development of new cultivars is a process that reinforces public presence and its importance in the seed market, for example. With respect to the fact that the new cultivars receive *sui generis* protection, the authors explain that "plant varieties or cultivars protection differ from patents, for example, both by the scope and by the exceptions or limitations imposed on the holder of rights. It is, therefore, considered a *sui generis* protection. (*Ibid*., P.325)

For Mascarenhas (2004), although the biotechnology sector is considered strategic for the country, the low technological and economic capacity to use the available natural resources in a sustainable way is

a fact that affects not only Brazil, conforming in one of the great challenges to be faced by economically poor countries (Mascarenhas, 2004). According to Padilha (2012, p. 169), "[...] The search for a balance between the international protection of intellectual property rights and the effects of intellectual property rights in competition law are related not only to legal and economic arguments. In fact, according to the authors, a range of "social issues, which become important and necessary, is opened for both analysis and assumptions about the existence of interfaces.

Vieira Filho; Vieira (2013) carried out a mapping of the evolution of cultivars protection records after the implementation of the Cultivars Protection Law, based on data from the National System of Protection of Cultivars of the Ministry of Agriculture and Livestock (SNPC/MAPA). The authors note that the number of protected cultivars is increasing at an accelerated rate, while the profile of the companies that hold plant variety rights has been defined in an environment that ranges from public institutions to private companies, both domestic and foreign. They also noted that between 1998 and 2012, the number of protected cultivars in Brazil rose from 51 to 1,780, a jump of approximately 35 times. The authors exemplify that "only in the soybean market, on the one hand, in 1998, were 39 protected cultivars. On the other, in 2012, they added to these more than 500 cultivars, totaling 539 "(*Ibid*., P.25). The authors also highlight the case of Embrapa, which in 2012 had 30% of soybean cultivars, or 158 cultivars, of which 39 were transgenic.

Finally, it can be seen that the issue of intellectual property rights on cultivars is multidimensional and can be analyzed from several points of view. In this paper, we highlight the case of RIDESA, a network of 10 Brazilian public universities, as it is a network that holds the intellectual property rights of more than 60% of all sugarcane varieties currently cultivated in Brazil. The emergence and the role of RIDESA in the research and development of new cultivars shows the importance of the formation of collaborative innovation networks to strengthen the Brazilian sugar-energy sector.

3. Results and Discussions

3.1 The Role of Collaborative Innovation Networks in the Brazilian Sugar-Energy Sector

The need for innovation in the Brazilian agricultural sector, especially in the sugar-energy sector, is the search for alternatives to increase productivity in the agricultural field. In this sense, the importance of collaborative innovation networks, in the development and commercialization of new cultivars, becomes a point of convergence for strategic actions aimed at the promotion of intellectual property in agriculture. RIDESA, understood as a collaborative innovation network is situated in a context in which innovation and technological development alternatives are the main determinants of productivity growth, bypassing the historical determinants, for which the increase in production is directly linked to the increase in planted area.

According to Vidal; Santos; Santos (2006, p.16), the cost of sugar production in Brazil is the lowest in the world, at around US $ 180 / ton in the Center-South and US $ 210.00 in the North-Northeast. According to the authors, these data shows that the sugar-energy sector in the north and northeast of Brazil has competitiveness in the external market, with production costs slightly higher than those obtained in the

south-central part of the country. However, the specificity of soil and climatic conditions, especially low soil fertility, the reduced average volume of rainfall associated with the irregularity of the topography, considered inadequate for mechanization in many regions, lead to extra costs of production in the northeastern sugarcane crop. [...] The largest sugarcane producers in the Northeast are the states of Alagoas and Pernambuco (figure 1), and the expansion of the sugarcane frontier in the Northeast should focus on Maranhão, Piauí and in the valleys of the semi-arid region. (*Ibid*., P. 7-8).

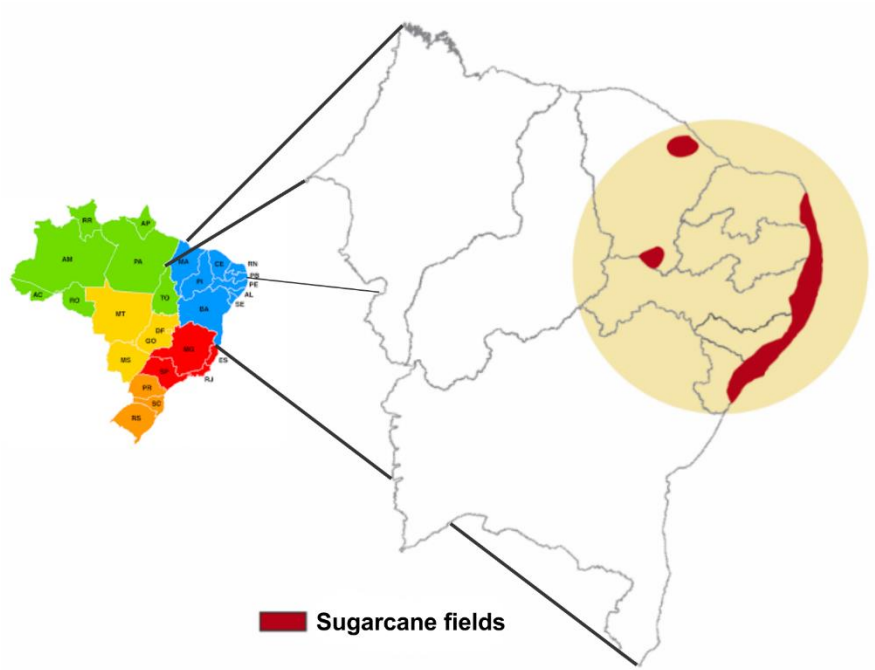

Figure 1. Sugarcane in Northeast Brazil region

Source: Prepared by the author (2018)

According to Pegorin; Andrade (2011), the increase in ethanol production in the last ten years in Brazil was due to a large investment in research and technological development, but also to a strengthening of the innovation networks of the sugarcane industry and environmental governance of the sector. It is considered that there is a technological platform in the sugar-energy sector that favors the consolidation of bioethanol in the domestic market. But the expansion of bioethanol in the foreign market and the increased market for co-products derived from sugarcane depends on the commercial scale deployment of second generation technologies. (*Ibid*., P.28)

For Fronzaglia and Martins (2010), there are three coordinated ways in structuring the research and development of technological innovations in the sugar-energy sector: 1. Public research organizations; 2. Research corporations; 3. Networks. In Brazil, the role of innovation networks in the sugar-energy sector is essential to the technological development of the sector. RIDESA was created, in this sense, with the intention of continuing the development of research in the context of the Sugarcane Genetic Improvement Program (PMGCA). In the last 20 years, 65 RB cultivars were launched, according to the table 1.

Table 1. Cultivars released by RIDESA

Launch Year	*Institution holding the intellectual right*	*Cultivars*		
1977	PLANALSUCAR	RB70141*	RB70194*	RB7096
1981	PLANALSUCAR	RB705007	RB705051	RB705146
1982	PLANALSUCAR	RB725147*	RB725828*	RB735275*
		RB72454*		
1985	PLANALSUCAR	RB732577	RB754665	
1986	PLANALSUCAR	RB721012*		
		RB705440	RB739359*	RB739735*
1988	PLANALSUCAR	RB765418*	RB785148*	RB735220*
1992	UFSCar	RB785750*	RB806043*	RB825336*
		RB835089*	RB835486*	
1993	UFAL	RB75126*	RB83102*	RB83160*
		RB83252	RB83594*	
1995	UFSCar	RB835019	RB855156*	RB855453*
		RB855563		
1996	UFRPE	RB763710	RB813804	
1998	UFSCar	RB835054*	RB845257*	RB855035*
		RB855113*	RB855536*	RB855546
	UFV	RB867515*		
1999	UFRRJ	RB758540*		
2000	UFAL	RB8495	RB842021	RB855511*
		RB855463*		
2001	UFPR	RB845197*	RB845210*	RB855036*
		RB865230*		
2002	UFV	RB928064*		
2003	UFRRJ	RB858927*		
	UFAL	RB92579*	RB93509	RB931530
2005	UFRPE	RB863129	RB872552	RB932520
		RB943365	RB943538	
2006	UFSCar	RB925211	RB925268	RB925345
		RB935744		
2010	UFAL	RB931003	RB98710	
		RB931011	RB99395	
		RB951541		
2010	UFPR	RB946903	RB956911	
		RB966928		

2010	UFRPE	RB962962	RB002504
2010	UFSCar	RB965902	RB965917
2010	UFV	RB937570	

* Cultivars that have had or have commercial cultivation.

Source: Adapted from http://www.ridesa.agro.ufg.br/p/3723-technology

3.2 Sugarcane Varietal Census in the State of Alagoas (2016/17)

Currently, the varieties of acronym Republic of Brazil (RB) are being cultivated in more than 65% of the area with sugarcane in the country, that is, a contribution of around 12.3% in the Brazilian energy matrix (RIDESA, 2018). In the state of Alagoas, the RB varieties are cultivated in at least 68% of the planted area. According to the National Supply Company of the Southeast Region, it continues to be the largest national producer, accounting for 73% of the sugar produced in the country, followed by the Central-West Region (11%), the Northeast Region (8.2%) and South (7.7%). São Paulo, Minas Gerais, Paraná, Goiás and Alagoas remained the largest sugar producers (CONAB, 2018). In Figures 2 and 3 below, it can be observed the 10 most cultivated varieties and the 10 most planted varieties, respectively, in the state of Alagoas, in the 2016/17 crop.

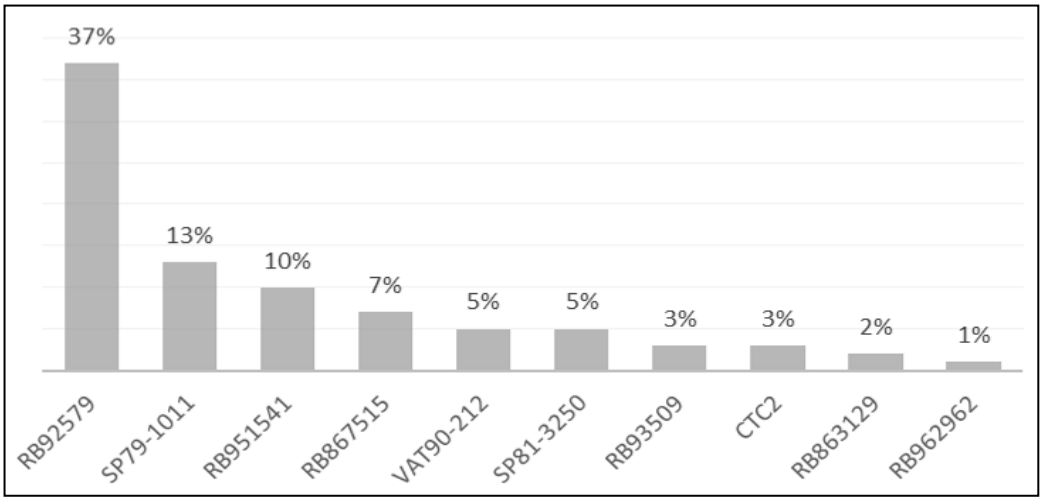

Figure 02 - 10 Cultivars most cultivated in the state of Alagoas - 2016/17 crop.

Source: Data from the National Supply Company (CONAB), 2018.

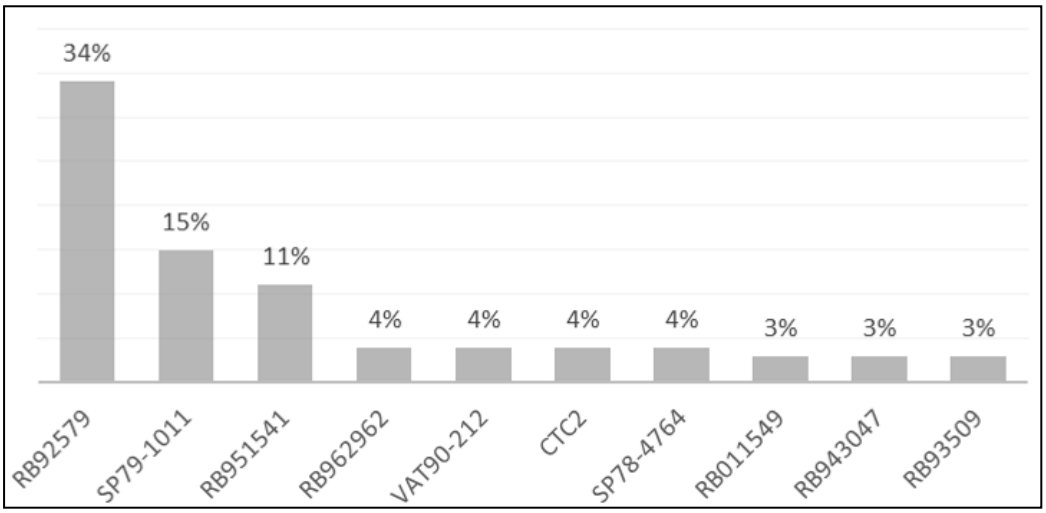

Figure 03 - 10 Most planted crops in the state of Alagoas - 2016/17 crop.

Source: Data from the National Supply Company (CONAB), 2018.

In Figures 2 and 3 it can be seen the importance of RIDESA in the development of cultivars, especially in the launching of variety with the characteristics necessary for its development in different regions. It can be noted that cultivar RB92579 is both the most cultivated and the most planted variety, surpassing at least twice the cultivation area of the variety SP79-1011. In Figure 4, it can be observed the distribution of the most planted and cultivated varieties in the state of Alagoas, with absolute prominence for the RB varieties.

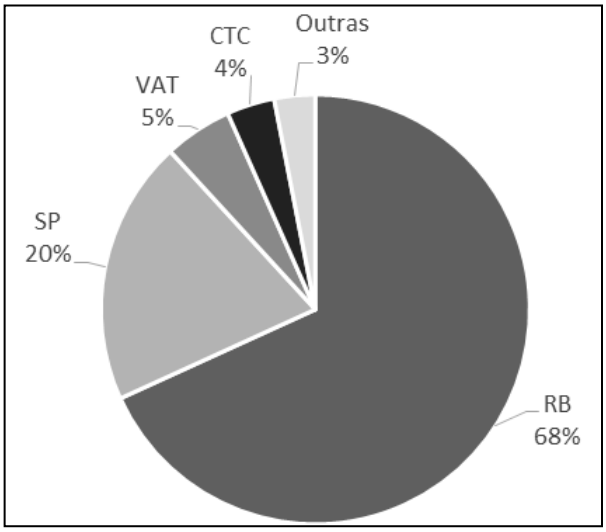

Figure 4 - Most cultivated varieties in the state of Alagoas2016/2017 crop

Source: Data from the National Supply Company (CONAB), 2018.

It is known that the increase in productivity is largely due to the development of new cultivars, which directly implies the importance of programs such as those proposed and developed by RIDESA. In

this sense, it can be concluded that during the development of new varieties, advances in agronomic research, involving the emergence of new techniques and technologies associated with soil management, production of high quality seedlings, new planting techniques and cultural management, new developments and new perspectives related to the legal guarantees of cultivar protection have projected new socioeconomic development horizons, in the state of Alagoas and in Brazil as a whole.

4. Conclusion

Intellectual Property is a legal device, linked to innovation, fundamental for the technological and economic progress of organizations. Federal universities, whether through individual research activities of teachers or through existing research groups, have been taking increasingly significant steps in the consolidation of knowledge management models and practices aimed at the development of intellectual property. The consolidation of interuniversity research through collaborative innovation networks is a decisive and strategic step towards technological development guided by the strengthening of intellectual property

With regard to *sui generis* protection, it was observed that the creation and consolidation of collaborative innovation networks, like RIDESA, constitutes a decisive step related to the advances in agronomic research, leading to the emergence of new techniques and technologies associated with soil management, production of high quality seedlings, new planting techniques and cultural management, projecting new frontiers and perspectives related to the legal guarantees of cultivars protection.

In Brazil, since federal law n. 10,973 of 2004, federal universities have created nuclei of technological innovation (NIT's) as well as nuclei of intellectual property (NPI's) aiming at the development of models and practices of innovation that produce concrete results in terms of indicators of Intellectual Property. Although these nuclei are consolidating recently, institutions still lack knowledge management models, especially to work in networks or to create the conditions for existing research groups to articulate themselves in interuniversity networks, such as RIDESA, in a process that leads to the emergence of new collaborative innovation networks in all areas of scientific research.

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Population Analysis of The Snapper *Lutjanus Griseus*, Based on The Artisanal Fisheries of The Tamiahua Coast, Veracruz

Miguel Ángel Barrera Lara[1], Ascensión Capistrán Barradas[1], Arturo Serrano[1], Rodrigo Cuervo González[1] Eduardo Alfredo Zarza Meza[1]*

[1]Facultad de Ciencias Biológicas y Agropecuarias, Región Poza Rica-Tuxpan, Universidad Veracruzana, Carr. Tuxpan-Tampico Km. 7.5, Tuxpan, Veracruz, 92850, México. ezarza@uv.mx*

ABSTRACT

Artisanal fishery in the Gulf of Mexico is mainly undertaken for subsistence and is, thus, of great socioeconomic importance, with Lutjanidae one of the most important families caught in the region. However, there is scarce fisheries knowledge in the Gulf of Mexico and, in light of pressure from the fishing community, research into the population dynamics of these species is of vital importance for the management or conservation of coastal resources. This study aims to contribute information for the analysis of the population of Lutjanus griseus (Linnaeus, 1758), a common species on the Tamiahua coast, in the state of Veracruz. Samples and biometric data (weight, sex, total length and maturity) were recorded by the fishing community on this coast. The monthly population structure was constructed using fish size. Data from 987 individuals, the size of which oscillated from 15 to 80 cm, were registered over the course of a year. The sex ratio was 1:1, while the maximum calculated age was 10 years. Von Bertalanffy and Gompertz growth models reported a maximum age and growth of $L\infty$=182.46 K= 0.05 and t^o = -1.71. The best fit was achieved by means of the Gompertz model, as based on the Akaike criteria and the biological interpretation of the parameters. Reported data and the models used in this study suggest that the minimum catch size should be 40 cm and that the fishery should either cease activities in the months of the reproductive peak or that quotas should be among the fishing cooperatives on the coast of Tamiahua.

Key words: Growth, age, *Lejanas griseus,* population, sex.

INTRODUCTION

Snapper distribution generally coincides with the presence of coral reefs, with its distribution limit found in the northern West Atlantic, and on the coasts of Massachusetts, North and South Carolina, Florida, the Gulf of Mexico, the Caribbean and southeast Brazil (Fischer, 1978).

Some studies have taken a joint approach to biological aspects, such as sexual maturity, sex ratio (Claro *et al.,* 2001; García-Cagide *et al.,* 2001; Chiappa-Carrara *et al*., 2004), and age structure (Amezcua *et al.,* 2006), to determine the age, growth and mortality of *Lutjanus peru* and *L. guttatus*. Dynamic population

studies reveal catch size recommendations oscillating between 30 and 40 cm (Rojas, 2001; Rojas, 2004; García-Contreras *et al.,* 2009; Manjarres *et al*., 2010).

While studies undertaken in the Gulf of Mexico on the snapper are scarce, research conducted by Burton (2001, 2002), Mikulas (2008) and Wells *et al.* (2008) determined age, growth parameters and mortality rates in order to propose management guidelines. Among studies conducted on snapper fishing in Verzcruz, Jiménez-Badillo *et al.,* (2006), Jiménez-Badillo and Castro-Gaspar (2007) and Gutiérrez, (2012) are highlighted.

Research has also been undertaken on decreasing snapper production levels, given that this family was found to be at its maximum sustainable yield (Arreguín-Sánchez and Arcos Huitron, 2011), while Cullis *et al*. (2012) performed a fishery analysis in order to implement a per trip catch quota program.

L. griseus is a little-studied species despite the ecological importance of the snapper to the stability of coastal ecosystems (Pérez-España, 2003). According to the National Fisheries Charter, the current situation shows that, in the last 5 years, the average annual snapper catch for the Gulf of Mexico was 4,257 t, of which Veracruz contributed 417 t (CNP, 2010). This resource, which comprises scaled fish species (60% of the total fishery production), has been considerably decreasing.

MATERIALS AND METHODS

From March 2012 to May 2013, 987 *Lutjanus griseus* organisms were caught for this study using longline and hooks in the fishing area off the Tamiahua coast, found in the central eastern area of the Gulf of Mexico between 21° 50’ 05” latitude North and 97° 50’ 0” longitude West and 21º 10’ 0” latitude North and 97º 40’ 0” longitude West.

Biometric data was taken for total length (TL) and weight (gutted weight - GW), while the sex ratio and sexual maturity were determined.

The per-month size composition for the population sampled was obtained by means of a frequency histogram. Average male and female sizes were compared by means of a Student’s t-test, while the median sizes caught each month were compared via a Kruskal-Wallis non-parametric ANOVA test.

Finally, the population size was ascertained, in accordance with Sparre and Venema (1997), using the statistical programs Statistica Version 7 (2004) and SPSS Statistics (2005) Version 19. The ratio/relationship/relation between length (TL) and weight (GW) was determined by means of a potential model, PE= $a*LT^b$, where “a” and “b” are the regression constants generated by the logarithmic transformation of TL and GW and the fit is made via the method of least squares (Ricker, 1975).

The gonads were extracted from each organism and, based on their coloration and morphology, the sex and sexual maturity was determined in accordance with the Nikolsky classification (1963), as adapted for tropical fisheries.

Two deterministic models were compared for the growth calculation, with the aim of establishing the best fit to the length-age data and obtaining the most reliable growth parameters (Braccini *et al*., 2007). The Von Bertalanffy model (1938) was applied, as it is the most commonly used to describe fish growth:

$$L_t = L_\infty\left(1 - e^{-k(t-t_0)}\right)$$

In this model, Lt is the length of the individual at age t, $L\infty$ is the asymptotic length, k is the parameter for growth rate, and t_0 is the theoretical age at zero length. The Gompertz model was also applied (1825).

$Lt = L\infty e\text{-}e\ (-k\ (t\text{-}to))$

In order to fit the models, the least squares criterion was used, while the Akaike information criterion, described in the following formula (Bolker, 2008), was applied in order to select the best fit:

AIC= -2In $L(\theta)$ + 2k

where L (ɵ) is the verisimilitude and k is the number of estimated parameters in the model.

Parameters from the Von Bertalanffy equation (Sparre & Venema 1997) were used to estimate natural mortality:

log M = -0.0066 -0.279 log ($L\infty$) + 0.6543 log (K) + 0.4634 log (T)

The Beverton and Holt equation (1956), in which L is the average size of fish of length L and above and L´ is the size at which all fish of this size and larger are caught, was used to obtain the rate of mortality due to fishing:

z= K* (L∞- L) / (L-L´)

RESULTS

The *L. griseus* population mainly comprised individuals 30 to 50 cm in size, with an average size of 39.52 cm, a maximum size of 134.0 cm and a minimum size of 15.0 cm. (Fig. 1).

The non-parametric Kruskal-Wallis (H) test detected significant differences among the median sizes for the different months sampled (H=107.63; $P < 0.05$).

The individuals caught in the month of September presented sizes smaller than 30.0 cm, with fish caught from October to July increasing in size. Lengths of 40.0 cm and above were found from November to May 2013 (Table 1).

In terms of the relationship between total weight and total length for males and females, a positive and significant relationship was found, with a correlation coefficient of $r^2 = 0.93$ and a $P < 0.0001$. The value for Coefficient B was 3.1, which indicates that the growth presented by *L. griseus* is isometric. The maximum weight registered for *L. griseus* corresponded to a 42 kg individual with a size of 134.0 cm, which, according to the model, corresponds to a weight of 41.480 kg (Fig. 2).

With regard to the average size, the females were larger than the males (38.56 cm and 36.52 cm respectively); however, these differences were not statistically significant (t=0.61 $P < 0.54$).

The sex ratio for the population studied was 1:1.2. The females matured at a length of 22.0 cm and the males at 25.0 cm.

In accordance with Nikolsky (1963), 22.68% of the total population was found to be in Phase III and 28.71% in Phase IV.

Natural mortality was M=0.34 from the value of K=0.10 upwards, corresponding to a low mortality rate, which is due to the fact that there are few predators and that the temperature of tropical waters is not a harmful factor for the species. Mortality per catch was F=0.52.

DISCUSSION

Although large *L. griseus* individuals (20 to 90 cm) on the Tamiahua coast are displaced beyond the reef and smaller individuals remain within its protection, even juvenile individuals are displaced to estuarine environments (Nagelkerken, 2009).

With regard to estimations of the size-weight relation in *L. griseus,* studies carried out in the Caribbean (Claro *et al*., 2001) have produced highly significant values, as Burton has also described (2001, 2002), for *L. analis* and *L. griseus* on the east coast of Florida. In the *Alacranes* reef (Yucatán), the values for the correlation were also high (r^2= 0.98) for *L. griseus* (González-Gándara *et al*., 2003), a little higher than the result reported in the present study (r^2= 0.93), which is probably due to the fact that the present research found an atypical value of 134.0 cm, the largest size reported for this species. Those studies which recommend catch sizes report values lower than 30.0 cm and individuals that are mainly sexually immature. This same situation presents on the Colombian coast of the Caribbean (Manjarrés, 2010; Rojas and Puentes, 2004), where a catch size of 48.0 cm has been reported due to the fact that fishery there focuses on undersized organisms.

It was found that *L. griseus* fishing is concentrated on organisms smaller than 40.0 cm (average 39.52 cm), which could negatively affect the population dynamic, leading, for example, to early sexual maturity and the redirection of physiological effort to reproduction at the expense of growth, which would reduce the recruitment of large individuals. Therefore, the selectivity of fishing gear should be calibrated for sizes larger than 25.0 or 30.0 cm (Wells *et al*., 2008). Generally, in the snapper populations of the Gulf of Mexico, individuals reach sexual maturity at sizes that fluctuate around 23.0 cm (84%) (Brulé *et al*., 2004). Moreover, Domier *et al.* (1996) report that sexually mature males measuring 18.0 cm can be found on the east coast of Florida at the beginning of March, while females measuring 19.0 cm and in an advanced state of sexual maturity (between stages 4 and 5, according to Nikolsky, 1963) can be found in the region up to mid-June. Spawning presents in the months of July and August and culminates in September. Rojas and Puentes (2004) also observe that *L. arginteventris* individuals in a more advanced state of maturity present throughout the months of May, June, August, November and December. This coincides with that reported by Grimes (1987) for *L. griseus*, while the insular species spawn in spring and fall. The sex ratio reported in the present study is similar to that found on the Florida and Caribbean coasts, where the population is 1:1.06 and 1:1.13 male-female, respectively. Rojas and Puentes (2004) reported a 1:1.2 female-male sex ratio, which is the same result found in the present study.

The minimum size to reach sexual maturity concurs with that reported by Claro and Linderman (2008), who affirm that females mature at 22.0 cm and males at 23.0 cm, up to a maximum size of 26 cm at an age of 1 to 2 years. Similarly, for *L. jocu*, Brulé *et al*., (2009) (Bloch and Schneider, 1801) stipulate that the minimum catch size, as a fishing regulation measure, should depend on the size at which individuals sexually mature, which differs in terms of the type of reproduction and the spawning phase for each species. Necessarily, this would involve a different minimum catch size for each species, which, in turn, protects juveniles. Similarly, Gutiérrez (2012) mentioned that the first catch size for the species *Ocyurus chrysurus* (Bloch) (Perciformes: Lutjanidae) caught with number 3 and 4 hooks, was 36.0-38.0 cm, while this was

26.0-28.0 cm, 44.0-46.0 cm and 40.0-42.0 cm with number 10, 6 and 14 hooks, respectively, concluding that juveniles should be protected by artisanal fishing.

This study also determined the growth parameters, obtaining L∞= 182.41 cm K= 0.05 $t0$= -1.71, where the estimated length is greater than that reported by studies conducted in Florida, which reported values of L∞= 89.0 cm K= 0.10 $t0$= -0.3 (Manooch, 1987), or that reported by Burton (2002), namely - L∞= 71.6 cm K =0.11 $t0$= -1.33. Lower values, of L∞= 77.22 cm, K= 0.11 and t0= -3.73, have even been reported on the coast of Brazil (Padovani and Rezende, 2004). With a maximum length of 134 cm found via artisanal fishing, it can be deduced that the species *L. griseus* undergoes rapid growth at a young age, which subsequently slows as individuals reach great lengths (Braccini *et al*. 2007). Moreover, studies focusing on the biological aspects of snappers agree that they are long-lived species. The growth values for *L. griseus* registered on the Caribbean coasts are lower, with values such as L∞= 54.8 cm K =0.23 $t0$= -1.06, which contrasts with the values registered on the coasts of Florida and Tamiahua, where the organisms reach greater lengths. The differences found between the populations in Florida and Tamiahua and the Caribbean may be due to a greater availability of food in the two former areas or to the fact that the populations in the Caribbean are over-exploited.

The K values indicate that *L. griseus* is a species susceptible to rapid over-exploitation and show that adult individuals probably constitute a part of recruitment along with juveniles.

Mortality is an indispensable parameter for understanding population dynamics given that it can be used to obtain species exploitation rates for use in their management (Pauly, 1980).

A fishing mortality of Z= 0.52 was obtained for *L. griseus*, while natural mortality was an estimated M=0.34, coinciding with the natural mortality obtained for the species *L. analis* (Cuvier, 1828) and *L. synagris* (Linneus, 1758), with values of M=0.35, M=0.37 and M= 0.33, respectively (Manjarrés *et al.*, 2004).

Manooch (1987) identified a fishing mortality of *Z*=0.60 for *L. griseus*, considering that these values indicate both that the snapper species slowly reach their maximum size and that they present low natural mortality rates. Given that the mortality data reported here partially coincides with that reported by the authors mentioned above, the natural mortality of *L. griseus* can be considered "acceptable".

With regard to fishing mortality in *L. analis*, Burton (2002) affirmed that estimations are higher (Z=0.49) than they were 20 years ago, referring to the fact that catches are aimed at breeding individuals, which suggests that this resource is overexploited and coincides with the statistics reported here. Similarly, the same study also reported a value of M=0.38 for *L. griseus*, although fishing mortality was found to be high (Z=0.94), indicating that this resource is exploited at intense levels. Moreover, the recruitment of individuals to the exploited population occurs between the ages of 4 and 5 years old. The estimated mortality rates in the study fall within that reported for snapper species and denote, in the case of fishing mortality, that the resource is found to be in a state of moderate exploitation. This, thus, would favor the recovery of the population, due to the fact that there has been a moderate increase in artisanal fishing catches and that these increases may reach a high level of production.

Among the 24 main fisheries of the Gulf of Mexico (CNP, 2010), *Lutjanidae* fishing comprises more than 50% of the fishing effort and requires immediate attention and regulation (Vázquez-Hurtado *et al*., 2010).

Based on the foregoing, fisheries analysis is an important tool for ascertaining the state of fish populations in order to regulate fisheries and provide complete biological-fishery information on which the sustainable management of fishing resources can be based. In this sense, the study of the size structure of *L. griseus* caught on the Tamiahua coast via artisanal fishing has revealed it to be predominated by individuals measuring 30- 50 cm. This finding is similar to the data obtained for *L. griseus* in Florida, whose intervals included sizes of 30-57 cm (Burton, 2001), suggesting that the population of this species is abundant in relation to the sizes reported here.

Aside from the economic interest in these snapper species, they are also an important ecological component at a community level as they are apex predators that consume shrimps, crabs, fish and cephalopods in the reefs of the Gulf of Mexico (Pérez-España, 2003). Moreover, the community of Antón Lizardo makes up 86% of the catch of the fisheries in reef zones (such as the Veracruz reef system) (Jiménez and Castro, 2007), with the *Lutjanidae* family contributing 16.33% of the economic value of the marine fishery of Tamiahua (Arguelles *et al.,* 2010). Both of the foregoing are evidence that the high commercial value of this species could provoke a collapse in its fishery, leading to the fishing of smaller-sized individuals and reducing the number of catches. In the south east of the Gulf of Mexico, snappers represent 54% of the catches made by the coastal fleet, while at the same time being the principal contributor to maintaining the ecological balance of the complex communities of hard-bottom tropical fish. A decrease in the population level could drastically affect the structure of the community of benthic organisms, as well as the trophic dynamic of coral ecosystems (Brulé *et al*., 2009). Under these conditions, the species *L. griseus* represents an important resource in the catches made by the fishing fleet on the Tamiahua coast, which could rapidly generate a level of over-exploitation. Arreguín-Sánchez and Arcos (2011) state that snapper species are at their maximum sustainable yield, which could generate the exploitation of this resource. Even bad practice during catches could cause a deterioration in the reefs, thus damaging coastal marine diversity.

Although the official fisheries statistics lack precise information at a species level, fisheries production statistics for *L. griseus* showed that this family is fundamental to artisanal fishing, which has notably maintained moderate increases in terms of both the catch and the fishing effort. As mentioned above, with two cooperatives with a different level of fishing effort responsible for the catches, consequently, said catches increase unequally. Some authors suggest the application of generalized linear models for detecting which variables can be mainly used to down detail the fishing effort (Parrága and Correa, 2010). The aforementioned authors standardize the fishing effort corresponding to *L. synagris* catches with the objective of avoiding excessive increases in both monthly and annual production, which would involve species management.

Snappers present two migrations, during which, throughout the transition from winter to summer (March-April), a notable decrease in growth occurs, but which is short in duration, given that, from April to May, individuals again begin to increase in size, reaching maximum growth intensity by the end of the summer (September-October). These conclusions, made by Claro *et al.,* (2001), concur with that which is reported here for April to June, as with November and December, where sizes above 40 cm are registered, while, from September to October, sizes were lower, which could be due to the fact that the population presents individuals recruited from the most recent reproductive season.

Studies on spawning aggregations for snapper species in reefs in the Atlantic Ocean are reported for the months of May and July (Domeier *et al*., 1996; Lindeman *et al.*, 2006; Burton *et al*., 2005; Graham *et al*., 2008, cited in Claro *et al*., 2009) in the context of an increased fishing effort. This finding is apparently occurring with *L. griseus* on the Tamiahua coast, due to the fact that, in May, the fishing effort increases in terms of the catch, possibly a month prior to the spawning aggregation.

The application of regulatory measures for the species *L. griseus* is necessary, due to a moderate catch increase (CNP, 2012) and the fishing effort reported here.

Currently, the *ad hoc* creation of legislation for the protection of a species involves the participation of various agencies and a relatively long development process (DOF, 2009). This process includes reviewing the different pieces of legislation in force which have shared benefits or, in this case, which apply to 55 species in common, in order to generate specific legislation per species.

In this sense, this suggests the generation of specific legislation for *Lutjanidae*, which includes information related to the reproductive period – the first catch size, the age at which mature size is achieved, and the recommended hook type – as a possible closure period with which the species could be exploited adequately. Similarly, the information obtained could be included in Official Mexican Standard NOM-65-PESC-2007, which regulates the exploitation of grouper species and associated species on the coasts of the Gulf of Mexico and the Caribbean Sea. This indicates that all species listed in the NOM present abundancies and specific biological characteristics that converge in their distribution in some zones of the Gulf of Mexico and the Caribbean Sea. For this reason, it is necessary to ascertain the biological characteristics of each species in order to generate regulatory measures for its sustainable exploitation (DOF, 2009), such as a reduction in the catching of juveniles in the population, namely the fishing of commercial sizes of 40 cm, which would be younger than the age of first or second maturation.

One management measure explored by Stewart (2008), depending on the natural mortality rates, focused on mitigating the effects in order to reduce catch numbers. This was achieved through the creation of apertures in fishing nets for certain sized (< 30 cm) individuals and a balance in traps in shallow waters in which the fish are more likely to survive, as well as the establishment of legal criteria for deep waters.

Similarly, Brandt and Jackson (2013) establish a form of managing *L. campechanus* that determines that individuals must be caught at sizes of 40 cm, considering that these sizes produce 3.2 metric tons. For this, they propose the use of traps with nets in a pyramid shape, which protect the reefs and slightly reduce the fishing effort. Given that this study found a similar pattern for *L. griseus* in terms of size and spacing in reef zones, this management approach can be considered for the species.

The structure of the *L. griseus* population off the Tamiahua coast seems to indicate that it is especially vulnerable to fishing between the months of May and September, for which reason the species should be protected by legislation during these months. It can be concluded that the *Lutjanus griseus* population on the Tamiahua coast principally comprises individuals between 30.0 and 50.0 cm in size.

For the first time, a size of 134.0 and a weight of 42.0 kg cm have been registered for *L. griseus* in the Gulf of Mexico. The sex ratio was 1:1.2, male to female, while the size at first maturity in females was 22.0 cm and 25.0 cm for males.

Age is estimated as up to 10 rings, while the growth parameters were L∞=182,46 K= 0.05 and to = -1.71, with the Gompertz model providing the best description of *L. griseus* growth.
The estimated natural mortality value was M=0.34 and F=0.52 per catch. The *L. griseus* individuals caught range from 2 to 6 years old and are still biologically reproductive, which presents a risk for the population. The production of the fishery presented slight catch increases in 2013. The monthly catch volumes demonstrated significant differences, depending on the month featured in this research.

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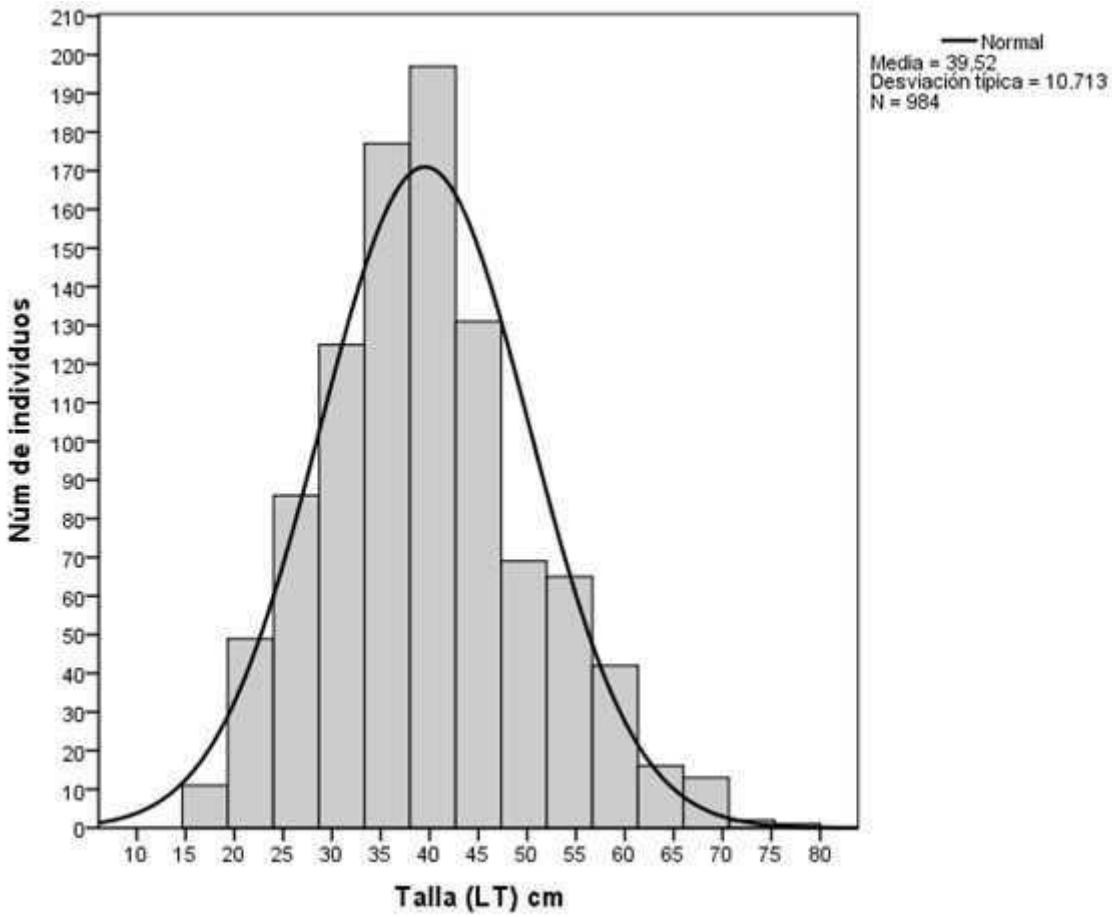


Fig. 1 Histogram of size for the *Lutjanus griseus* population of the Tamiahua coast, Veracruz, Mexico

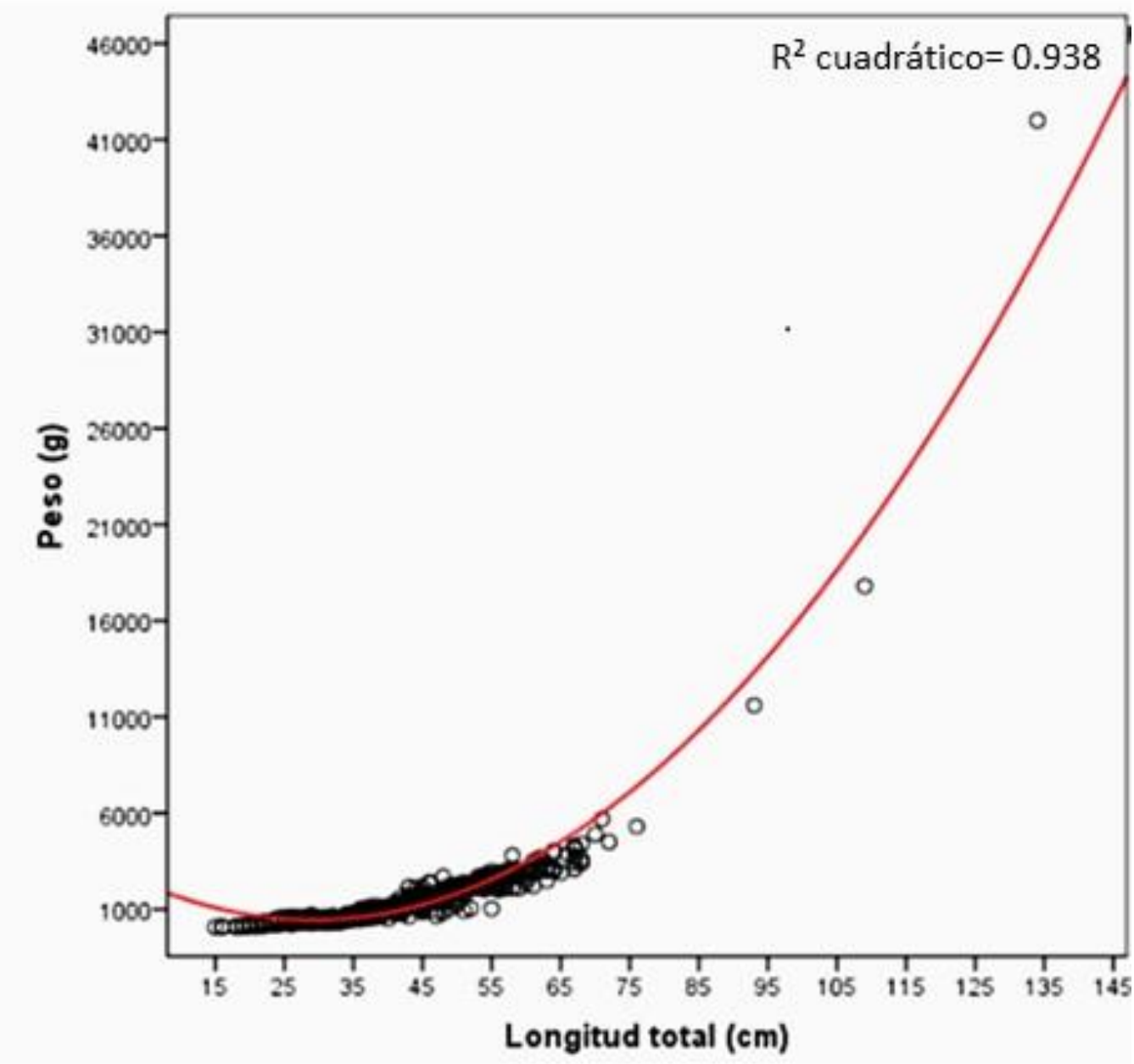


Fig. 2 Total Length and weight relation (n=987) for *Lutjanus griseus* individuals of the Tamiahua coast, Veracruz, Mexico

Table 1. Kruskal Wallis test, monthly differences (average size) for *Lutjanus griseus* organisms caught in the Laguna de Tamiahua coast, Veracruz, Mexico

Year	Months	Size	E.E.
2012	March	41.26	1.30
2012	April	36.63	1.43
2012	May	45.45	1.28
2012	June	46.65	3.81
2012	July	38.89	.88
2012	August	37.09	1.53
2012	September	33.52	1.43
2012	October	35.01	1.21
2012	November	40.52	.80
2012	December	40.71	1.00
2013	February	38.62	2.49
2013	March	40.24	1.68
2013	April	41.28	.72

Educational Games in the Construction of Knowledge in Programming Logic

Francisco Euder dos Santos
PhD Student in Technology in Education, Federal University of Rio Grande do Sul, Porto Alegre, Brazil
Professor at Federal Institute of Education, Science and Technology of Rondônia (IFRO), Cacoal, Rondônia, Brazil
euder@ifro.edu.br

Dauster Souza Pereira
PhD Student in Technology in Education, Federal University of Rio Grande do Sul, Porto Alegre, Brazil
Professor at Federal Institute of Education, Science and Technology of Rondônia (IFRO), Porto Velho, Rondônia, Brazil
dauster@ifro.edu.br

José Valdeni de Lima
PhD in Computer Science from the Federal University of Rio Grande do Sul (UFRGS), Porto Alegre, Rio Grande do Sul, Brazil
valdeni@inf.ufrgs.br

Abstract

This paper presents results of an "action research" developed in the subject of Programming Logic. The proposal of a pedagogical intervention occurred after teacher reports on the difficulties in the teaching-learning process of the discipline. The research allowed identifying and analyzing the main difficulties, as well as the progress after the intervention. Based on the Historical-Cultural Theory of Lev Semenovich Vygotsky, and considering the mediating elements, Zone of Proximal Development and social environment, backed the hypothesis that a methodological process, involving an educational game in the representation of algorithms constitutes a tool for the discipline

Keywords: Programming Logic; Algorithms; Educational Games.

1. Introduction

During the teaching and learning process of the discipline of Programming Logic, from the Computer Science Technical Course, integrated to high school, of the Federal Institute of Education, Science and Technology of Rondônia (IFRO) - Campus Ji-Paraná/Rondônia/Brazil, it was found that some students presented difficulties in abstracting the contents of the discipline and transforming them into instruction sets to be executed later by a computer; therefore causing serious problems for these students in the

continuity of said course.
These sets of instructions are necessary steps of solving a given problem in everyday life, called algorithms. According to [5], an algorithm is "a sequence of steps aimed at achieving a well-defined goal."
An algorithm can be developed using several tools, among them, there are graphical tools (Block Diagram or Chapin Diagram) and textual (Narrative Description or Pseudocode), for example.
It is understood that, in this scenario, the school should provide the student with the necessary tools to develop their knowledge and skills through a social, cultural and educational environment; stimulating the curiosity of this student so that he is able to continue his studies.
In this article, it was described a study with approximately 50 students, in which the main difficulties in the contents of the discipline of Programming Logic, to understand the use of educational games in the process of teaching and learning of algorithms, to understand the use of the diagram blocks and, at the same time, minimize these difficulties through a teaching-learning process using an educational game based block diagrams as a methodological resource.

2. Related Work

For the development of the research, having the goal of identifying similar difficulties, initial research was carried out in several databases available on the Internet, for example articles, dissertations and/or theses, such as the works by [2], [1] and [4]. These researches demonstrated that the problems in several schools were similar to those found in classes in "X's" Programming Logic discipline.
The proposed solutions in those works were through softwares [11], [1] and [4], with the purpose of assisting in the construction of knowledge, but for different reasons the results fell short of its goals.
Thus, this research did not seek to confront these softwares during the teaching-learning process, but to produce clarifications for the students' performance, suggesting a teaching process for the contents of the discipline, using an educational game based on the graphic tool of block diagram.
The choice of using a game was due to the fact that educational games allow to strengthen and enrich the pedagogical act by providing the student with "finding solutions to the challenges encountered, diagnosing abstract information, developing strategies, proposing solutions, among others" [6]. According to the author, playful activities, not only facilitate the acquisition of meaningful learning, but also promote the construction of knowledge in a more fun and interactive way.
It is understood that games, when used in combination with planning and defined goals, stop being just for fun and become a learning tool in a playful as well as educational way, when used inside the classroom.
It is believed that through the educational games it is possible to act in the Proximal Development Zone (ZPD) of the student in difficulty, stimulating their cognitive habilities for the construction of new knowledge, in a social environment using mediating elements (instruments and signs), as proposed by [14].
In addition to allowing the role of stimulator / mediator to be given to the teacher in the construction and reconstruction of knowledge in a more dynamic and meaningful learning process, it also avoids a traditional approach, which would consist in transmitting-receiving-memorizing the contents.

3. Literature Review

Here we present a brief overview of the term algorithm and how this term was associated with the area of computing, as well as its importance in the development of computer programs. It is also shown the use of logic in the construction of algorithms and the forms of representation of these algorithms through graphical and textual tools, with emphasis to the block diagram graphic tool.

3.1 Algorithm: Concept

In computer science, the term algorithm may be one of the most important of all, because of its applicability in the field.

This term came from the references and annotations by Ada Augusta Byron King[2], known as Countess of Lovelace, who is considered the first computer programmer [9]. These notes were definite instructions so that the Analytical Machine, idealized by Charles Babbage[3] in 1834, could compute the values of mathematical functions.

Since the machine of Charles Babbage did not work, because of the technology available at the time, the concepts of instructions were transformed much later in algorithm and used in the Machine of Turing, of Tuby Alan Turing[4], in 1936.

Alan Turing was able to show through his machine that a well-designed algorithm is needed for its operation. Thus, the term algorithm has been used in computing to represent a sequence of instructions [9].

3.2 The Importance of Logic in the Algorithm

The logic when applied in computer programming has the objective of rationality and development of techniques for the production of logical solutions with the purpose of solving problems, in this way, the logic is treated as programming logic, which can be represented in any existing programming language. Thus, to represent the rationale of logic more accurately, we use the algorithms. [9].

It is understood that, when an algorithm is elaborated, it must be considered that the specifications of the actions need to be well defined, following a rule of execution, with the objective of achieving a final result, that is, the solution of a certain problem. This implies that if the constructed logic is correct, it will be possible to achieve the expected result. According to [4], even if the solution of a problem is considered simple, the student will need to understand the statement and adopt logical procedures to solve it.

Thus, the algorithm must, therefore, anticipate all situations that may occur when it is transformed into a programming language, thus allowing the programmer to express his or her logical reasoning, regardless of the language that will be used, without computational details.

3.3 Forms of Representation of Algorithms

An algorithm, according to [3], can be represented in several ways depending on its developer. The main

[2] Ada Augusta Byron King, born in London on (1815 – 52), was a mathematician and english writer. Source: [9].

[3] Charles Babbage, scientist, mathematician, philosopher, mechanical engineer e english inventor; born in London (1791 – 1871). He was best known for introducing the idea of the Analytical Machine, considered the precursor of the computer.Source: [9].

[4] Alan Mathison Turing, mathematician and computation scientist; born in Londres (1912 – 1954). Source: [9].

ones are: Narrative Description, Pseudocode, Block Diagram and Chapin Diagram.
According to [9], the forms of representation use a structured programming technique or modular programming, being in line with the thought, which is structured.
Structured programming allows one to subdivide a given problem into smaller problems, “subproblems”, so that the larger problem can be solved. To solve each subproblem, one must have an algorithm.
There are some methodologies that are focused on Object Oriented Programming. In this methodology, the central idea is the decomposition of data rather than the decomposition of functions [9]. For [11], "the differences between both intensify only at the moment of coding the algorithm through a programming language".
Given the following example "Elaborate an algorithm that shows the mean value between two numbers", the solution through Narrative Description [3], which is developed through stages and using the English language here, is presented in Table 1 below.

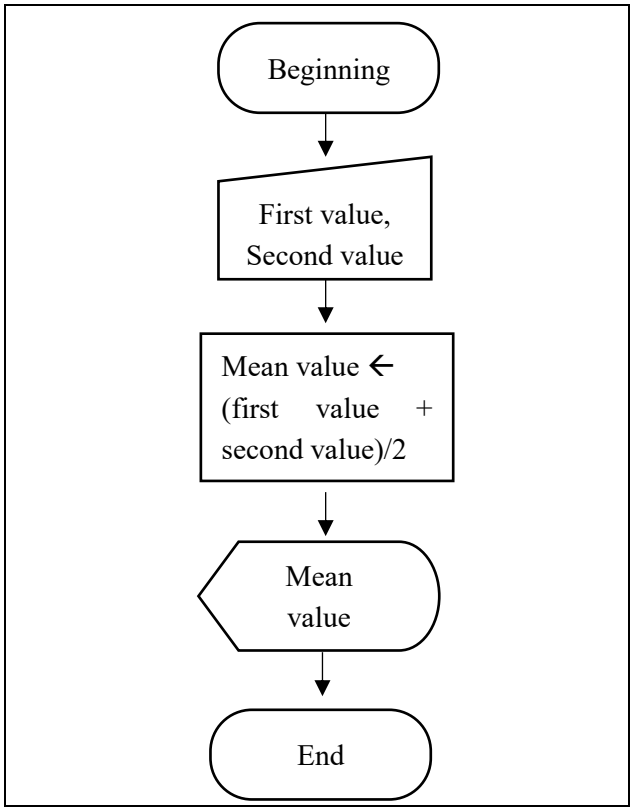
Table 1. Narrative Description

1) Read first value (Ex.: 10)
2) Read second value (Ex.: 4)
3) The mean value is the sum of the input values divided by 2. Eg: [10 + 4] / 2.
4) Show the average value

Source: Researcher's database

Since the algorithm is personal, each programmer can solve with the information he considers appropriate, as long as he shows how to solve a certain problem.
Table 2 depicts the same example represented by the Block Diagram [9], [3], which uses a graphical form and is formed by geometric figures; the symbols are standardized.

Table 2. Block Diagram



Source: Researcher's database

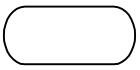
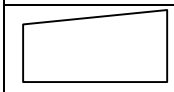
Considering the above, it is considered that the representation of an algorithm through a given tool is essential to visualize and analyze all the existing steps in a given task.

3.4 Block Diagram

The block diagram is one of the graphical tools used in the logical designs of a given program, allowing the computer programmer to draw the line of logical reasoning. Its elements allow visual and universal communication, as it is one of the most well-known tools in the area of software development and its symbols are standardized through ISO 5807: 1985 (E). [8]

However, it is believed that if ISO[5] 5807: 1985 (E) is used in a manner in which the programmer doesn't know its goals, it will provide documentation of an incomprehensible project. The Block Diagram symbols are represented in Table 3.

Table 3. Symbols of a block diagram

Symbol	Description
	Terminator: Represents the start and end definition of the logical flow of a program.
	Manual input: Represents manual data entry.

[5] ISO are the initials for Organization for Standardization, founded in February 23, 1947, in Geneva, Switzerland. The ISO approves the international guidelines and rules in all technical fields. Source: http://www.iso.org/iso/home.html. Accessed on: October 25, 2018.

	Process: Represents the execution of an operation or group of operations.
	Display: Represents the execution of the visual data output operation.
	Document: Represents the execution of the printed output data operation.
	Decision: Represents the use of conditional variances.
	Preparation: Represents the modification of instructions or group of instructions in relation to the action of its subsequent activity.
	Connector: Represents the input or output in another part of the block diagram.
	Line: Represents the link action existing between the various symbols in a block diagram.

Source: (ISO 5807-1985 (E) apud [8], [9]

These symbols can be drawn through specific software or an official template, as shown in Figure 1.

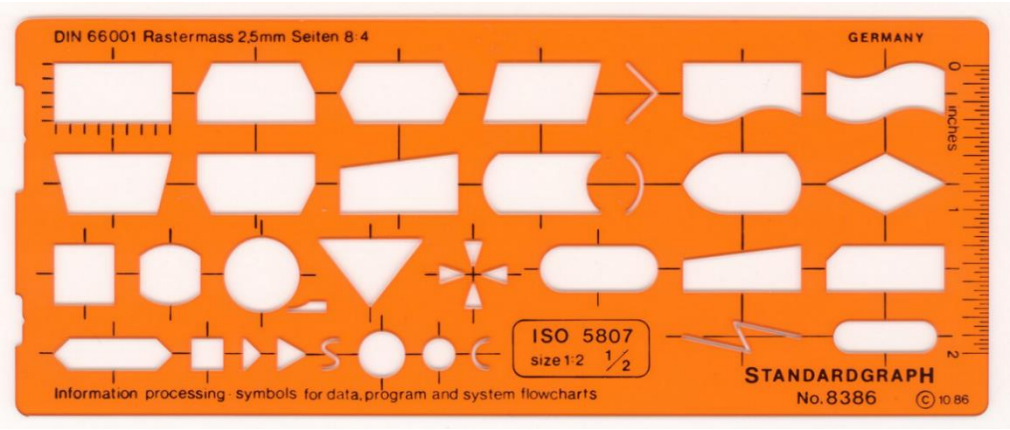


Figure 1. Template for Program Diagramming.
Source: http: //www.fh-jena.de/~kleine/history/software/iso5807-flowchart-template-halfsize-huge.jpg

4. Methodology

The research-action method was used, which linked research to practice or action, thus developing knowledge as part of practice. The method allowed studying the transformations that occurred during the interventio. The authors [13], [12], were the theoretical contributions used in this method.

According to [13], action research is a method in which practice is investigated for the purpose of improving it, proposing a reflexive pedagogical action.

The subjects that participated in the research were 37 students from the 1st. year, 11 students from the 2nd. year of the course in Information Technology Integrated to High School and the teacher in the discipline of Programming Logic of the Federal Institute of Education, Science and Technology of Rondônia (IFRO) -

Campus Ji-Paraná/Rondônia/Brazil.
The students of the 2nd. year were invited by the teacher to participate because they had knowledge of the subject and could contribute with their experiences.
This research was triggered after the teacher expressed his concern with some students in the classroom. The teacher identified that during their classes, in the construction of algorithms, these students were presenting unsatisfactory learning results, such as: difficulty in interpreting question statements, developing logical reasoning, and constructing algorithms.
The research was developed using the inductive method, with a qualitative and quantitative approach [10].

4.1 Research Instruments

As data collection, several questionnaires were used at different moments, applied to the teacher and students, with open, closed, multiple choice and yes or no questions, and observations of the development of the respondents, as well as bibliographic searches, hoping to find clarifications on the surveys carried out.

4.2 Planning

Planning encompasses the initial schedules of the research, involving literature reviews, questionnaire applications, and observations. The initial objective was to understand the main difficulties of the students in the discipline, how the discipline was being conducted and what educational tools were used in the classroom to represent the algorithms.
It was verified that every other classe took place in the computer lab, using the narrative description and the pseudo-code as tools. However, the students presented a high degree of difficulty in the discipline.

4.3 Proposed Action: Intervention

The proposed intervention was of a workshop, entitled "Workshop of Logic of Programming using the Diagram of Blocks" tool, with duration of 20 hours. During this phase the basic exercises and rules and the applicability of an educational game were defined.
At first, there were meetings with the 2nd year students and in a second moment with the 1st year students. Lastly, the 2nd year students, researcher and teacher developed all activities together.
This division was necessary, since the students of the 2nd. year had more experience in the discipline in relation to the 1st graders. Thus, these meetings had specific objectives, such as preparing them to be mediators in the teaching-learning process.

Figure 2. Students from the 1st. Year
Source: Researcher's Stock Image

According to the data collected, 94% of the students of the 1st. year said that the block diagram tool facilitates the representation of algorithms. Corroborating with [8], when the author comments that through the block diagram tool it is possible to obtain a better clarity of the algorithms.

Figure 3. Students of the 1st. Year with students of 2nd. Year
Source: Researcher's Stock Image

The students of the 1st year when asked if the interaction with the most experienced students (2nd year) facilitated in the process of teaching and learning algorithms, 100% answered positively. Thus, in a Vygotskian socio-interactionist approach, it is perceived that in addition to the student being active in the construction of his knowledge, this construction will also happen with the interaction between teachers, colleagues and object of learning.

4.4 Data Encounter: Result of the Action

After the action, the application of the knowledge was registered through a championship entitled "CHAMPIONSHIP OF PROGRAMMING LOGIC - USING THE BLOCK DIAGRAM TOOL", in which the students applied their knowledge before a new context. It was constructed an educational game[6] with its rules using the elements of the block diagram to be used in the championship. The game allowed the students manual contact with the elements of the tool and representation of the algorithms in a playful way.

[6] Product patent requested on the Federal Institute of Education, Science and Technology of Rondônia (IFRO). The answer from responsible parties is still awaited.

The championship was carried out with 7 teams, in 3 phases with punctual exercises for each phase. At the end of each exercise, every mistake was pointed out, so that competitors could learn from these mistakes as well. In the perspective presented by [7], the error is considered a stage of learning.
After the game, a questionnaire was applied for the final data collection of the proposed methodology.

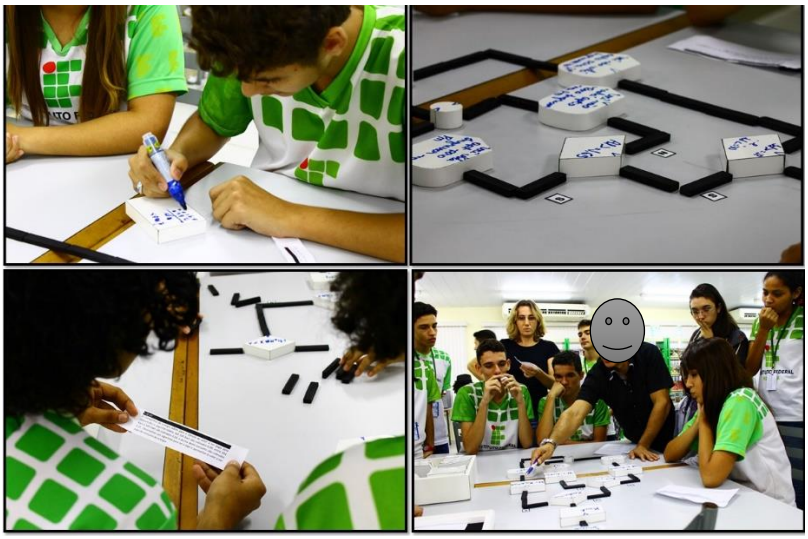


Figure 4. Championship of Programming Logic
Source: Researcher's Stock Image

In the students' opinion, a tool such as educational games, could be used to provide necessary interaction between the subjects; and through this interaction it is possible to achieve the desired objectives and to provide the construction of knowledge.

5. Conclusions

The game used in the process of knowledge acquisition, made possible to verify that the use of classroom games is one more playful and creative tool that teachers can use during their classes. For they have broadened their knowledge about algorithm building, according to the students.
Thus, the proposed strategy of a methodology using educational games was considered valuable in the process of knowledge construction by the students. The game allowed the integration between students and teachers, through moments of relaxation aimed at (re)building knowledge. It is worth mentioning that for this it is necessary to have defined goals, and not being taken as an activity of dispute between students, but rather, a possibility to seek and develop students' potentialities of learning and creativity, cooperation, interaction, among others skills.
It is believed that the teacher can use several methods to minimize the obstacles in the teaching-learning process. However, the methodology applied with the interaction between teacher and students involved, with mediating instruments, and in an environment built with defined purposes, proved to be a point of reference for the applicability during the classes of the Programming Logic discipline.

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HTML5 Authoring Tool to Support the Teaching-Learning Process: a case study with H5P framework

Dauster Souza Pereira
PhD Student in Technology in Education, Federal University of Rio Grande do Sul, Porto Alegre, Brazil
Professor at Federal Institute of Education, Science and Technology of Rondônia (IFRO), Porto Velho, Rondônia, Brazil
dauster@ifro.edu.br

José Valdeni de Lima
PhD in Computer Science. Ful Professor at the Federal University of Rio Grande do Sul (UFRGS), Porto Alegre, Rio Grande do Sul, Brazil
valdeni@inf.ufrgs.br

Liane Margarida Rockenbach Tarouco
PhD in Electrical Engineering. Full Professor at the Federal University of Rio Grande do Sul (UFRGS), Porto Alegre, Rio Grande do Sul, Brazil
liane@penta.ufrgs.br

Rafaela Ribeiro Jardim
PhD Student in Technology in Education, Federal University of Rio Grande do Sul, Porto Alegre, Brazil
Professor at Federal Institute of Education, Science and Technology Farroupilha (IFFarroupilha), Alegrete, Rio Grande do Sul, Brazil
rafa.rjardim@gmail.com

Paulo Santana Rocha
PhD Student in Technology in Education, Federal University of Rio Grande do Sul, Porto Alegre, Brazil
Evandro Chagas Institute, Belém, Pará, Brazil
rochap01@gmail.com

Francisco Euder dos Santos
PhD Student in Technology in Education, Federal University of Rio Grande do Sul, Porto Alegre, Brazil
Professor at Federal Institute of Education, Science and Technology of Rondônia (IFRO), Cacoal, Rondônia, Brazil
euder@ifro.edu.br

Abstract

The objective of this experiment report was to describe the development of studies of authorship tools and creation of educational resources carried out in 2017 by 12 students of the Doctoral Course in "Informatics in Education" of the Federal University of Rio Grande do Sul (UFRGS), 6 students of the Teleducation discipline and 6 students of the discipline of Hyperdocuments as Teaching Material. The impacts of the use of an authoring tool in the teaching-learning process were explored, focusing the analysis in descriptive aspects. It was concluded that the use of H5P contributed to discussions and reflections on authoring tools, also it was possible to establish an effective relationship between theory and practice, and its use proved to be satisfactory as well as promising for the teaching-learning process.

Keywords: Authors' Tools; Learning Objects; Hyperobject.

1. Introduction

The search for innovative methodologies in the educational context is a necessary task, given the recurrent existence of problems presented by students in certain areas of knowledge. Because of this, both teachers and researchers have dedicated efforts to improve their methodologies. However, in spite of the engagement of teachers and researchers, the methodology is often not improved because it ends up being a simple reproduction of traditional methods using technological tools. [19]

In this scenario, it is not possible to affirm that only the production of educational contents using technological tools can guarantee student learning. On the other hand, the use of technology can effectively support and enrich activities in the classroom, provided they are used properly [14]. According to [13], in order for teachers to understand how to manage and take advantage of the available technological resources they need to understand what their real role is in relation to such resources. It is necessary for teachers to be comfortable with the use of technological resources, as well as perceive their importance in the teaching-learning process.

According to[17], like any other software, the authoring tool refers to any type of software or collection of software components with which one can implement or change certain content and make it available for other people.

The authoring tools have been used by teachers as support to the teaching process, since they can make the development of more creative and motivating activities possible for the students. In this way, it becomes fundamental that teachers acquire the necessary skills to make use of all the resources available to them in order to improve learning.

In this scenario, this paper intends to present an experiment report about the use of an authoring tool called H5P, when applied in two disciplines of a post-graduation program in Informatics in Education, in integration with the authoring tool and the Moodle environment.

2. Theoretical framework

According to [23], an authoring tool is any application, part of an application or collection of applications with which the author interacts to produce, change, or assemble Web content that can be used by others. The authoring tools aim to reach a more lay public to assist in the process of producing content or educational materials [15]. However, [8] points out that the absence of authoring tools is still a challenge for the elaboration of interactive contents.

In this context, [16] carried out a study in which they presented a method for the quick and easy production of micro-learning content. According to [4] micro-Learning is characterized by allowing interactions with combinations of short or long activities, so that the teacher can establish predefined periods of time. In addition, it allows interactions with data, photos, activities and videos in real-time mobile environments. This way, it enables the teacher to manage the interactive contents and the time periods. For the development of the interactive contents were added the Bitnamsi Wordpress and H5P plugins in the Moodle platform. The authors noted that the use of these Web-based authoring tools was essential for the development of the study, as well as the use of the Moodle platform. The integration of these tools allowed teachers to develop content easily and enabled students to learn content with lower cognitive loads.

[22] presents a positive approach in the evaluation of the hypervideo authoring tool to support surgery learning. The main contribution of this work was the possibility of the students of the veterinary medicine course to interact with surgical simulations in the practical classes. This study contributed to the consolidation of new practices that make it possible to replace live, nonhuman animals in veterinary medicine training. The main limitations encountered by the author during the development of this work were related to the size of the videos, quality and access time. Finally, with this study it was possible to verify that the hypervideo is a learning support tool that allows the perception of surgical procedures.

[2] carried out an evaluation of four authoring software aimed at the development of educational games. For the application of the evaluation criteria, a set of activities were implemented with each of the software. The Hierarchical Analytical Method (MAH) was used in order to identify the most appropriate authoring software for use in the classroom. The MAH is one of the multicriteria tools used in decision making [9]. According to the authors, of the evaluated software, Visual Class was the one that showed the best results and met most of the criteria evaluated in the study.

3. Methodology

This work reports an experiment in postgraduate courses, exploring the impacts of the use of an authoring tool in the teaching-learning process, focusing the analysis on aspects of a descriptive nature.

This report was experimentd during the second semester of 2017 in the subjects of Teleducation and Hyperdocuments as Educational Material, both taught in the Program of Post-graduation in Informatics in Education of the Federal University of Rio Grande do Sul (UFRGS), counting on a total of 12 students.

The classes were organized in order to have two face-to-face meetings weekly, always held in a computer lab, as well as activities to be carried out in the EAD modality. During the face-to-face meetings the established dynamics took into account aspects of the cognitive domain of Bloom's Taxonomy [3], so each

meeting suggested the production, or evaluation, of educational resources, with subsequent validation of their suitability at a certain stage of Pedagogical Wheel.

In this scenario, the production of digital content always occurred in face-to-face meetings, thus requiring tools for material management and learning objects. Because of that, the virtual Moodle learning environment, for storing and creating content, was adopted. This technological choice was made due to the adoption of the environment by the research institution.

However, as an authoring tool for creating educational resources, H5P framework was explored, through its version available as a plugin for Moodle.

4. Results and Discussion

The experiment reported in this work was carried out at the Federal University of Rio Grande do Sul (UFRGS), in two classes of the postgraduate course in Informatics in Education, with the participation of 12 students.

In the Teleducation discipline, the objective was to investigate the various possibilities related to the use of information technology and communication, aiming at the production of theoretical and practical knowledge including the context of mobile learning.

Based on each of the themes foreseen in the syllabus of the subject, the teacher explained the educational theories related to the subject, discussing the main points necessary for their understanding, and later the students researched mobile authoring tools that could be used to support the teacher's activities inside the classroom. At a few points during the classes the students had time to explore these tools, each one of them should choose one authoring tool different from the other and give a presentation demonstrating its purpose and main features.

In addition, it was also noted whether the authorial result produced by using H5P could be used on Android or Iphone. The tests performed have generally shown that the produced content can be displayed and that the features created with the H5P work on a mobile device. At the end of each lesson, based on the topic that would be addressed in the next class, each student should choose a new tool to be studied. Based on the chosen tool, each student placed in the Moodle environment a small tutorial about the use and main features of the same.

The discipline of Hyperdocuments as Educational Material, aimed to provide students with the opportunity to learn methods for designing hyperdocuments, taking into account the definition of guided and guided-indexed script and temporal synchronization between text, voice and video.

The discipline dynamics was initially based on the research of hyperobjective modeling methods, where each of the students carried out a research on a particular model and presented it in the classroom. Based on the models studied, we explored in the discipline the main aspects to be considered in the creation of a hyperobject, which are: object model, hyperobject model, navigation model and interface model.

We also used the Synchronized Multimedia Integration Language (SMIL) to demonstrate the development of multimedia applications on the Web. Finally, it was proposed the implementation of a hyperdocument project called educational resource with a concept teaching approach. aspects of timing, voice, video and text. It was suggested to students to apply their educational resource, in order to test it and validate it.

Several researchers have dedicated efforts to analyze authoring tools to support teaching and learning. Among them, we can mention [11], [12], [1], [5], [10], [18], [8].

According to [20], authoring tools have been widely used for the creation of educational software, since they allow teachers to prepare materials for their classes without the need of help from computer specialists. Thus, the use of authoring tools provides greater independence for the teacher.

Considering that the proposal to use authoring tools aims to create educational resources that will be used by students with fewer skills to students with more skills, it is necessary to mention the importance of the Bloom taxonomy in this context.

[3] has developed its taxonomy, which comprises a hierarchical organization of educational objects classified as being knowledge, understanding, application, analysis, synthesis and evaluation. The use of the Bloom taxonomy assists the teacher in defining his goal considering the teaching-learning process. However, it is necessary that every process needs to be planned in order to guarantee effective and efficient results [21].

Four decades after the release of Bloom's taxonomy, it was reviewed by a group of experts in the fields of psychology, education, curriculum specialists, tests, assessments, and more. David Krathwohl also participated in the review, which also helped create the original taxonomy in 1956 and is redefined at the following levels: remember, understand, apply, analyze, synthesize and create. [7]

In addition to the concepts related to Bloom's taxonomy, the evaluation of the authoring tools analyzed in this report of experiments took into account the Padagogical Wheel developed by [6], which classifies some authoring tools in the various levels of the Bloom taxonomy, as observed in Figure 1 below.

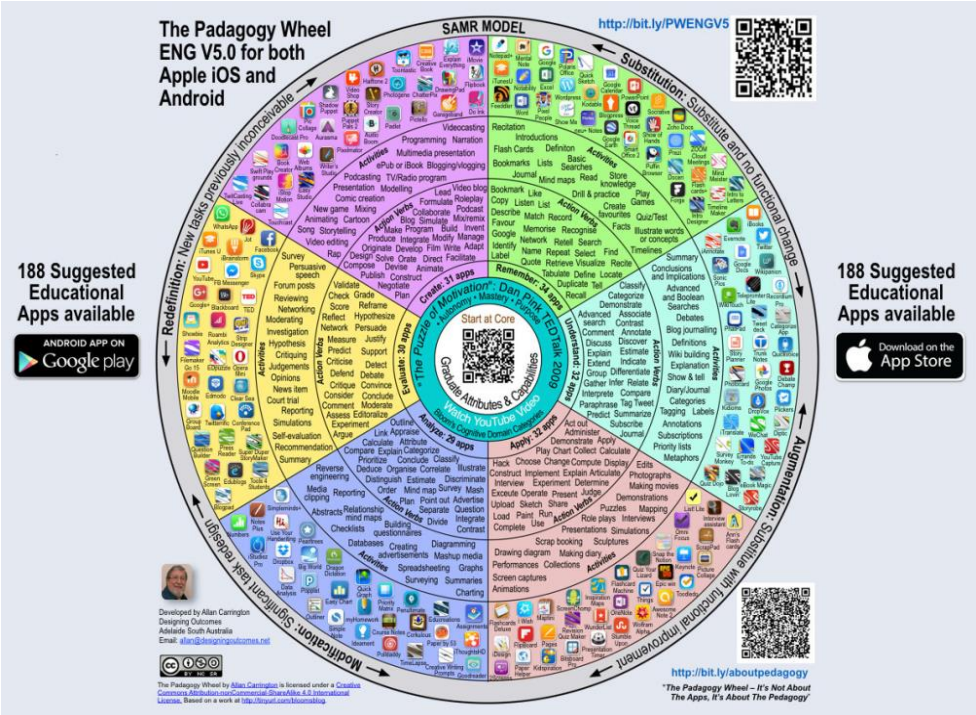

Figure 1. Padagogic Wheel Developed by Allan Carrington

Source: https://designingoutcomes.com/english-speaking-world-v5-0/

In the course of Teleducation and Hyperdocuments as Educational Material, the Moodle environment was used as a tool to support teaching during the activities of the two disciplines. Moodle was used both for the provision of subject material to students, as well as for the postings of the analysis activities of the chosen authoring tools.

The Moodle environment has a variety of features, allowing its users the use of collaborative and interactive, synchronous and asynchronous tools, enabling teachers to use various strategies in the teaching process.

Among the various resources available in the Moodle environment, the H5P authoring tool was used throughout the courses. This plug-in was installed in the Moodle environment of the graduate program and enabled the creation of dynamic and interactive content.

The H5P authoring tool can be used from the plug-in installed in the Moodle environment, as mentioned previously, but can also be accessed directly via the internet browser on the official website. Upon accessing this URL, the user will see Figure 2 which is the screen where the H5P login can be accessed. Note that it is necessary to register an account to access the H5P.

Figure 2. Login screen or account creation in H5P

Source: Author

H5P is an authoring tool that offers a variety of features that can be used for content generation. Some of these features are described in Table 1.

Table 1. Available features in the H5P

Available features			

Multiple Choice	*Interactive Video*	*Course Presentation*	*Fill in the Blanks*
Quis (Question Set)	*Questionnaire*	*Drag the Words*	*Drag and Drop*
Speak the Works Set	*Mark the Word*	*Image Hotspots*	*Accordion*
Dialog Cards	*Personality Quis*	*Single Choice Set*	*Memory Game*
Flashcards	*Collage*	*True/False Question*	*Timeline*

Source: Author

During the lessons of Teleducation, some resources of the H5P authoring tool were explored to identify its purpose, according to some examples detailed below:

- ✓ Multiple Choice: used for elaboration of multiple choice questions. In this type of resource the student receives immediate feedback regarding their performance. You may have one or several correct options for the question.
- ✓ Interactive Video: used to include interactivity in videos, such as explanations, extra images, tables, white space fill and multiple choice questions.
- ✓ Fill in the Blanks: Used to fill in the blank left in a given text to test the student's ability to reproduce facts or produce mathematical inferences.
- ✓ Quis (Question Set): used to create a set of questions of various types (multiple choice, drag and drop, fill in the blanks). It also allows you to add videos that are played at the end.
- ✓ Drag the Words: used to drag the previously chosen words to spaces absent in a given text.
- ✓ Drag and Drop: used for drag-and-drop questions, allowing the student to associate two or more elements and make logical connections in a visual way.

One of the activities of the discipline of Hyperdocuments as Teaching Material was the creation of an educational resource that had the purpose of supporting teaching. Both the choice of content to be taught and the technological tool to be used was freely chosen.

In view of this, it was decided to develop a prototype of an educational resource that contributes to the teaching of data structure contents. In order to create this educational resource, it was necessary to take into account some aspects covered during the discipline of Hyperdocuments as Teaching Material, as an example, the definition of guided and guided-indexed route, temporal synchronization between text, voice and video. Taking into account these requirements, it was decided to use the H5P authoring tool for the implementation of this educational resource, since the available resources could meet the established requirements in a satisfactory way.

Figure 3 shows the initial screen of the educational resource prototype created for teaching Data Structure using the Python language.

Figure 3. Screen of the Educational Resource Prototype using H5P
Source: Author

Figure 4 shows the use of the H5P Timeline feature that was also used to create the educational resource for teaching Data Structure. Using this feature, timelines are easily editable, shareable, and reusable. The content type of the timeline allows you to insert a sequence of events in a chronological order. For each event you can add images and texts as well as include Twitter, YouTube, Flickr, Vimeo, Google Maps and SoundCloud features.

Figure 4. H5P Timeline Feature
Source: Author

In the progression bar highlighted in Figure 5 it is possible to notice some markers that indicate that in that location there is some feature of the H5P created and that at that point it will be initialized.

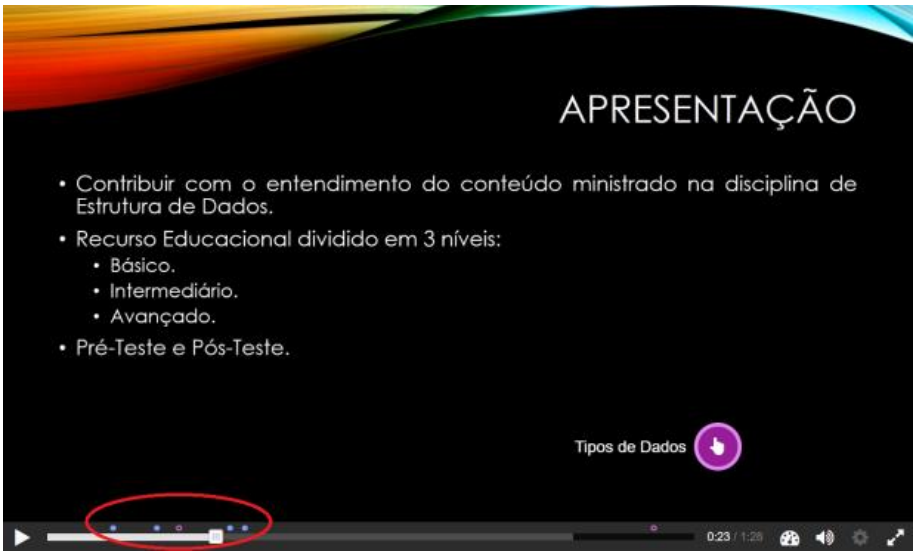

Figure 5. Educational resource in execution
Source: Author

Figure 6 shows the moment when the resource is initialized and, in this case, it requires the user to answer a multiple choice question about the desired topic.

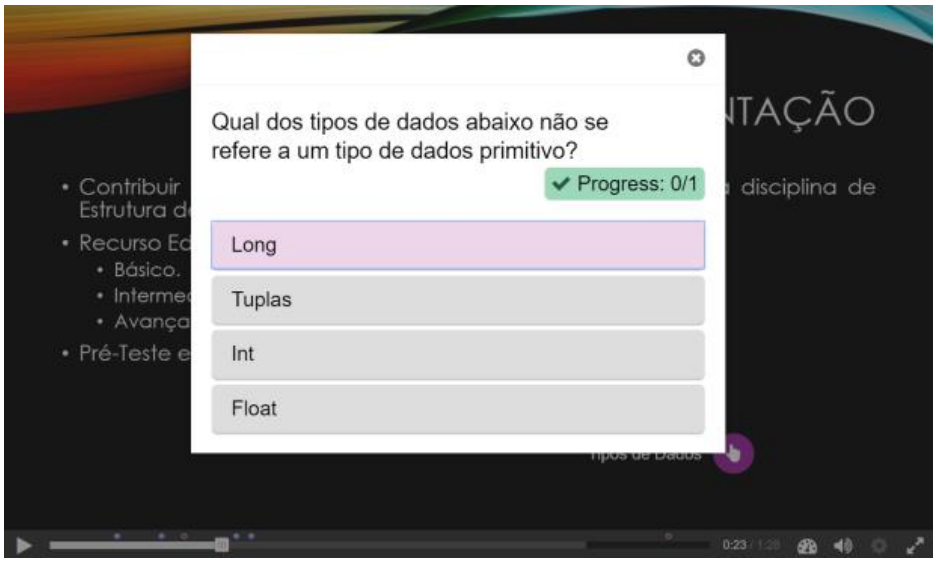

Figure 6. Educational resource in execution - multiple choice question
Source: Author

It can be noticed that the authoring tools can be used for content creation and, because of this, end up being a great ally of teachers in the teaching-learning process, since they enable the creation of interactive learning contents that tend to motivate students' interest, mostly because of the diversity of resources presented to them.

5. Final Considerations

This report shows the importance of using authoring tools, such as the H5P framework, in the teaching-learning process.

From the activities developed in the subjects of Teleducation and Hyperdocuments as Educational Material, it was possible to get to know better the resources available in the H5P and how they can be used for the creation of an educational resource.

A few difficulties that can be described relate to the unavailability of a Moodle environment in the Hyperdocuments as Teaching Material course, in which the students should have had administrator privileges so that the installation of the H5P plugin could be done in the environment. To solve this problem it was decided to create a Moodle environment external to the UFRGS where the tests were carried out.

As future recommendations, it is suggested to continue the development of the educational resource mentioned in this report so that it is applied in the classroom with the objective of analyzing if there will be improvement in learning when students make use of it.

As a general result, it was possible to observe that the H5P authoring tool integrated with the Moodle environment has great potential to collaborate in the teaching-learning process.

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Instrumental Character of the Concept of Sustainability Focusing to the Institutionalist Theory

Vanessa Piffer
Graduate Student Master's Degree in Administration PPGMAD/Federal University of Rondônia (UNIR). Specialist in Engineering and Work Safety at Faculdade Santo André, Brazil. Specialist in Sanitary and Environmental Engineering from the Pan American College of Ji-Paraná, Brazil. Environmental Engineer from the Federal Institute of Rondônia (IFRO), Brazil.
eng.vanessapiffer@gmail.com

Flávio de São Pedro Filho
Post-Doctor in Management and Economics from the University of Beira Interior, Covilhã, Portugal. PhD in Business Administration from the University of São Paulo, Brazil. PhD in Business Management from the Autonomous University of Asunción, Paraguay. Professor of Socio-Environmental Management at the Program Master in Administration (PPGMAD /UNIR), Professor and Researcher at the Federal University of Rondônia (UNIR), where he is Coordinator of the Management of Innovation and Technology Research Group (GEITEC/UNIR/CNPq), Brazil.
flavio1954@gmail.com

Leonardo Severo da Luz Neto (Corresponding author)
Master in Education - Autonomous University of Barcelona, Spain. Master in Psychology - University of São Paulo. Master in Religious Studies - Faculty of Theological Education Logos of São Paulo. Bachelor of Nusring. Professional Physical Education. Bachelor in Theology. Professor at the Federal University of Rondonia, Brazil - Department of Collective Health and Researcher at the Technology Research Group (GEITEC/UNIR/CNPq), Brazil. and Interdisciplinary Studies in Collective Health Group (GEISC/UNIR/CNPq), Brazil.
lluz@unir.br

Luiz Carlos Cavalcanti de Albuquerque
PhD in Psychopedagogy from the University of Coruña, Spain. Bachelor in Psychology. Professor of Professional Orientation and General Psychology discipline and Researcher in OBSAT and GEISC of the Federal University of Rondônia, Brazil.
carlos_lula@hotmail.com

Abstract

In organizations, we seek to adapt to the good practices of a relationship with nature, transforming technologies, processes and structural and productive redesign. Reflections such as these motivate

research supported by the Institutionalist Theory and the assumptions of sustainability. The general objective here is to carry out a theoretical-conceptual study on the instrumental character of the concept of sustainability in focusing to the of institutionalist theory; and to the results, the specific objectives of contextualizing the concept of sustainability (1), addressing the main concepts raised in the face of institutionalist theory (2), and analyzing the approach of the conceptual perspectives considered in this research (3). The question to be answered in this study is: what is the instrumental character of the concept of sustainability in the face of institutionalist theory? The Content Analysis Method and data analysis techniques are applied in qualitative research, such as cleavage and categorization. As a result, it brings a virtuous circle of conceptual relation in evidence; points out inequality of behavior in organizations, making it difficult to achieve sustainability; Criticism points to the lack of employee awareness of the rules. We also look at organizational levels that reflect on sustainability. Conceptual applicability converts the commitment to protect and conserve natural resources, while at the same time channeling real benefits to all who are around the institution that promotes the activities. These concepts will result in a balance between the constraints that lead to scarcity and progress on the sustainability tripod; are isomorphic measures that are somehow beneficial in the relationship between the environment and the social and economic.

Key words: Institutional Theory, Sustainability, Organizations, Management, Environmental Practices.

1. INTRODUCTION

The demands for economic efficiency and productivity were disregarded in sustainable organizations of the past. The new scenario predominates the emergence of sustainable development, now with cultural paradigmatic changes, with the objective of impacting social tensions, environmental degradation and other effects that demand desirable practices as a priority in this context. In order to meet good environmental, social and economic practices, organizations seek to adapt, transforming their technologies, processes, redesign of production, structure; for this, they continue to redirect their mission, vision and corporate goals. Such reflections motivate this empirical research, supported by the Institutionalist Theory and the assumptions of Sustainability, in an attempt to reconstruct perspectives that serve as instruments in organizational studies. For this, the general objective is to carry out a theoretical-conceptual study about the instrumental character of the concept of sustainability in the face of institutionalist theory; and as specific objectives to contextualize the instrumental character of the concept of sustainability (1) to deal with the main concepts raised in the face of institutionalist theory (2), and to analyze the approach against the conceptual perspectives considered in this research (3). The question to be answered in this study is: what is the instrumental character of the concept of sustainability in the face of institutionalist theory?

The study contributes to the discussion of how institutional concepts can contribute to explain behavioral changes in organizations in face of social demands in relation to sustainable practices. It allows the confrontation of diverse and sometimes antagonistic positions in the Sustainability debate, and can be an argument in public and private institutions committed to sustainable development and corporate social responsibility.

2. THEORETICAL-CONCEPTUAL REVIEW

Faria and Marques (2017) report that organizations behave according to environmental influences, their concrete variables, such as the use of technology in processes, as well as shared values, beliefs and myths among its members. With regard to sustainability, there is a growing behavioral equality in organizations, considering their reports and their disclosure with elements demonstrating the inherent interests of environmental issues that concern society, especially compliance with regulatory standards.

According to Pereira (2012), the new organizational structures are adapted to the recent management models, which is characterized by the opening to new trends and standardized behaviors, among other characteristics that demonstrate a transition or rupture in the face of accelerated unpredictability or complexity incident to the institutions. The Institutional Theory starts to gain space in organizational studies, especially for providing different interpretations on how to understand implicit standards, in addition to supporting the significant diversity in organizations.

According to Jacometti et al. (2016), in Institutional Theory, social practices are determined by institutions, as they confer certain probabilities of action to the detriment of others. One does not have the understanding about the uniformity in precepts, that is, it does not depend on the will of those involved; but they arise from the institutionalized reality, with concrete typifications about how phenomena are revealed in the organization. However, the subjects' passivity is not deduced, or that these subjects are positioned in different realities, since the prism comes from the same pressure that causes them to manifest themselves by similarity of behavior.

Faria and Marques (2017) report on Meyer and Rowan's view of institutional theory, pointing out that it addresses the influence of institutional dynamics on companies, as well as their need to legitimize themselves before the social, institutional and economic agents. In this way, the process of institutionalization creates myths that cause individuals in organizations to respond, now adopting the best models and practices that are usual in the market where they operate. Thus, the institutionalist theory was chosen in this study because it proves to be a valid instrument to explain the behavioral change in the organizations, in face of the social demands with respect to the sustainable practices. In addition, the influence of its precepts on organizations, results in the projection of changes in the behavior of its members, in several aspects, which drives improvements in the compliance with procedures, rules, laws, values, certificates, norms, beliefs and meanings.

2.1. Concepts and definitions of sustainability in view of its instrumental character

Silva (2013) discusses the concepts of variables to be considered in studies related to the environment, sustainable development and sustainability; this author makes it clear that the conceptual strands hitherto exposed have not yet been consolidated, which implies generating new academic records in order to provide references in this approach. So much so that Amador and Faustino (2016) and Boff (2017) affirm that the concept of sustainability has been gaining ground in modern society, and has come to mean the commitment of economic exploitation in a conscious way. Therefore, this concept, coupled with the concept of development with conservation and preservation of resources, for future societies, allows full reflections that satisfy social, economic, environmental, cultural and institutional interests.

Boff (2017, p.4) defines that real, true, effective and global sustainability combined with the preservation of natural resources. For him it is the only way to provide care for the planet and human and animal life, thus overcoming the risks of extinction. The author also conceptualizes sustainability as a set of processes and actions that aim to maintain the life and integrity of the planet, the preservation of ecosystems and its range of physical, chemical and biological elements that allow the existence and proliferation of life, continuity, the enlargement, the concretization of the human capacities in its various faces.

According to Munck, Bansi, Galleli, (2016), the definition of the Triple Bottom Line (TBL), involves the achievement of sustainability, when organizations should invest in their economic, social and environmental capitals, because these pillars are interrelated, in this way a relation of cause and effect between them. Philippi Jr., Sampaio and Fernandes (2017) remind Marrewijk (2003) to conceptualize corporate sustainability through the tripod of environmental responsibility, social responsibility and economic responsibility; these record that corporate sustainability assumes five levels of commitment and integration of the company with society, namely, legality, investment, responsibility, synergy and integrated sustainability.

Cassar (2013) reports that sustainability can be considered as a process of transformation, and the limitations of sustainable development are in the management, improvement of new technologies, and social organizations, linked by educational criteria that start with awareness. Thus, according to Dias (2015), learning for sustainability is introduced, which always results in the incorporation of organizational strategies. This scenario minimizes economic, social and environmental risks, as well as providing change in the organizational culture and in the minds of the individuals involved. Through existing concepts in the literature, it is possible to affirm that sustainability brings the prospect of a promising future, including in the productive sector, as long as it essentially includes rational values, which benefits the whole society.

2.2. Main concepts of Institutionalist Theory valid for the instrumentalization of sustainability

Institutionalization is a process of organizational structuring that takes place over time, reflecting on the particular history, the staff working in the organization, the groups that operate for different interests, as well as how everyone adapts to the same environment. The degree of institutionalization of an organization depends on the level of personal and group interaction. Thus, it is observed that the more specialized and technical the operations in an organization are, and the more precise the purpose of the organization, the less likely the internal and external agents will negatively affect organizational development. In this way, it is possible to consider that awareness for sustainability implies the institutional diffusion of this concept of value of the organization, adding this to the technical requirements in the task environment, following the prescriptive approach in Quinello and Nascimento (2009).

Casagrande and Lavanda (2015) concluded an analysis of the relationship between corporate governance and sustainability, based on the legitimacy and approach of institutional theory. They produced the definitions in Table 1 below.

Table 1: Theoretical convergences between institutional theory and the approach of legitimacy, corporate governance and sustainability.

Term	Definition
Institutional Theory and legitimacy	Institutional theory works with the concept of social construction, and considers social processes, schemas, rules, norms and routines. Seek to deal with authority guidelines for behavior. It allows the central view that legitimation takes place through a collective construction of reality, in which the elements of a social order are seen in line with norms, values and beliefs that people share.
Corporate Governance	The adoption of corporate governance precepts has been widely recognized as essential for access and acceptance of market structures. Corporate governance also acts as a catalyst for sustainability action as it addresses the importance of value creation and balance between economic, social and environmental issues in decision-making.
Sustainability	The organizational changes that bring to legitimacy in environmental and social issues have been shifting towards greater responsibility in the organization. Thus, sustainability studies began to approach transparency in a systemic way, in the economic, social and environmental dimensions, influencing significantly in the corporate decision making.

Source: Adapted from Casagrande and Lavanda (2015).

As Rezende (2013) explains in Institutional Theory, organizations function as a system of rules and incentives to behavior, in which individuals seek to maximize their usefulness by constructing procedures to simplify the interaction process. And the studies in Piaia (2013) point out that institutions must structure political, economic and social interactions in the conformity of informal rules, such as sanctions, taboos, customs, traditions and code of conduct; formal rules such as constitutions, laws and norms are also imposed there.

2.3 Definition of the doctrinal perspective located in the environment of sustainability in the contribution of the instrumentalization in the organization

In the institutionalization is adopted actions for sustainability that become habitual in the scope of the organizations. They are, as a rule, referring to the behaviors adopted by individuals or groups, sometimes objectifying resolution of common interests. When there are efforts to resolve conflicting issues, organizational problems are indeed solved. However, there are several conflicts that can be solved through categorization of actions, considering the adoption of measures conventionally practiced in the organization to contemplate logical arguments, such as those related to sustainability. Issues such as those related to socio-environmental issues, problems related to the recycling of waste, or those related to the extraction of raw materials in the environment, or displacement of residents for economic purposes.

Pereira (2012) refers to Clegg and Hardy to affirm the constant of Table 2 below. There, the process of institutionalization can be measured in stages to be advanced by the workers, in order to establish strong social relations and normative rules to be understood in an objective way. It is in this way that the organizational identity diffuses among the employees, through a certain fluidity.

Table 2: Stages of institutionalization and comparative dimensions

Dimension	Pre-institutional internship	Semi-institutional internship	Internship of total institutionalization
Processes	Habitualization	Objectification / generalization	Sedimentation
Characteristics of adopters	Homogeneous	Heterogeneous	Heterogeneous
Impetus for diffusion	Imitation	Imitation / normative	Normative
Theorizing activity	None	High	Low
Variance in implementation	High	Moderate	Low
Structural Failure Rate	High	Moderate	Low

Source: Adapted by the authors from Pereira (2012).

A search carried out in Munck, Bansi and Galleli (2016) indicates the existence of several divergences on the responsibility of practice aiming at sustainable development, which gives rise to new thematic conclusions. What was the responsibility of the rulers was now the responsibility of the organizations. However, organizations deplete environmental and social resources daily, leading managers to rethink their processes. Thus, Santos (2013) affirms that society began to consider the environment as a new element in the support of relations and decisions; as a consequence of this fact debates and studies on the environment, sustainable development and sustainability are added, as an instrument for measuring these elements in the institutions. This premise guides the researchers and consultants in the search for and understanding of the necessary changes, in order to meet the principles that emerge from this relationship.

The definition of Silva (2013) on sustainability deserves attention. For this author, the term means the dynamic balance between the social, economic, ecological, geographic and cultural dimensions, in the way of the encounter of systemic solutions that allow an articulation of equity, justice and freedom, through the rights of individuals.

3. METHODOLOGY

This interdisciplinary study is based on the Content Analysis Method which, as suggested by Bardin and treated in Cavalcante, Calixto and Pinheiro (2014); this method involves several techniques of organization and data analysis in qualitative research. It gathers techniques used to describe a content in a communication, either by means of speech or texts; this task uses communication by selected texts. Systemic procedures are supported to assist in the collection of theoretical-conceptual codes and, in this way, provides inference of content treated in the format outlined in this methodology.

Cavalcante, Calixto and Pinheiro (2014) show that the choice of method can be explained by the need to overcome the uncertainties caused by assumptions, or by the need to enrich reading using the understanding

of meanings; includes generating transparency in the hidden relationships that can be brought to context, and then interpreted in the light of the subjectivity of the researcher committed to the critical analysis of the content under treatment.

A study in Oliveira (2008) allowed to know that several authors define different techniques that can be used to elaborate a Content Analysis, such as the thematic or categorical analysis applied in this task. For the present study we opted for this technique of Discourse Analysis by Category, following the prescriptions of Cavalcante, Calixto and Pinheiro (2014) and Oliveira (2008); and this task is divided into three stages, and subdivided into nine (9) sub-stages, as shown in Figure 1 below.

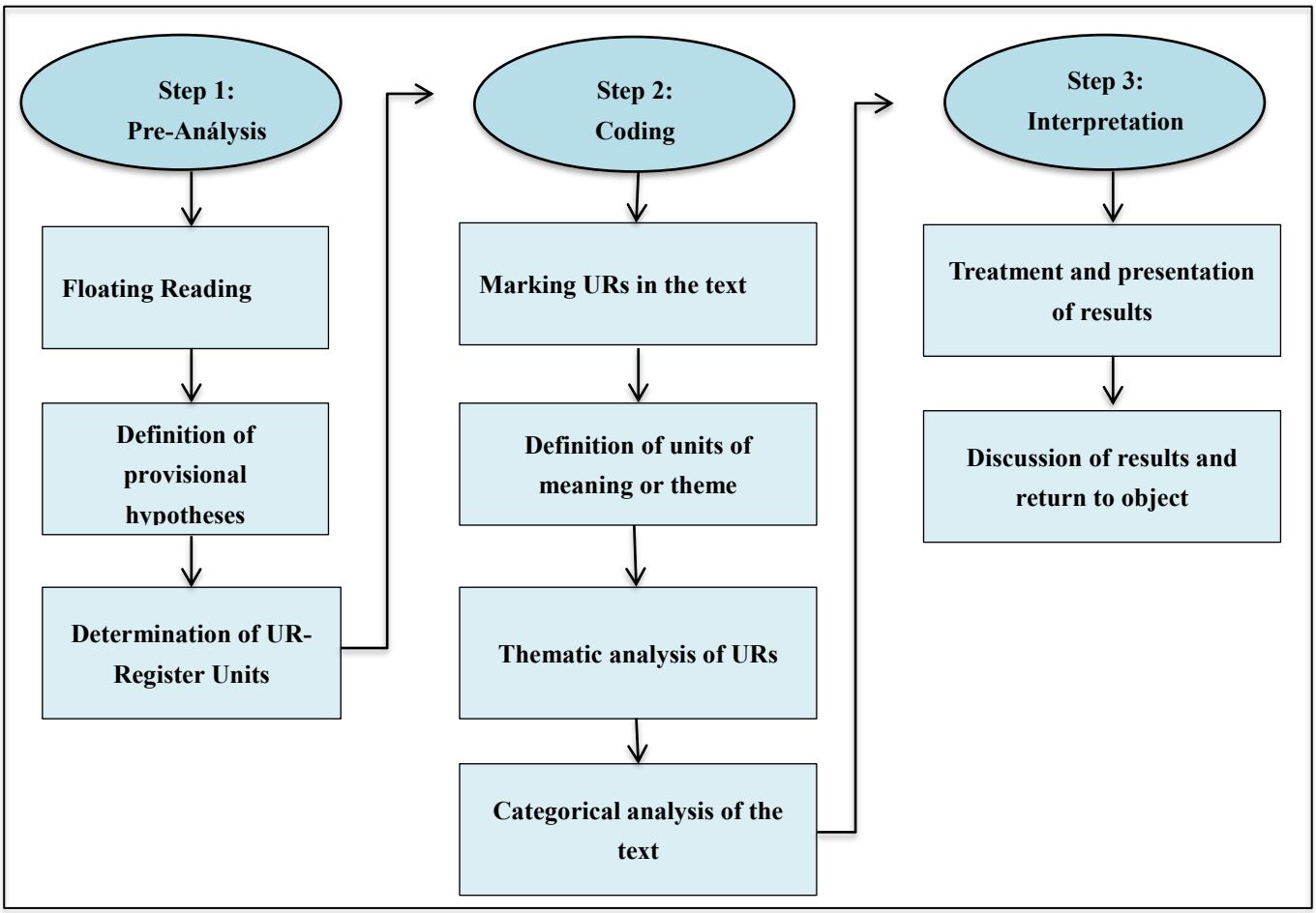

Figure 1: Stages and sub-steps of the Content Analysis Method based on Cavalcante, Calixto and Pinheiro, (2014) and Oliveira, (2008).

Source: created by the authors.

Cavalcante, Calixto and Pinheiro (2014) define the steps, and Oliveira (2008) defines the steps and sub-stages of the Content Analysis Method, by categorization, as discussed below. In the pre-analysis stage are chosen the documents or studies that will be used in the analysis of content; here also the hypotheses are formulated, the objectives of the analysis; it also defines the indicators that will inform the final interpretation of the research work. According to Oliveira (2008), the floating reading deals with the exhaustive interpretation of the texts to be analyzed, so that the researcher allows himself to be freely

involved with the content; allows the construction of hypotheses, always provisional, about the object under study or the contents of analyzed text. The determination of the units of registration (UR) refers to the choice of the type of words, phrases, paragraphs, themes, object or reference, character, event, document; will be used throughout the analysis, in order to allow the application of quantification or frequency rules. It is at the stage of coding or exploiting the material that the raw data are systematically transformed and aggregated into units; such units provide an exact description of the characteristics relevant to the content expressed in the text. The marking must be carried out from the beginning to the end of the text of each observed UR; most of the text must be transformed into UR. Next, the association of RUs with units of meaning or themes must be carried out; that is, each theme will consist of a set of UR. That said, the thematic analysis of URs must be carried out; here the quantification of the themes in number of UR, and then the categorical analysis of the text is carried out, based on the determined themes and their quantification; the dimensions in which the themes appear must be defined, grouping them according to the theoretical or empirical criteria, and the hypotheses of analysis obtained from the context.

In the interpretation phase, the information provided is explained, the results can be presented in the form of descriptions, accompanied by an example of significant registration units for each category, or in the form of tables and graphs, tables followed by descriptions and others. Finally the discussion of the results and return to the object of study is made, since the categories follow in the logic printed by the researcher; represent the reconstruction of the discourse, its intentionality to re-present the object of study, besides allowing a specific theoretical view. This logic applied to the object of study and the derived theoretical constructs need to be pointed out, in terms of the object reconstructed by the analysis in a work after the application of the technique.

4. STUDY ON THE INSTRUMENTAL CHARACTER OF THE SUSTAINABILITY CONCEPT

In this result will be treated on the contextualisation of the instrumental character of the concept of sustainability in the face of Institutional Theory. For this, the treatment of the collected notes is entered following an analysis of the approach and perspectives considered in this study. The rules of preparation are those outlined in the previous topic and the task has the scope delineated in the virtuous circle as in Figure 2 which follows.

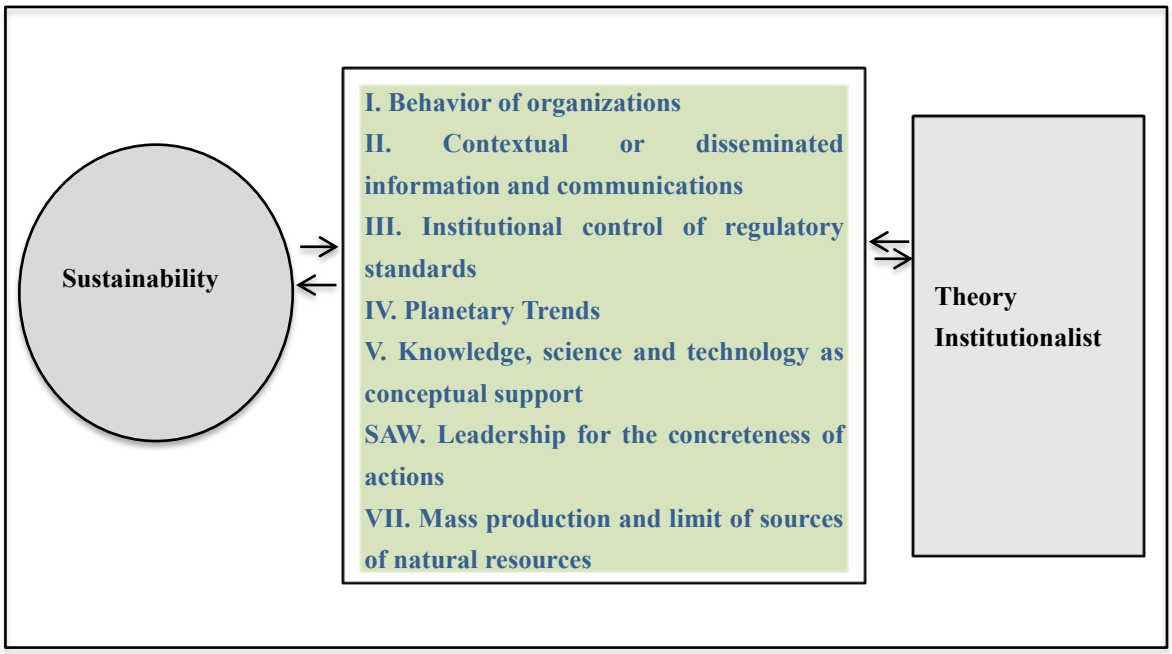

Figure 2: Virtuous circle of conceptual relation.
Source: created by the authors.

Bibliographical search in Faria and Marques (2017) points out a significant inequality in relation to behavior in organizations, a complicating factor that greatly hinders the achievement of sustainability. The fact is due to the lack of awareness of the employees in the institution, because they are affected by the lack of information about the socio-environmental relationship. Issues such as these are, in general, rather obscure, and it is reasonable to attribute to the lack of objective regulations, unworkable laws and operating norms, or political interference that negatively influence the organizational environment. Therefore, the arguments of Pereira (2012) deserve credit when addressing the new trend in organizational studies; such logical arguments satisfy in the construction of applicable instrumental concepts; this author turns to the interpretation of the Institutional Theory pointing to implicit normative standards to be interpreted by those involved in management, independent of the various forms of vision of those who seek to define sustainability within the realm of conjunctural reality. It is clear that they could enrich the concepts in the direction of improvements, providing attitudinal actions such as maturation of constructs, notes of idealizers, formatting of rules, and monitoring of cognitive actions.

A complementary study in Machado and Fialho (2018) supports an analysis of constructs in evidence. Here knowledge is the basis prescribed by these authors, since the information-interconnected society gives rise to several prisms of conscious vision to act, because in the digital era fast facilitators are optimized by communication technologies, with a retransmission of planetary reach allowing to attend to the global emergency on issues related to sustainability. Now, this theoretical complement indicates the possibility of network sharing, with positive effects on organizations. Then, the constructs generated by this knowledge can be reworked, treated and disseminated among institutional participants.

The idealization in the format of conceptual development of sustainability in organizations, according to the studies of Silva Filho et al. (2016) became part of modern society if the environmental impacts resulting

from the mass production of consumer goods and services were observed. Decision-makers now feel the need to reconcile the means of production with sustainability, even because they could prove their socio-environmental responsibility and even use such initiatives for the marketing of their business. In this way, they create institutional mechanisms that transform their processes, creating alliances against the devastation of natural raw materials, while mobilizing efforts for readjustment practices in the face of scarce resources, always benefiting future generations.

Reading in Buainain (2014) made it possible to conclude on the recurring concern of the limitations that impact the competitiveness of organizations in the market. Significant adjustments are now being made to the macro institutional constraints, now pulverized by rules and standards focused on supporting sustainability. Demands of environmentally correct consumers imply a posture for cleaner production, in which they employ technologies that are much more compatible, such as the reorganization of production, for example, disciplined by general and sectoral policies of protection of natural resources, confirming their form of task corresponding to the new requirements of the market. Already Faria and Marques (2017) treat the Institutional Theory from the perspective of its influence in the business dynamics, being established in the need of the legitimation that weighs on the social, institutional and economic agents. It is concluded that myths are created in the process of institutionalization, aiming at better practices in the market, such as a subsidy learned from the community, such as social technologies that express not only the level of knowledge of reactive groups, who offer their knowledge in a complementary way results.

Mapurung, Lima, and Holanda (2015) argue that the search for social legitimacy in organizations, argued above, is based on three pillars or institutional elements that follow; the regulative, which are rules and laws; the normative, in the case of certification, and of accreditation, and the cognitive in which isomorphism predominates. They emphasize the cognitive pillar, emphasizing isomorphism as a mechanism of institutionalization, emphasizing the relevance of the subjectivity of actions and their interpretations, in which symbols and meanings shared in social reality are valued. It is when individuals act under rules constructed from their social interactions, beyond objective reasons, such as constraints, somehow imposed, that they unconsciously fulfill. Thus, if configures the conception of an ample system of belief considered as natural and unquestioned.

Jacometti et al (2016) report that in institutionalized organizations, that is, where there is determination of how processes should occur, social practices are explicit, with properly defined attributions, which results in a greater probability of blocking those actions that, institutionally inflict organizational relationships at the expense of sustainability. Social practices do not tend to be aggregated in a uniform way regardless of the will of the individuals involved, but rather tend to produce typologies of behavior.

4.1 Contextualization of the instrumental character of the concept of sustainability

The comments of Amador and Faustino (2016) and Boff (2017) deserve credit when they report the innumerable environmental impacts caused by organizations from various angles, with emphasis on their productive process, which in itself becomes a reality of practices in today's society. They bring about the wear and tear on the natural sources of raw materials, while pointing out the complexity surrounding environmental awareness itself, and the pressure for its managers to commit to cleaner production means

in order to preserve natural resources. Boff (2017) emphasizes care for the environment and thus prevents the extinction of natural resources and, consequently, the human species itself; the author proclaims the benefits obtained from sustainable means of production, since they aim at maintaining the life and integrity of the planet; asserts that it is possible to coexist the productive systems without depriving the continuity or expansion of said means of production, which can be guaranteed thanks to the human capacity to adapt to their performance.

Significant instrumental concept is dealt with in Philippi Jr., Sampaio and Fernandes (2017) and Munck, Bansi, Galleli, (2016). These authors discuss the Triple Bottom Line (TBL), defining that sustainability in organizations involves three areas closely related by actions undertaken for cause and effect in direct reciprocity; has an economic, social and environmental effect, as can be seen in Figure 2, which demonstrates the cited instrumental character of sustainability in organizations; Table 3 below shows the details.

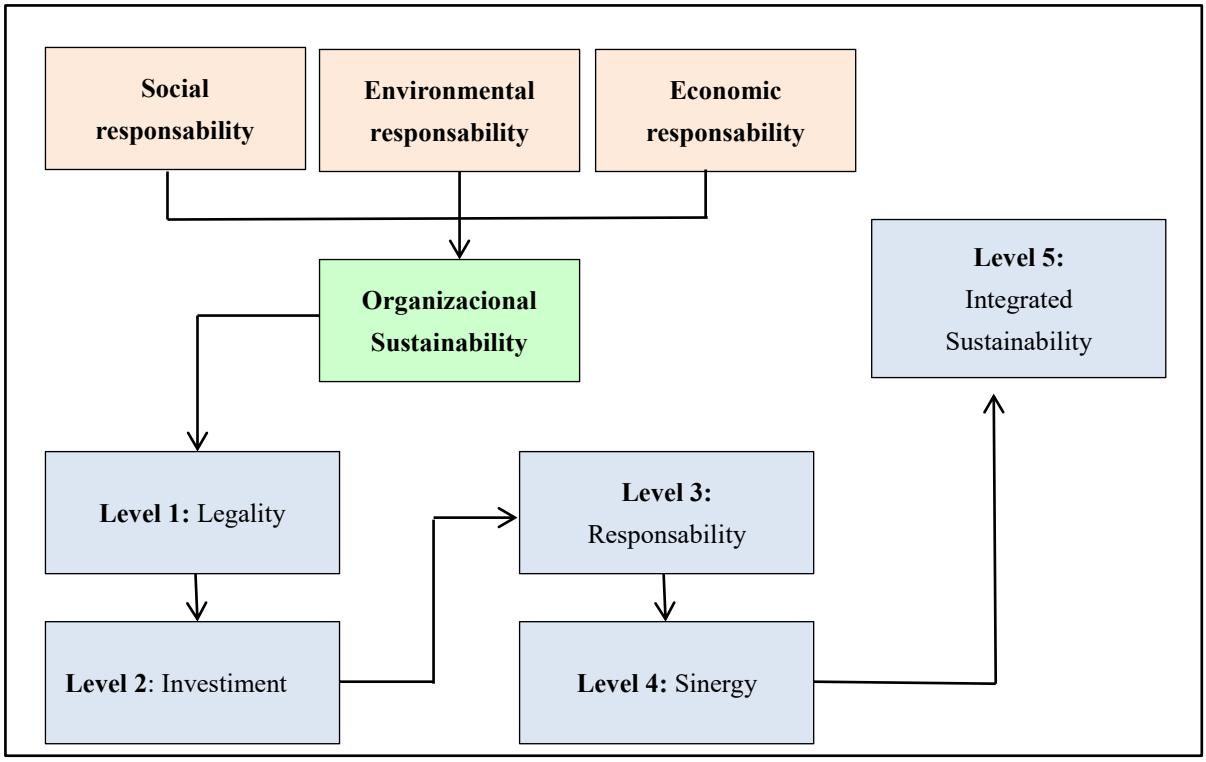

Figure 2: Sustainability in view of its instrumental character.

Source: Elaborated by the author from a study in Marrewijk (2003) apud Philippi Jr., Sampaio and Fernandes (2017).

Table 3: Sustainability in view of its instrumental character

Instrumental character of sustainability	Corporate sustainability according to levels of commitment and integration of the company with society
Social responsability	Practiced through actions that involve social value.
Environmental responsibility	It involves actions that aim to keep the environment balanced.
Economic Responsibility	These are actions that will generate values, through the reduction of expenses, that can later be implemented in actions of environmental and social responsibility.
Level 1: Legality	Performance in compliance with legal observances, such as correct behavior and obligation.
Level 2: Investiment	Social and environmental investment as a way to increase profits and improve reputation.
Level 3: Responsibility	Go beyond legal compliance and profit opportunities to act with social and environmental responsibility unrelated to gain.
Level 4: Synergy	Socio-environmental contextual attitude; corporate performance associated with stakeholder gain; sustainability as an intrinsic value inevitably recognized.
Level 5: Integrated Sustainability	Integrated and integrated sustainability in all aspects of the organization as a key to the future, the only social and economic alternative. The present responsibility is the guarantee of survival.

Source: Prepared based on Philippi Jr., Sampaio and Fernandes (2017).

Environmental responsability allows the environment to be balanced, in accordance with regulatory standards, based on an obligation of all to ensure that these are fulfilled. Managers can practice environmental responsibility through control; for example, whether there is treatment of the waste generated in the production processes, or the treatment of effluents and discards incurred; these controls are precarious and cause the emission of pollutants with significant damages to the elements of nature.

Organizations can take actions that go beyond their normative environmental obligations, when they generate modern instruments in favor of sustainability; for example, the development of wildlife protection programs in a given region; are actions that can be initiated with the environmental education to the community of its surroundings, that very much help the concretion of public policies; another measure could be the depollution of soils, rivers and lakes present in the sphere of their physical reach; all these measures give him the respectability and the recognition of the society.

Already the social responsibility of an organization involves the professional qualification of the internal and external collaborators, the school education in support to the families assisted by its programs, or to the resident community in its surroundings; it includes investments and incentives for sports and leisure, measures aimed at health care and community welfare, managerial attitudes such as these that generate the value that are recorded in their social balance sheet.

Economic responsibility includes actions within the organization involving the generation of employment and income for the beneficiary populations of the goods and services offered to the consumer market. It implies investments in new machinery that reduce the consumption of electricity, or in new technologies

to treat the waste generated. They are measures that improve economic results, with full employment, in the face of public policies, such as the orientation towards the reuse of leftover raw materials or their discards; the reduction of costs with water and energy consumption, optimization of its industrial park, with the improvement against the depreciation of machines and equipment, resulting in lower costs and efforts to those involved in the production process. It is also the measures that somehow promote environmental or social sustainability, but that result in economic effects to the enterprise.

The observations of Cassar (2013) and Dias (2015) in which they define that the practice of sustainability by the organizations involves an internal transformation, where the management is its great propeller, being decisive for the success of its results. Thus, the transformations involve the improvement of more sustainable technologies, the dissemination of educational criteria among employees and community, in which they aim to raise awareness among individuals about related issues. In this way, corporate sustainability always results in the incorporation of strategies that seek to minimize economic, social and environmental risks, providing a change in the organizational culture and in the minds of the agents involved.

4.2. Treatment of the main concepts of sustainability in the face of Institutional Theory.

Quinello and Nascimento (2009) explain about the long process that is the institutionalization in an organization; according to these authors, this incurs an organizational restructuring in order to meet the rules of the environment to which it belongs, since it is in this scenario that the factors that significantly influence this process predominate. It is for this reason that the historical reflections that reveal the particularity of each organization, amalgamated to the technical body that influences the interests and the adaptive capacity predominate. These authors complement the main meaning of institutionalization which, according to them, involves the inclusion of an organization in the environment impregnated by rules and in complexity to obtain legitimacy, as well as instilling values supra in the pre-established requirements in their own context.

Study in Rezende (2013) brings about the phenomenon of the institutional functioning of the organization as a system. The rules and incentives become part of their context, multiplying the meaning of its usefulness in the environment. These rules may be informal, structured by sanctions, taboos, customs, traditions and code of conduct for institutional behavior; may be formal, such as the constitutions, laws and norms specified in Piaia (2013), useful in the political, economic and social interaction that regulate or are part of organizations. In Vicente and Portugal (2014) it was possible to find an account of the operationalization of these rules and standard procedures; incorporate the institutionally established by the environment, modeling the conduct to be followed and, if the organizations do not meet such precepts, would hardly reach the legitimacy expected by the market.

Vicente and Portugal (2014) focus on the pressures on companies from institutionalized environments. These organizations begin to express similarities, that is, due to regulatory pressures determined by law, for example, impact their strategies, as they influence decision making. This is the idea of isomorphism, a process derived from assimilation and institutional similarity; although it can help to understand the external environment, determines the actions in the companies creating barriers to innovation and

competitiveness. In fact, firms can undergo isomorphism under two spheres, namely, competitive and institutional. The isomorphism under the competitive sphere deals with the rational question in which the market is observed, changes of segments, areas of action in the scope of competition; since isomorphism under the institutional sphere defines how organizations compete with each other for resources, legitimacy, and power.

It was possible to know in Munck, Bansi and Galleli (2016) the varied market demands on companies regarding environmental issues and process sustainability. It begins with the understanding that organizations exhaust daily environmental and social resources without control. Thus, according to these authors, the fact has led institutional managers to rethink the productive processes. Therefore, what was previously held to be the responsibility of the rulers is now the responsibility of organizational managers.

Pressures suffered by companies in institutionalized environments are reported in Quinello and Nascimento (2009); are the regulatory forces, cultural-cognitive forces, and normative forces, and are shown in Figure 3 below; in Table 4 comes the treatment regarding the convergent theoretical model of the institutionalization of the process of organizational sustainability.

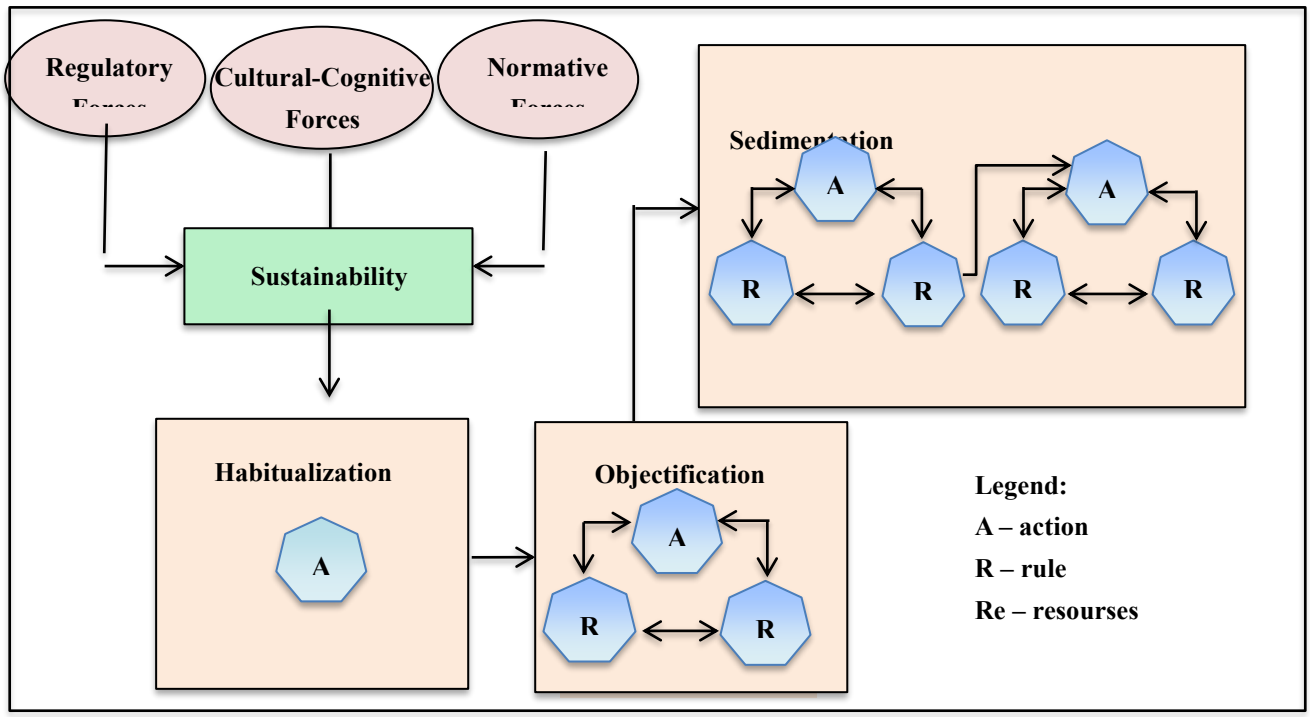

Figure 3: Convergent theoretical model of the institutionalization of the Sustainability process
Source: Adapted by the authors from Quinello and Nascimento (2009).

Table 4: Specifications of Institutionalist Theory in Operational Perspective

Elements	Specifications
Regulatory Forces	Organizational structure, rules, procedures, organizational systems, sanctions and laws.
Cultural-cognitive Forces	Systems with shared meanings, dominant identities, schemas, beliefs and meanings.
Normative Forces	Social obligations, expectations, norms, valued rules, values, certificates and credentials.
Sustainability	Set of actions aimed at natural resources processed from human action preserving the capacity of the environment.
Habitualization	At this stage, the organization seeks to create new structural arrangements in response to uncertainties, organizational problems or specific goals, innovating;
Objectification	The search for a more consolidated and permanent stage follows the diffusion process of the new structure in response to the new challenges.
Sedimentation	Here is the continuity of the trajectory, scope of the diffusion and the long-term survival of the actions / projects adopted aiming at sustainability.

Source: Elaborated by the authors based on Quinello and Nascimento (2009).

Treatment on the one demonstrated in Figure 3 and explained in Table 4 allows to affirm that in the institutionalized environment, the organizations undergo pressures, many times of regulative, cultural-cognitive and normative forms, as explicit in Quinello and Nascimento (2009). In this case, such a cognitive scenario allows restoring actions that aim to conserve natural resources, preserving the capacity of the environment. According to these authors, companies tend to go through a process of habitualization to new rules and requirements, seeking to create new structural arrangements to meet specific goals; in this case, about environmental issues. Next, the organizations undergo a process of objectification, where they seek to follow the diffusion process of the new structure; is a response to the new challenges, where there is a need for social consensus among managers regarding the value of sustainable production for the organization; thus, the diffusion of the new model of sustainable production begins to occur in full in the form of the demonstration diagrammed in this document, whose concreteness results in a virtuous circle of excellence. Ultimately, organizations go through the sedimentation and continuity of their actions or projects employed to meet such positive marketing demands regarding sustainability in the organization.

4.3. Analysis of the approach against the conceptual perspectives

It is worth analyzing the position of Pereira (2012) when defining the process of institutionalization of organizations by levels. As they advance, these levels tend to establish strong social relationships, while rules and norms become clearly understood. Significant is knowing the level of organizational levels that reflect the sustainability of organizations. According to the perspective of Pereira (2012), the first level is the one of the Pre-institutional stage, phase where the process of habitualization occurs in this study; prevails the impetus for contextual diffusion, while tending to imitate best practices from other institutions of the same context or specialty. This variance implements significant new practices, always resulting in an institutional identity. Already in the semi-institutional stage, the organization goes through the process of objectification, while its members will be motivated to continuous diffusion by imitation, but it has a certain normative influence, consubstanciada in obligations imposed by society, in order to meet internal and external expectations; in addition, seek to meet norms and rules, among others, culminating in the variance of the implementation of moderate practices. Finally, there is the total stage of institutionalization, in which the organization will go through the sedimentation process, through the continuity of the actions and projects disseminated in the previous phases; organizations now meet the demands of the market, with a force in the diffusion of practices, in a normative way, and their variation can be considered low, since it is in fact consolidated in the scenario where it operates. Figure 4 illustrates the operational perspective of sustainability assessment in organizations, and Table 5 shows the related descriptions

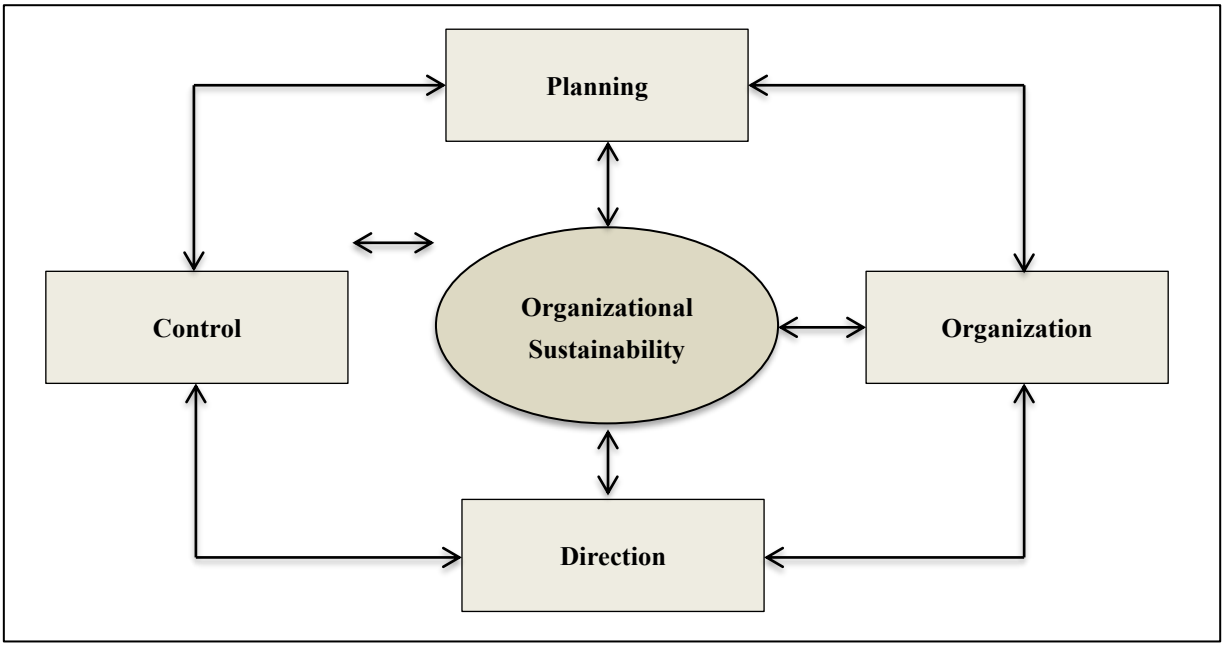

Figure 4: Diagram of the evaluation of the operational perspective of sustainability.
Source: Adapted by the author from Chiavenato (1999).

Table 5: Specifications operational sustainability assessment

Items	Specifications
Organizacional Sustainability	Provision of services and the production of consumer goods in a sustainable manner, such as the environmental services required by society.
Planning	Definition of plans in the face of objectives and proposals for organizations, through adaptation of goals that satisfy the socio-environmental relationship.
Organization	It configures the structure of processes to achieve sustainability goals while pooling the essential resources to achieve results.
Direction	Action and dynamization through people, implying decision, orientation, leadership and coordination of actions coherent with the socio-environmental relationship.
Control	Action to evaluate and measure the planned results, establishing verification in the face of parameters to adopt required adjustment measures.

Source: Adapted by the author from Chiavenato (2014)

Figure 4 shows that for the implementation of sustainable processes in an organization, it is necessary that the planning, organization, direction and control of these processes are interconnected, in support of the sustainable objectives of the organization, always preserving the specific character as contained in Table 5.

Thus, the practice of institutionalization in organizations is consubstantial as a valid tool, because it brings high performance in management, ensuring that the productive processes run with the sustainability expected by employees and the market itself. Here, the three pillars of sustainability, namely, economic, social and environmental, will achieve their effects significantly. Through sustainability, ensured by responsible management, the tendency will be to recognize the organization in the face of its practices, acting in the market with the support of collaborators who will keep with the usuality that allows to identify the organization as efficient in the scenario where it operates.

In this study, a critical analysis of the dynamics processed in the organizations, and which reflects in the consolidation of the institutional sustainability, here the actions of planning, organization, direction and control enter into agenda. According to Chiavenato (2014), planning is a process of setting goals and deciding how to achieve them. The objectives are the specific results consubstanciados by goals to be achieved; so the plan is to put in an orderly manner what is necessary to achieve these goals. Organization as an administrative function is the process that means pooling the resources in order to structure and integrate the resources, when then the bodies in charge of the equifinality will achieve the expected practical results. Direction is the way in which goals are to be achieved, involving not only decision making, but

also the issuance of relevant instructions to be fulfilled by individuals in the application of organizational resources. And, finally, the control process, which seeks to guarantee the perfect functioning, defining the typology of performance and performing the monitoring, through which the performance is compared between the planned and the executed, guided by the established standards; Finally, it includes the corrective action to optimize the scope of the established in the plans, with the desired quality in the evaluation.

5. CONCLUSION

The perception that organizational activities have consumed and degraded natural resources above the capacity for recovery and replenishment in nature, culminated in the emergence of new reflections on the theme. Here, the responsibility for maintaining and preserving the environment, the responsibility of government, has become a credible commitment of institutional managers; now, directly or indirectly, they make use of their resources respecting new rules originating from regulatory agencies. There is no doubt that coercive, mimetic or normative pressures influence project adaptations and actions along the road to corporate sustainability; therefore, they are institutional implicators coming from multiple strands that converge towards the environmental, social and economic relationship. Insisting on these new rules reverts to demands that induce the loss of legitimacy and therefore discredit the competitive action in the market where the organizations operate.

It is concluded that the concepts present in this study regarding sustainability allow to affirm its instrumental character. The conceptual applicability converts a commitment to protect and conserve the resources present in nature, while channeling real benefits to all located in the surroundings of the institution that promotes the activities; if they are linked to the development of production processes, meeting the requirements of regulatory agencies, these concepts will result in a balance between constraints leading to scarcity and progress on the sustainability tripod; are isomorphic measures that are somehow beneficial in the relationship between the environment and the social and economic.

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DEVELOPING ELECTRICAL CIRCUITS FLIPBOOK USING FLIPBUILDER

Mukhlis Hidayatulloh, Iskandar Wiryokusumo, Djoko Adi Walujo
Postgraduate University PGRI Adi Buana Surabaya, Indonesia

Abstract

The students learning outcome in electrical circuits topic are not satisfied. Then, researchers developed an interesting ebook using Flipbuilder that integrated with PhET Simulation software, called electric circuit flipbook. The objectives of this study are: (1) Describing the validity of flipbook based on three lecturers and three teachers; (2) Describing the practicality of flipbook from students respons questionnaire; and (3) Describing the effectiveness of the Electric Circuit Flipbook based on the improvement of student learning outcomes. The development of Electric Circuit Flipbook used ADDIE model. The instruments used are: material, media, and language validation sheet; questionnaire of student responses; and learning outcomes test. The results showed that: (1) The validity of the Electric Circuit Flipbook is very feasible; (2) The practicality of the flipbook is in very practical category; and (3) Flipbook effectiveness is in very effective category. Flipbook electrical circuits developed is eligible to use as a learning medium.

Keywords: Electric Circuit Flipbook, ADDIE

INTRODUCTION

There has been a lot of researches that solve the problem difficulty of learning about electrical circuit material. Fajar (2013: 24) uses an inquiry learning model, only effectively reducing misconceptions in circuit series electrical materials. Hidayatulloh's research (2015: 31) using a scientific approach can only reduce the mistakes of students' concepts with low to moderate criteria. Andriani, et al (2015: 369) using PhET simulations with student's worksheet shows improvement in concept understanding only in low to moderate category.

The results above are relevant to the conditions in the school that will be researched. The pre-research questionnaire given to 40 ninth grader Junior High School of Progresif Bumi Shalawat 2017/2018 academic year stated that 62.5% of students considered science to be an elusive subject, specifically, 80% of them declare that electrical circuit is the difficult material. The reasons are: (1) 37.5% memorizing; (2) 25% many concepts county; (3) 28.1% many elusive terms; and (4) 9.4% the concept is elusive. This is also in accordance with the results of teacher interviews that some students have difficulty in studying electrical circuit material, especially regarding the count.

Based on similar issues, research from Fajar (2013: 24), Hidayatulloh (2015: 31), Andriani, Indrawati, and Alex (2015: 369) suggest other methods to overcome concept errors in electrical circuit materials with interactive media that support learning.

These suggestions have been conducted such as Nurhayati and Mutmainnah (2014: 1) study which states that the students' learning outcomes are increasing with the teaching of demonstration method with PhET Simulation software. Student motivation is improved because the PhET Simulation software provides a virtual display of real electrical circuits. Ghofur research (2015: 179) about the development of 3-dimensional ebook known as flipbook get positive response from students and get mastery learning. Ease of learning and increased understanding of electrical circuit material require media that is able to support the message to be more easily accepted by students and techniques that are able to display the concept significantly according to the cognitive level of students. 100% of students previously described require a handbook to understand electrical circuit material independently and 100% of students agree if given a science ebook equipped with visual animation to assist in understanding the concept of electrical circuit material science. From the results of teacher interviews, students need an ebook that can explain the application of electrical circuit materials, electrical visualization in the circuit, and can make the abstract electrical circuit concept becomes real for students.

Figure 1. Flipbook cover.

The alternative media that can be used is Flipbook. Flipbook is electronic like ebook, but the flipbook can be opened in sheet by sheet. Ebook is very static in nature (can't be opened sheet by sheet), while the flipbook more dynamic and interesting, can be given images, animation, music, video and others. Hull & Chaparro (2006) stated that the students were satisfied with their experience viewing a document flipbook format and participants completed tasks quicker using the Flipbook format of the university course schedule when compared to a website format.

Figure 1. Interactive quizzes for material review

The developed flipbook is made with Flipbuilder software. There is a quiz related to the discussed material created with ISpring software, each question has different music. When students score above the standard of graduation in the quiz, they get the music "we are the champion" as feedback at the end of the quiz. There are interesting videos and pictures related to the material to be discussed, practical tutorial video using PhET simulation software.

PhET simulation software can help the students to understand about material. PhET can be a good simulation to get maximum results in science learning and help students build a conceptual understanding of science. They present authentic scientific practices with appropriate animations that are useful in guiding students' thinking according to expert scientist's thinking. Student learns better when they build their own understanding of scientific ideas within the framework of their existing knowledge. They must be motivated to actively engage with the content and should be able to learn from that engagement. It can be fulfilled by interactive computer simulation. The students view simulations like as scientists view in their real research experiments (Wieman, Adams, & Perkins, 2008). Simulations in a PhET are interactive, students will feel like playing a game of science. In this simulation, PhET emphasizes the relationship between real-life phenomena and the underlying science. PhET is designed like a student to become an expert physicist (Perkins et al., 2008).

Figure 2. PhET simulation tutorial inside flipbook

Figure 3. Pop up video inside flipbook related of the topic

The ebook development research has got positive results in recent years. Research of Perdana (2013: 55) on Interactive Digital Book is feasible category from expert validity, student responses, teacher responses, and effectiveness. Nugraha's (2014: 1) research on bilingual interactive ebook media on heat material feasible in terms of material, presentation, language, illustration, and student responses. In addition, Istifarida, et al (2017: 143) about the ebook based problem-based learning GIS for the improvement of thinking skills are valid and feasible categories.

The errors of the students' concepts about electrical circuit material and ebook development research in the usual form or flipbook can be received well by experts and users both teachers and students. Therefore, a research aimed at developing a flipbook on electrical circuit material that is feasible in terms of the validity of expert and teacher judgment, practicality based on student responses, and effectiveness in terms of student learning outcomes.

METHOD

Creating quality interactive media is an elaborate process that requires an appropriate methodology and expert team collaboration on material, design, and instructional aspects. It starts with the creation of sample chapters that serve as a blueprint for creating ebooks. The sample chapter specifies the digital design for each element in the book, including the page layout that describes how the ebook will perform. To create a sample chapter, the material expert's validator begins to draft the content. Next, Design experts decide what content of the ebook can be improved in appearance, what kind of interactivity to use, and create storyboards for each interactive element (Bartoszewicki, 2013).

One model of flipbook development that suitable the Bartoszewicki (2013) theory is ADDIE which stands for Analysis, Design, Development, Implementation and Evaluation (McGriff, 2000:1). This research develops Flipbook using Flipbuilder and ISpring software integrated with virtual practice using PhET simulation on electrical circuit material.

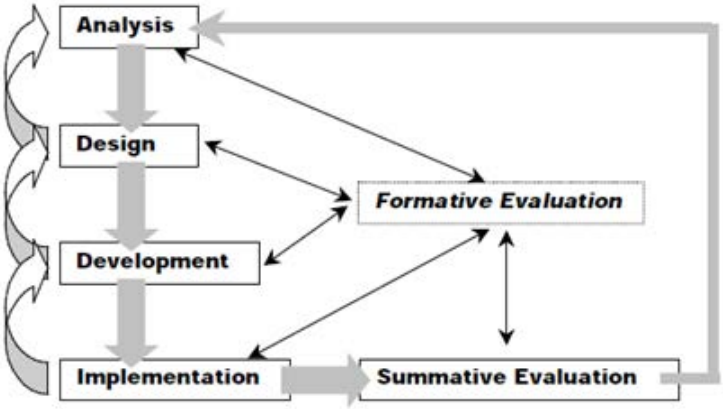

Figure 4 ADDIE Model

Source: McGriff, 2000:1

The developed flipbook is tested on the validator, ie three expert lecturers and three teachers to determine its validity. The average of validators' assessment results is determined by percentage and category according to Table 1.

Table 1. Flipbook validity categories

Percentage (%)	Category
0 – 20	Invalid
21 – 40	Validity is low
41 – 60	Medium
61 – 80	Valid
81 – 100	Very valid

(Source: Sugiyono, 2010)

The practicality of developed media was measured using a response questionnaire given to 40 students of ninth grade of Junior High School Bumi Shalawat Progresif 2017/2018 academic year. After learning using the developed Flipbook, they provide an assessment. The average of student response results is determined by percentage and category according to Table 2.

Table 2. Flipbook practicality category

Percentage (%)	Category
0 – 20	Not practical
21 – 40	Low practicality
41 – 60	Medium
61 – 80	Practical
81 – 100	Very Practical

(Source: Sugiyono, 2010)

Flipbook effectiveness was measured using a write test and analyzed using an N-gain test.

$$\langle g \rangle = \frac{(S_f - S_i)}{(S_{maksimal} - S_i)} \quad (1)$$

(Source: Hake, 1999)

The average of the N-gain test results is used to determine the flipbook effectiveness categories based on

Table 3.

Table 3. Flipbook effectiveness category

$\langle g \rangle$	Category
g > 0,7	High (very effective)
0,3 < g ≤ 0,7	Medium (effective)
g ≤ 0,3	Low (low effectiveness)

(Source: Hake, 1999)

RESULT AND DISCUSSION

The ADDIE development model is fully implemented in this study with no components removed.

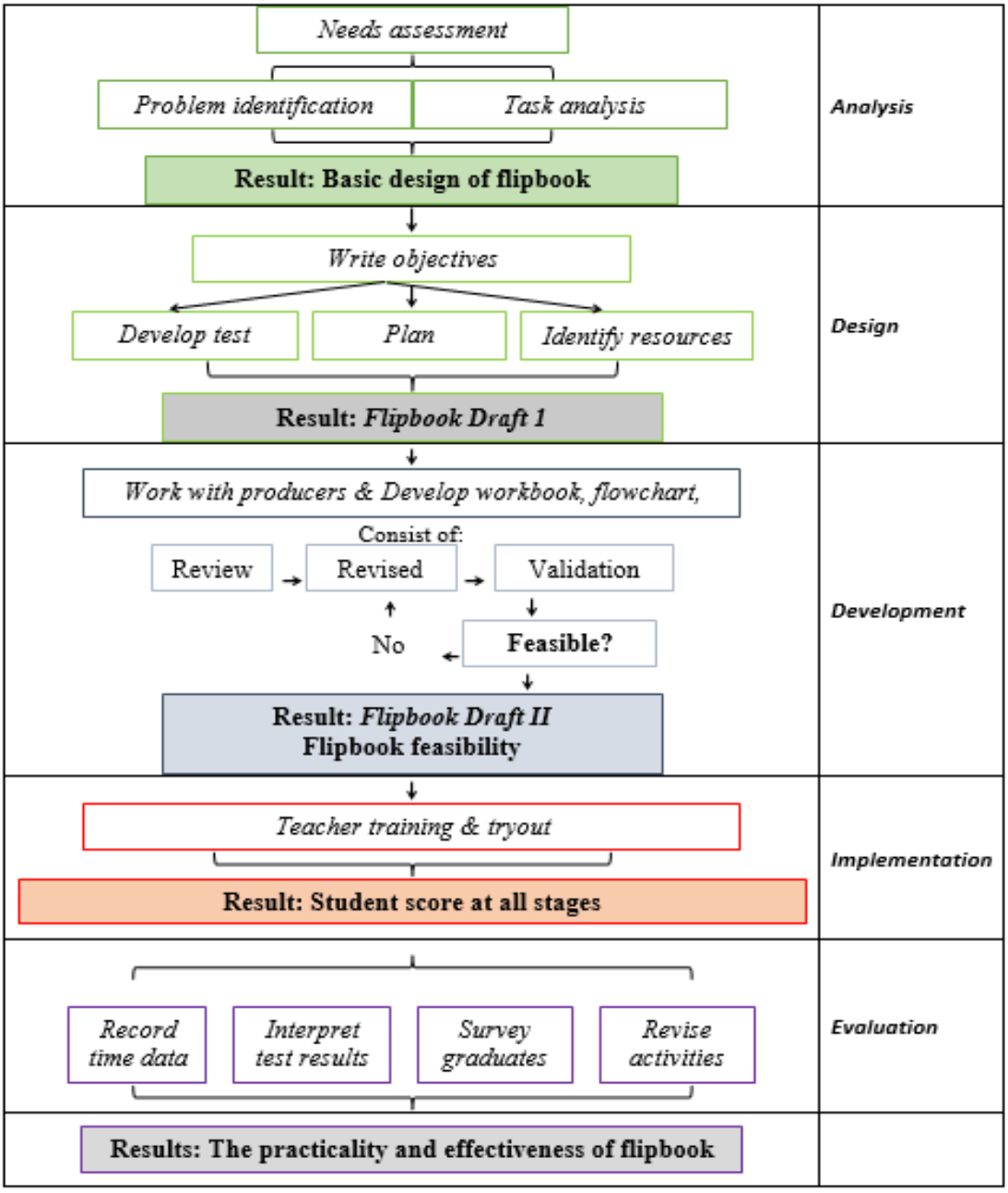

Figure 5. The research flow diagram

Flipbook electrical circuit has been validated by 3 expert lecturers and 3 science teachers. Furthermore, the

pretest is done on 40 students of ninth grade of Junior High School Bumi Shalawat Progresif 2017/2018 academic year followed by a learning activity using Flipbook. Then, students work on postes and fill out a response questionnaire to assess the flipbook.

According to Sullivan (2011) to determine the validity of a learning medium, first, do a literature search for a standardized validation instrument. Next, use expert judgment to assess media based on standard instruments. Therefore, the flipbook validation instrument uses: Instrumen Penilaian Buku Teks Pelajaran Kurikulum 2013 IPA Sekolah Menengah Pertama/ Madrasah: Buku Siswa, BNSP (2014). Validator consists of three professors who are experts in the material, media, and language of science books and three science teachers. Tables 4, 5, and 6 show flipbook validation results based on material, media, and language.

Table 4. The result of flipbook material validation

Indicator	Average	Category
Dimension of spiritual attitude (KI 1)	82%	Very feasible
Dimensions of Social Attitude (KI 2)	94%	Very feasible
Knowledge Dimension (KI 3) Scope of Material	90%	Very feasible
Dimension of Knowledge (KI 3) Material Accuracy	91%	Very feasible
Knowledge Dimension (KI 3) Updates and contextual	90%	Very feasible
Skill Dimension (KI 4)	94%	Very feasible
Average	**90%**	Very feasible

Table 5 The results of flipbook media validation

Indicator	Average	Category
Presentation techniques	90%	Very feasible
Supporting material presentation	87%	Very feasible
Learning Presentation	89%	Very feasible
Average	**88%**	**Very feasible**

Table 6 The results of flipbook language validation

Indicator	Average	Category
In accordance with the development of learners	82%	Very feasible
Communicative	94%	Very feasible
Dialogic and interactive	90%	Very feasible
Coherence and the demands of the thought line	90%	Very feasible
Conformity with Indonesian rules	92%	Very feasible
Use of terms and symbols	92%	Very feasible
Average	**90%**	**Very feasible**

The average of flipbook validation results based on material, media, and language is shown in Figure 7.

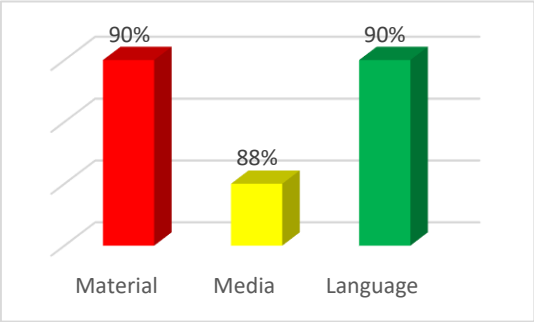

Figure 6. Graph of validation results of each flipbook eligibility criteria

The results of validation by three expert lecturers and three science teachers got an average score of 89% with very feasible category. The developed flipbook has been in accordance with BNSP rules (2014) and is ready to be used for students in Indonesia in science learning on electrical circuit materials

Table 7. Reliability of validation sheet items

Cronbach's Alpha	N of Items
0.983	49

(Taken from SPSS 17)

The reliability value of the question items of 0.983 is greater than Cronbach's Alpha minimum value of 0.6. This means that the items on the validation sheet are reliable or can be trusted as a data collection tool in the research.

The practicality of the flipbook was obtained from a questionnaire of student responses. According to Nieveen (Hobri, 2010) aspects of practicality based on field applications of student responses. The practical aspects of flipbooks are measured based on the clarity aspects of the format, material, media, and language.

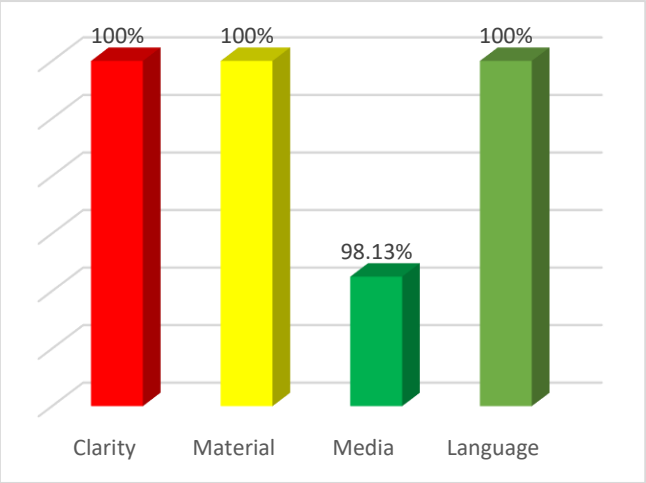

Figure 7. Graph of student response results

Based on Figure 8, the clarity of formats, materials, media, and language of the flipbook is categorized as very practical, with an average score of 99.53%. Based on the questionnaire question, the value of 99.53% means that the flipbook is interesting, easy to use, the language is easy to understand, motivates students

to learn, makes it easy to understand the electrical circuit material, and the flipbook illustration in accordance with the material. This is in accordance with the opinion of Karsenti (2014) that a good ebook is interactive, enjoyment, has a favorite multimedia content as well as adaptive for students.
According to Hobri (2010), the effectiveness of the media (including flipbook) is measured by improving student learning outcomes. The pretest and posttest mean values are shown in Table 8.

Table 8 Result of test

Pretest average	Posttest average	N-gain	Category
32,5	81,25	0,72	Very effective

With N-gain value of 0.72, the electric circuit flipbook proved to be very effective. In accordance with the opinion of Alós and Lago (2012: 1) the integration of textbooks with appropriate learning methods get higher quality in the learning process and learning outcomes. According to Dale (in Summers & Davis, 2015: 3) learning techniques with student actions result in up to 90% retention. People get the best learning outcomes as they use sensory-based learning styles. Good sensory channels are done through the interaction of students with learning resources, the more opportunities, the more learning from the learning activities. The content of the book should provide students with independent learning opportunities, providing plenty of time for student activities, so that students automatically learn. Flipbook electrical circuits are equipped with virtual labs, video phenomena, as well as concrete explanations, so retention can be maximized because the design of learning activities actually builds more real-life experiences for students.
Student responses in very practical categories and highly effective category of N-gain indicate that the flipbook succeeds in assisting teachers in improving students' motivation to discover the concept of a subject matter independently. This is in accordance with the characteristics of the ebook proposed Wijayanti (2015), through a good ebook, teachers can better position themselves as a facilitator to create self-reliance in learning to find their own concepts for students. Content in the ebook helps students to visualize abstract material especially in science learning.
Based on the validation, practicality and effectiveness aspects, the ADDIE development model has succeeded in making the learning media feasible and in line with its theory because ADDIE instructional design aims to create media with more student-centered learning objectives, organized based on an in-depth analysis of student needs (McGriff, 2000:1) and ADDIE is an effective design, with approaches that help lesson designers, media developers and teachers to create efficient and effective teaching designs by applying the ADDIE model process to every learning media product (Aldoobie, 2015).
Nguyen (2015:76) mentions there are four characteristics of the ebook. First, the ebook is a software product book, so it has a structure like a regular book, has a page and users can access the page on the ebook is randomly like a regular book page.
First, the ebook is a software product book, so it has a structure like a regular book, has a page and users can access the page on the ebook is randomly like a regular book page. Second, the ebook is a book software product that works online or offline. Second, the ebook is a book software product that works online or offline. Thirdly, the ebook is always equipped with ebook readers that can be accessed by a computer or

tablet device. Fourth, the ebook has the ability to integrate advanced and modern forms of technology as the best information transmission medium. The Ebook allows users to insert images, animations, videos, and more with the goal of helping to further understand the lessons in depth. Flipbook developed according to the characteristics of the ebook described by Nguyen (2015). Flipbook structures developed such as reversible books, able to work online or offline, are available in various formats such as fla (flash), exe (application) or in other extensions. Flipbook can be read through compatible smartphones, tablets or compatible devices. The ability to transfer flipbook messages has been proven in its validity, effectiveness and practicality.

CONCLUSION

Based on successful ADDIE stages, it can be concluded that the Flipbook electrical circuit is eligible. It is based on 88% validity score with very feasible category, practical score measured based on student response 99,53% with very practical category, and effectiveness score of flipbook was 0,72 with very effective category.

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Sustainable Practices in the Supply Chain under the UN Global Compact perspective

Bárbara Modesto da Silva, Denise Helena Lombardo Ferreira, Marcos Ricardo Rosa Georges
Pontifícia Universidade Católica de Campinas, Brazil

Abstract

The purpose of this paper is to identify and anlyze the practices found in the supply chain in order to verify how the sustainable supply chains follow the guidelines proposed by the UN Global Compact. Using a systematic review of the literature, based on the Elsevier-Scopus database and a time-cut from 2013 to 2018, sustainable supply chain practices were analyzed under the UN Global Compact perspective. With the aim of analyzing researches from national and international publications, the following keywords were used: sustainable supply chain management (SSCM) and green supply chain management (GSCM). National and international papers were considered for this study within the period from 2013 to 2018. This time cut was essential because of the need to focus attention on recent and current publications. The practices were stratified according to the four pillars that underpin the ten principles of the UN Global Compact. We can observe significant results with respect to the Environment (72%), followed by Labor (15%), Human Rights (9%) and Anti-Corruption (3%) and their corresponding quantities.

Keywords: Supply Chain Management; Supply Chain Management Green; Sustainability; Global Compact.

1. Introduction

Environmental problems have reached a global scale. Industrial impacts on the environment have become alarming, and consequently issues such as global warming, problems arising from pollution and environmental degradation have come to be discussed internationally. The understanding that natural resources are finite and that environmental capacity has reached its limits are leading organizations to seek balanced growth that does not sacrifice the environment (Alkhidir; Zailani, 2009).

Within this context, a transformation of scale begins in the perception of the environmental problems that have come to be considered alarming worldwide. Companies began to be constantly pressured by regulators, communities, NGOs and their own employees, demanding efficient actions regarding the environmental impacts of their actions (Paulraj et al., 2017).

Such a move occurs in a scenario in which companies no longer operate individually and independently, but rather in chains (Christopher, 2007). Supply chains can be considered one of the ways to generate positive repercussions worldwide, with approximately 80% of global trade flowing through supply chains. They are perceived as the driving force of the economy, providing products and services

around the world, connecting organizations and people operating beyond geographical and cultural boundaries (UN GLOBAL COMPACT SUPPLY CHAIN SUSTAINABILITY, 2015).

Within this context, the United Nations has developed a guide known as the Global Compact aimed at implementing sustainable practices in the supply chain. Thus, this research is based on the following question: do the sustainable practices adopted in supply chains found in the literature in the last five years follow the sustainability guidelines indicated in the UN Global Compact?

2. Overview of business supply chain management and sutainability in supply chain Management

2.1. Supply Chain Management

In recent years, there has been a significant transformation in the contemporary organizational segment, since individual companies have ceased to compete autonomously and have started to compete in chains (Lambert; Cooper, 2000). Due to the complexity on this subject, it is fundamental to understand the main aspects regarding this subject.

There are divergences within the academic milieu of when the term Supply Chain Management has been introduced in the literature and in the business world. Lambert and Cooper (2000) acknowledge that the term Supply Chain Management emerged in the 1980s. Mentzer et al. (2001) state that since the 1990s, specifically in 1995, at the Conference of the Concil of Logistics Management, the term was given a significant prominence by corporations. From then on, the concept was globally widespread and became part of the business environment.

There are several concepts about Supply Chain Management. One of the most well-known definitions is that of Ballou (2006). According to the author, the Supply Chain Management comprises from the process of issuing a purchase order until the delivery of that request to the end user. Ballou (2006) states that Supply Chain Management encompasses everything that is related to the operations related to the transportation and manufacturing of products, from the moment of obtaining inputs to the final consumer.

According to Levi and Kaminsky (2003), Supply Chain Management can be defined as an efficient integration between suppliers, producers and warehouses. According to the authors, this efficiency always aims at reducing costs, but without impacting the level of service stipulated. Lambert and Cooper (2000) explain that Supply Chain Management does not concern a network of business-to-business business activities, but rather a complex business network that can provide greater synergy within, outside, and between companies. This way of conducting business ensures greater excellence in the management of organizational transactions and configures a new way of coordinating business and, especially, a new way of interacting with other members of the chain.

The Council of Supply Chain Management Professionals (2017) recognizes Supply Chain Management as supply and demand management within and between organizations. In this way, planning and management of all the activities involved in procurement, production, supply and transportation is essential. It is also important to coordinate and collaborate between suppliers, service providers and

customers, forming a connection between all members of the chain.

In Supply Chain Management, all participants are directly interconnected and are key to the success of the business. A high level of performance requires that all operations along the chain operate in a balanced and transparent way (Oliveira et al., 2016).

2.2. Sustainability in Supply Chain Management

Over the past two centuries, rapid industrial expansion has brought prosperity never seen before. However, all this productive development showed signs of being unsustainable, as it led to negative environmental impacts, such as industrial accidents that surprised the world: one of the biggest oil spills in 1978 (France); largest chemical plant accident known as the Bhopal tragedy in 1984 (India); Chernobyl nuclear disaster in 1986 (Ukraine) among others (Rajeev et al., 2017; Paulraj et al., 2017).

Another central aspect that is being discussed internationally is the limit of the natural resources of the planet. Some researchers assert that environmental capacity, including ores, fossil fuels, agricultural productivity and the possibility of regeneration of the natural environment is being exceeded. This is due to the fact of irrational consumption, together with the irresponsible environmental pollution that results from the product life cycle from the extraction of inputs, production and disposal of industrial waste (Al Khidir; Zailani, 2009).

All of these factors contributed to the need for sustainable growth, since a "green" economy would be able to provide prosperity backed by a use of natural resources in a conscious way. Thus, supply chains began to reassess their actions, since their activities are fully integrated and represent a significant part of the environmental impacts of companies. (Paulraj et al., 2017).

In terms of sustainability in the supply chain, two concepts appear in the literature: Sustainable Supply Chain Management (SSCM) and Green Supply Chain Management (GSCM). Thus, for a better understanding of the terms used, Tables 1 and 2 show some of the main definitions found in recent years.

Table 1. Main definitions found GSCM

Source	Definitions Found GSCM - Green Supply Chain Management	Author
International Journal of Management Reviews	Green supply chain management comprises the environmental factor in the chain and encompasses product design, supplier selection, production, final product delivery, and end-of-life management of the product after its life.	SRIVASTAVA, S.K. (2007)
Global Journal of Environmental Research	Green supply chain management is linked to the assessment of the total environmental effects of the product throughout its entire life cycle of products and services.	ALKHIDIR, T.; ZAILANI, S. (2009)
International Journal of Production Economics	Green supply chain management has aspects of sustainability not only within organizations, but throughout the supply chain.	GENG, R.; MANSOURI, S. A.; AKTAS, E (2017)

Table 2. Main definitions found SSCM

Source	Found Definitions SSCM -Sustainable Supply Chain Management	Author
International Journal of Physical Distribution Logistics Management	Sustainable supply chain management needs to take into account the environmental, economic and social dimensions in the adoption of its practices for the purpose of improving long-term economic performance.	CARTER, C.R.; ROGERS, D.S. (2008)
Journal of Cleaner Production	The authors state that in sustainable supply chains environmental criteria must be met by the members who remain within the chain.	SEURING, S.; MÜLLER, M. (2008)
Supply Chain Management: An International Journal	Sustainable supply chain aims to search for sustainability through the purchasing and supply process, adopting social, economic and environmental processes.	WALKER, H.; JONES, N. (2012)
The International Journal of Advanced Manufacturing Technology	Sustainable supply chain addresses the economic, environmental and social dimensions.	AL ZAABI, S.; AL DHAHERI, N.; DIABAT, A. (2013)
Journal of Business Ethics	Sustainable Supply Chain can be considered as the incorporation of the social, environmental and economic objectives of an organization with the objective of improving the long-term economic, social and environmental performance of the individual organization and its supply chains.	WOLF, J. (2014)
Supply Chain Sustainability: a practical Guide for Continuous improvement	The sustainability of the supply chain is the management of environmental, social and economic impacts and the foci of good governance practices throughout the life cycles of goods and services.	UN (2015)
European Journal of Operational Research	The sustainable supply chain can be defined as complex network systems that involve several entities that manage products from suppliers to customers, considering the social, environmental and economic impacts.	BARBOSA-PÓVOA, A. P.; SILVA, C.; CARVALHO, A. (2017)
Journal of Business Ethics	Sustainable supply chain management encompasses a company's internal practices and external practices to make its supply chain more sustainable in terms of the three economic, social and environmental dimensions.	PAULRAJ, A.; CHEN, I. J.; BLOME, Co (2017)

It is thus realized that the current context requires that there be an understanding of the economic greatness related to sustainable practices so that they propagate rapidly in society. The change in patterns

of production and consumption can no longer be postponed or downgraded. The impoverishment of the planet is a reality that can change if there is a possibility of guaranteeing resources for the maintenance of future generations. The trajectory is difficult, since it requires a transformation in the form of the companies to operate (Betiol et al., 2012).

3. Sustainability and the UN and the Global Compact

3.1. Sustainability and the UN

The late 1960s were deeply marked by a wide range of environmental research. These recent findings argued that if emerging countries reached production levels in developed countries, there would be an environmental catastrophe resulting in the end of the planet's resources (Almeida, 2002). In this way, the need arose to carry out an in - depth study on the availability of natural resources in relation to the current economic model.

To that end, the Club of Rome was formed by a team from the Massachusetts Institute of Technology and responsible for producing a report known worldwide as "The Limits of Growth." This report, based on mathematical models, asserted that the planet could not withstand the same levels of population growth, exploitation of natural resources, industrialization and food production (Almeida, 2002; Betiol et al. 2012).

Many assumptions pointed out by the report were not confirmed, but the main idea about the limits of natural resources remained valid and supported a new understanding between the relation man and nature (Betiol et al., 2012). This fact can be observed to the extent that in 1972 the United Nations, which until then was not involved in environmental issues, decided to hold the First World Conference on Man and the Environment in Stockholm (Boff, 2015, Betiol et al. 2012). This conference was a milestone in history, since the theme had been discussed only in the academic context and began to receive the attention of nations around the world (Almeida, 2002).

In the 1980s, however, there was frustration with regard to the Conference. This is because the industrialized countries, which accounted for only 20% of the world's population, were responsible for consuming eight out of every ten tons for all foods. In addition, only seven countries released half of all polluting gases into the atmosphere, and the twenty richest nations had sixty times the income of poorer countries (Betiol et al., 2012). In addition to these factors, there was still the question of how to strike a balance between the current economic model and the need to preserve the environment (Almeida, 2002).

Thus, in 1983 the UN Secretary-General invited Dr. Gro Harlem Brundtland to chair the World Commission on Environment and Development. In April 1987, this commission released a report known as "Our Common Future" that presented the concept of sustainable development for the first time (UN BRAZIL, 2018). This concept has been defined as "one that meets the needs of the present generation without compromising the ability of future generations to meet their needs and aspirations" (Boff, 2015, 34).

Due to the complexity of the recommendations proposed by the Commission, the United Nations Conference on Environment and Development was convened in 1992 and became known as the "Earth Summit". This conference developed a number of documents, including Agenda 21, which emphasizes the

importance of participation by governments not only in relation to environmental issues, but also in relation to poverty, unsustainable patterns of production and consumption, and the disposition of the international economy, among others. This action plan called for several groups to achieve sustainable development, including the business segment (UN BRAZIL, 2018).

These activities did not develop as expected and in 1997 another meeting was held known as the "Earth Summit + 5", whose final document reinforces the importance of reducing greenhouse gas emissions, increasing the distribution of sustainable energy, among other issues. All these actions needed to be centralized on the issue of poverty eradication, whose topic becomes a unique condition for sustainable development (UN BRAZIL, 2018).

In 2000, 191 countries gathered at an event known as the Millennium Summit. The purpose of this assembly was to propose to States Parties a greater commitment to peace, human rights, environmental sustainability and the eradication of poverty. From this meeting, a document known as "Millennium Development Goals" was drawn up, consisting of a future-oriented agenda. Until now, a set of global goals had been proposed at all levels (international, national, regional and local). All goals were centralized in a single document composed of indicators to be monitored (Okado; Quinelli, 2016).

In the same year, in an attempt to move closer to the private sector, UN Secretary-General Kofi Annan presented a challenge to the international business community by launching the Global Compact, which will be detailed in the following section.

3.2. Global Compact

Officially launched on 26 July 2000 at the UN office in New York, the Global Compact was designed to help organizations around the world include in their business scope the ten universal principles that have their roots in the Declaration Universal Declaration of Human Rights, the International Labor Organization Declaration on Fundamental Principles and Rights at Work, the Rio Declaration on Environment and Development and the United Nations Convention against Corruption, as can be seen in Table 3 (UN GLOBAL COMPACT, 2018).

It is important to reinforce that the Global Compact is not a regulatory device or a code of compulsory practices to monitor private policies and actions. In fact, it is a voluntary initiative whose purpose is to provide references capable of enabling sustainable growth through committed and transformative organizational leadership (UN GLOBAL COMPACT, 2018).

Table 3. Ten Principles on Human Rights, Labor, Environment and Anti-Corruption

Human rights	Principle 1	Businesses should support and respect the protection of internationally proclaimed human
	Principle 2	Make sure they are not complicit in human rights abuses
Labor	Principle 3	As empresas devem manter a liberdade de associação e o reconhecimento efetivo do direito à negociação coletiva

	Principle 4	The elimination of all forms of forced and compulsory labor
	Principle 5	The effective abolition of child labor
	Principle 6	The elimination of discrimination in respect of employment and occupation
Environment	Principle 7	Businesses should support a precautionary approach to environmental challenges
	Principle 8	Undertake initiatives to promote greater environmental responsibility
	Principle 9	Encourage the development and diffusion of green technologies
Anti-corruption	Principle 10	Companies must work against corruption in all its forms, including extortion and bribery

Source: Prepared from UN Global Compact Supply Chain Sustainability (2015).

4. Research methodology

The approach used for this research has a descriptive and qualitative nature. According to Gil (2011), the descriptive research has as basic purpose to verify which are the main peculiarities of a specific population. In addition, the author states that descriptive research is associated with those whose purpose is to uncover the possibility of possible relationships between variables. In descriptive research, events are studied, interpreted and categorized without the intervention of the researcher (Prodanov; Freitas, 2013).

The systematic review of the literature was chosen as the procedure of this research. According to Tranfield, Denyer and Smart (2003), the systematic review is a tool used to obtain the best evidence and to verify which policies and practices are most used in a given area. It is a specific methodology that not only identifies existing studies but also analyzes and synthesizes the data obtained, thus allowing the collection of evidence of a specific study object (Denyer; Tranfield, 2009).

Denyer and Tranfield (2009) suggest that evidence should be found by defining the basis and keywords. The database defined was the Elsevier platform - SOCPUS. This database was chosen as one of the largest databases of abstracts and citations in the literature, covering important researchers from the national and international scientific community, focused on academic production. In addition, this scientific basis provides advanced search tools that allow a reliable, efficient tracking, analysis and synthesis of data. The following keywords were used: sustainable supply chain management and green supply chain management.

4.1. Methodology of data analysis

The search process provided a total of 366 articles published concerning the keyword Green Supply Chain Management and a total of 151 articles published concerning the keyword Sustainable Supply Chain Management.

Figure 1 shows the evolution of the number of articles publications in the period 2013-2018. It is possible to notice that there has been a significant evolution in the number of publications of articles in the last five years, representing an increase of 76%. This fact shows a greater interest in the academic environment about the sustainable and green supply chain management.

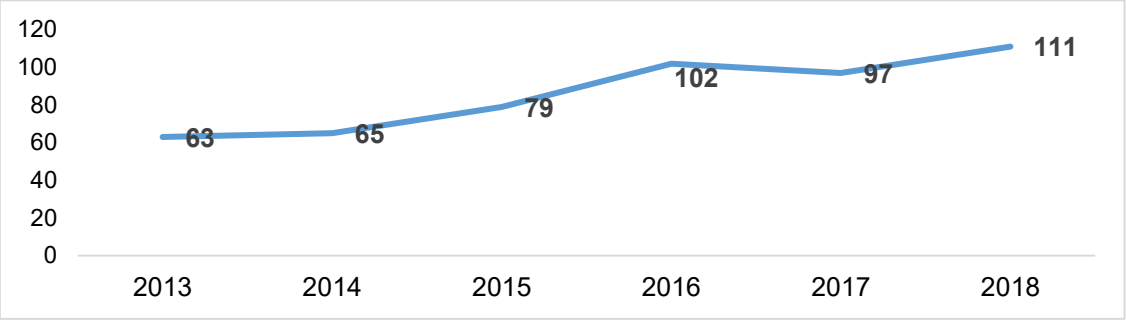

Figure 1. Total number of articles published (2013-2018)

Figure 2 shows a comparison between the two selected keywords (SSCM and GSCM) and total publications, also stratified per year.

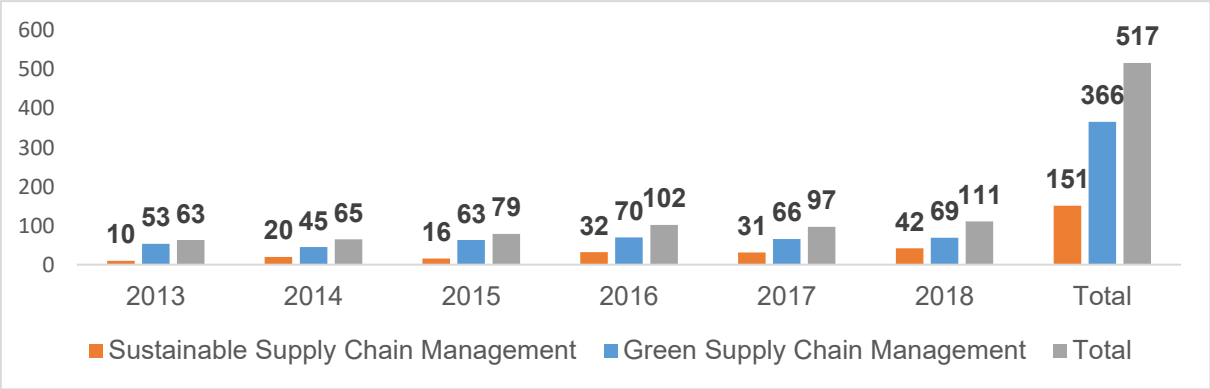

Figure 2. Total number of articles published (2013-2018)

Table 4 shows the articles with the greatest impact of publication.

Table 4. Ten journals with the largest number of published articles 2013-2018

Journal	Qty of Published Papers SCOPUS
Journal of Cleaner Production	83
International Journal of Production Economics	19
International Journal of Production Research	16

Resources, Conservation and Recycling	16
International Journal of Logistics Systems and Management	14
Journal of Supply Chain Management	11
Sustainability	10
Business Strategy and the Environment	9
Production Planning and Control	9
Transportation Research Part E: Logistics and Transportation Review	8
Total	***195***

Table 5 shows the ten journals with the highest number of citations

Table 5. Ten journals with the highest number of citations 2013-2018

Journal	**Number of citations**	**%Quoted Journals SCOPUS**
Journal of Cleaner Production	3552	33
International Journal of Production Economics	1233	11
Resources, Conservation and Recycling	605	6
Journal of Supply Chain Management	497	5
International Journal of Production Research	483	5
Supply Chain Management	238	2
International Journal of Advanced Manufacturing Technology	222	2
Transportation Research Part E: Logistics and Transportation Review	215	2
European Journal of Operational Research	214	2
Expert Systems with Applications	208	2
Total	***7467***	***70***

5. Analysis of results

After the systematic review of the literature, a total of sixty-eight articles were analyzed in detail, as shown in Figure 3. In addition, Table 6 shows the number of articles selected per periodical and their representativeness can be observed in Figure 4.

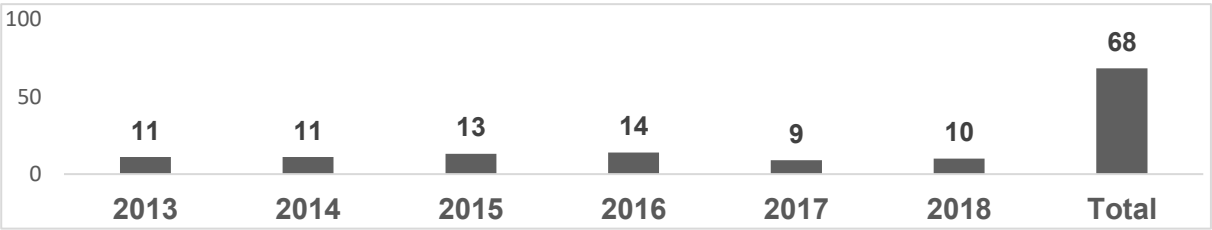

Figure 3. Number of articles selected for search

Table 6. Quantity and Percentage of Articles by Periodicals

Journal	**Selected Articles (Quantity)**	**Selected Articles (%)**
Journal of Cleaner Production	31	46
International Journal of Production Economics	9	13
Production Planning and Control	5	7
Resources, Conservation and Recycling	3	4
European Journal of Operational Research	3	4
Supply Chain Management	2	3
International Journal of Advanced Manufacturing Technology	2	3
Sustainability	2	3
Journal of Environmental Management	2	3
International Journal of Production Research	2	3
British Accounting Review	1	1
Industrial Management and Data Systems	1	1
Journal of Supply Chain Management	1	1
Expert Systems with Applications	1	1
Ecological Indicators	1	1
Cuadernos de Administración	1	1
Clean Technologies and Environmental Policy	1	1
Total	***68***	***100***

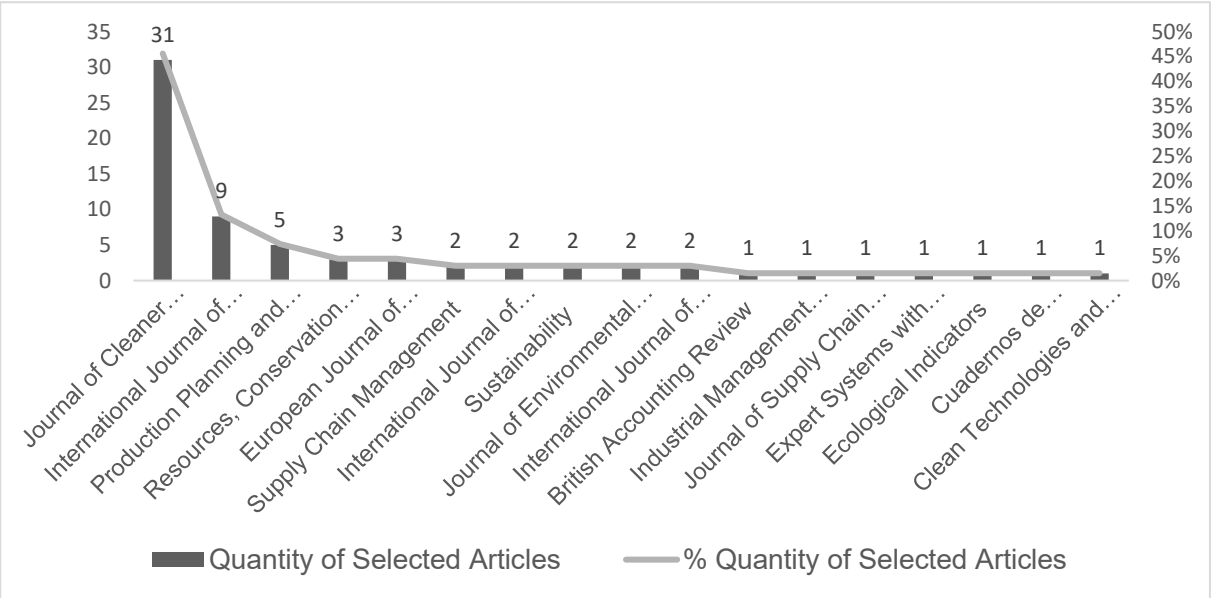

Figure 4. Quantitative Analysis Periodicals

5.1 Analysis of identified practices stratified under the pillars: Human Rights, Labor, Environment and Anti-Corruption

The practices were stratified according to the four pillars that underpin the ten principles of the UN Global Compact. In Figure 5, we can observe significant results with respect to the Environment (72%), followed by Labor (15%), Human Rights (9%) and Anti-Corruption (3%) and their corresponding quantities.

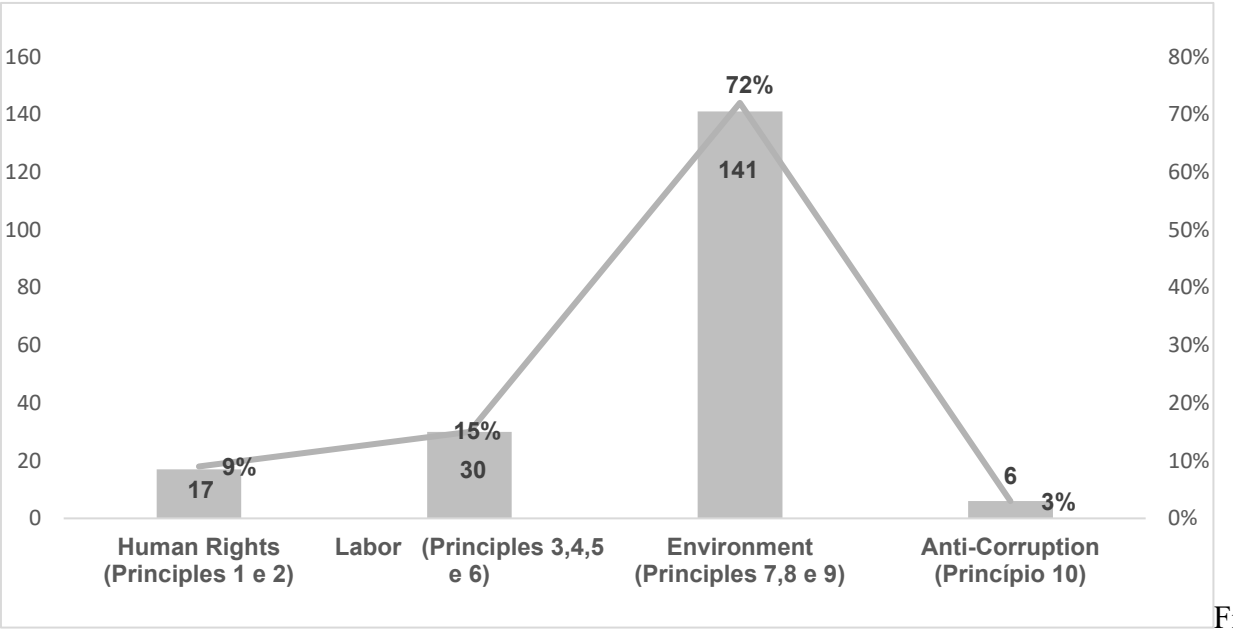

Figure.

Quantitative Analysis from the Identified Practices

Human Rights (Principles 1 and 2)

From the systematic literature review, 17 practices were identified regarding the Human Rights pillar, which represents only 9% of the total result of this research. In Table 9, the identified practices are observed in Table 7.

Table 7. Human Rights Identified Practices

Practices Found	**Quantity**
Collaboration between customers and suppliers	3
Management in order to minimize the handling of hazardous materials	1
Adherence to international initiatives (Global Compact)	1
Local community development	1
Contracts in which suppliers and customers agree to the ethical code	1
Social responsability	1

Work conditions	1
Health and safety management system	1
Health and safety at Work	1
Social Commitment	1
Training, education and influence in the community	1
Human Rights	1
Social Inclusive Practices for Employees	1
Social Inclusive Practices for the Community	1
Total	***17***

Labor (Principles 3,4,5 and 6)

From the systematic literature review, 30 practices were identified in the Work pillar, representing 15% of the total result of this research. Table 8 below shows the practices identified in this segment.

Table 8. Labor Identified Practices

Practices Found	**Quantity**
Collaboration between customers and suppliers	3
Develop suppliers	2
Partner Development	1
Long term relationship	1
Environmental awareness as culture of the organization	1
Corporate Sustainability	1
Strategic planning for environmental management	1
Sustainability certificates recognized by customers and secondary stakeholders	1
Improve Supplier Performance	1
Reputation improvement	1
Companies should also develop an organizational culture that encourages, for example, team collaboration and proactive behavior to find innovative sustainability solutions	1
Sustainability Reports	1
Adherence to international initiatives (Global Compact)	1
Training and education	1
Safe Work Initiatives	1
Contracts in which suppliers and customers agree to the ethical code	1
Green Training	1
Employee Reward	1

Selection of suppliers that plays an important role in achieving the social, environmental and economic benefits of SSCM	1
Work conditions	1
Health and Safety Management System	1
Health and safety at Work	1
Social Commitment	1
Training, education and influence in the community	1
Environmental and economic performance	1
Social Inclusive Practices for Employees	1
Social Inclusive Practices for the Community	1
Total	***30***

Environment (Principles 7, 8 and 9)

In all, 142 practices related to the Environment were identified. Some were evidenced in more than one article and, all in all, represent 72% of the result. In Table 9, all the practices that were segmented as Environment are observed.

Table 9. Environment Identified Practices

Practices Found	**Quantity**
Green shopping	11
Selecting green suppliers	9
Life cycle assessment	8
Reducing carbon emissions	8
Eco design	7
International Organization for Standardization 14001	7
Cleaner production	6
Power reduction	5
Reverse logistic	4
Collaboration between customers and suppliers	3
Green Innovation	3
Recycling	3
Product recovery	3
Waste management	2
Internal environmental management	2
Reuse	2
Renewable energy use	2
Adherence to international initiatives (Global Compact)	1

Green storage	1
Companies should also develop an organizational culture that encourages, for example, team collaboration and proactive behavior to find innovative sustainability solutions	1
Green performance appraisal	1
Sustainability certificates recognized by customers and secondary stakeholders	1
Commitment of management to sustainability	1
Environmental awareness as culture of the organization	1
Contracts in which suppliers and customers agree to the ethical code	1
Cooperation with consumers	1
Environmental and economic performance	1
Development of green products	1
Eco-efficiency	1
Consumer education	1
Management in order to minimize the handling of hazardous materials	1
Supply Chain Oriented Water Management	1
Carbon management	1
Central importance of supplier management and logistics for obtaining sustainable supply chains for Oil and Gas	1
Pollution Prevention Indices	1
Influencing stakeholders	1
Sustainable supply initiatives	1
Supply Chain Innovation for Sustainable Development	1
Sustainable Innovation	1
Environmental Leadership	1
Limits on Carbon Footprints in the Supply Chain	1
Measuring environmental performance	1
Reputation improvement	1
Standards and Certifications	1
Carbon footprint	1
Strategic planning for environmental management	1
Carbon dioxide emission tax policy	1
Environmental Management Practices	1
Sustainable Gas Supply Chain Management Practices	1
Green production	1
Certification Programs	1
Ecological Projects	1

Redesign of products and packaging	1
Packaging reduction	1
Reduction of gas emissions	1
Reduction of greenhouse gas emissions	1
Reduction of material used	1
Waste reduction	1
Sustainability Reports	1
Selection of suppliers that plays an important role in achieving the social, environmental and economic benefits of SSCM	1
Green selection	1
Quality Seal	1
Replacement of a non-renewable product with renewable	1
Internal management support	1
Corporate Sustainability	1
Eco-friendly technology in production	1
Ecologically correct technology in sales	1
Ecologically correct technology in transport	1
Advanced green technology	1
Green Transport	1
Training and education	1
Green Training	1
Use of recycled materials	1
Supply Chain Oriented Water Management	1
Total	142

Anti-Corruption (Principle 10)

From the systematic review of the literature, 6 practices regarding the Anticorruption pillar were identified, which represents only 3% of the total result of this research (Table 10).

Table 10. Anti-Corruption Identified Practices

Practices Found	**Quantity**
Collaboration between customers and suppliers	3
Adherence to international initiatives (Global Compact)	1
Contracts in which suppliers and customers agree to the ethical code	1
Identify and disrupt supply chain corruption schemes	1
Total	***6***

6. Final Considerations

The main purpose of this study was to investigate whether the sustainable practices found in the supply chains of different segments are following the guidelines proposed by the UN Global Compact.This study also sought to clarify the role of the UN in relation to sustainability. Notably, the entry of the United Nations in this respect has transformed the scale of perception in relation to environmental / social problems to another level of complexity and level. This fact was historically contextualized and led to the central question of this research: do the sustainable practices adopted in supply chains found in the literature in the last five years follow the sustainability guidelines indicated in the UN Global Compact?

To answer this questioning, the methodology of systematic literature review proposed by Denyer and Tranfield (2009) was used. The Elsevier-Scopus database was selected because it presented a high academic level and from pre-established keywords and a five-year time frame (2013-2018), the result was 518 articles, of which 68 were selected for presenting, in a clear and objective way, sustainable practices in supply chains.

It was identified that, of the four pillars proposed by the ten principles on Human Rights, Labor, Environment and Anti-Corruption, the Environment Pillar was the most outstanding, representing a total of 72% of the research. In the Environment segment, approximately 50% of the practices that stood out were Green Purchases, Green Suppliers Selection, Life Cycle Assessment, Carbon Emission Reduction, Eco Design, ISO 14001, Cleaner Production and Energy Reduction. As seen in the previous chapter, all these practices follow the guidelines proposed in Principles 7, 8 and 9 that underpin the Environment pillar. Research has shown that issues such as Human Rights and Anti-Corruption are not receiving the attention deserved, since only 9% of the practices identified were associated with Human Rights and 3% with respect to Anti-Corruption. Given the current scenario of globalization, the possibility of cheap labor and low material costs, manufacturers of most of the products that are consumed in developed countries have reallocated their production bases and production facilities in Emerging Economies (Geng; Mansouri; Aktas, 2017). These issues can be seen as problematic, given that some of these countries are notoriously known for indifference to these principles so essential to humanity (UN GLOBAL COMPACT, 2018). Finally, in view of the whole debate presented throughout this dissertation, it is observed that the Ten principles proposed by the UN must and must be seen as a determinant role for issues inherent to sustainability in the supply chain.

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A Collaborative System Architecture for Developing Digital Electronic Games

Filipe Raulino
Universidade Federal do Rio Grande do Norte, Brazil

Abstract

Educational electronic games have been gaining lots of space inside classrooms because of their contribution to the learning and motivation of the students. However, the development process of a game is complex and, normally, involves many people with different profiles, making it impossible for the teachers to develop games according to their pedagogical needs. Even though the existence of technical barriers, the teacher's involvement in this process is fundamental, since they are the ones that have the expertise on the pedagogical components of the process. Through a collaborative process, it is possible to merge all needed elements for the development of educational electronic games, since it allows mutual help among the participants. Furthermore providing individual learning to each collaborator, through the exchange of ideas and experience gain throughout the project development. This article has the objective of creating a community for collaborative development, that includes the pedagogical features on the development of educational electronic games. For this we will present a collaborative system model, based on the roots of the 3C collaboration model: communication, coordination and cooperation.

Keywords: Collaborative systems; educational games;

1. Introduction

The development of information and communications technologies (ICT) in the last decades has changed the lifestyle of society by a large amount, since we have started to act by the simplicity inherent in technology. Currently we have an environment for exchanging ideas, knowledge and opinions at an unprecedented speed rate.

The sociocultural relations and the professional profiles demanded are directly affected by the merge of technologies to the common routine, demanding an update on the curricula and the traditional teaching and learning manners. Almeida and Valente (2011) said that the ICT must be used to further potencialize the pedagogical practice allowing the development of the student's autonomy on the search of meaningful information and on the development of critical thinking.

Education must be in sync with the others aspects of the student's life so that their curiosity can be pushed forward. Therefore, the ICTs have the possibility of promoting an environment favorable to learning. Tarouco et al. (2004) point out educational games as a complementary tool on the construction and retention of concepts developed on classroom, as well as a motivator both for the student and the professor.

However, the production of educational games needs, besides pedagogical planning, knowledge of multiple technologies, such as high-level programming languages, what requires a multidisciplinary team and, consequently, a high production cost, many times making the educator close the production by themselves because of their pedagogical needs.

This scenario ends up forcing the educator to not use or to adapt their content and didactic to the available material, instead of customizing in agreement to their necessity or the one of a group of students.

Against the exposed scenario, one can realize that there is a demand for the insertion of new educational technologies in the classroom, and that there is an obstacle made by the lack of technical knowledge and on the complexity of the development of these artifacts, especially with regard to educational games.

Still, many educators have trouble in using these resources on the classroom, especially when it comes to digital games, because they aren't able to find games suitable to their needs. Almeida and Valente (2011) have stated that one of the key factors that contributed to the separation of ICTs from curricular activities was the fact that the used softwares were far from what is discussed on classrooms.

To create a game is not a trivial task, besides creativity and a good script, it is needed to create, edit and organize many types of media and the development of the programming code, in order to create the game's dynamic and control the interaction with the user. The characteristic complexity of the gaming production implies on the necessity of a series of professional profiles such as programmers, illustrators, animators, musicians, game designers, among others according to the nature of each game. In the event of educational games there are still educators and pedagogues. Bertin (2015) et al. stated that the development of *gamified* educational technologies constitutes an interdisciplinary challenge that involves in-depth studies in Didatics, in Games and in Software Engineering.

To adjust the alignment between the pedagogical and techniques is one of the main faced challenges. To Tarouco et al. (2004) the ideal solution would be that the teachers could create their own games, adapting them to their contexts without compromising pedagogical quality.

Therefore it is needed to work around the technical obstacles and make possible the teacher's participation in the developing process, with the goal to prioritize pedagogical components. This article proposes the creation of a collaborative system for the production of educational electronic games that makes possible the connection between educators and the tech team (developers, designers), in order to contribute for the creation of didactically relevant games and to make available an open digital games repository.

2. 3 collaboration model

The proposed idea that initiated the 3C model was formulated by Ellis et al. (1991) and classified the implementation of a collaborative activity in three domains: communication, coordination and collaboration. Later, other authors (Amiour & Estublier, 1998; Borghoff and Schlichter, 2000; Fuks, Gerosa and Lucena, 2002) started to adopt the term cooperation in place of collaboration that went on to designate the whole process of working together. (Fuks et al., 2011).

The model is based on the premise that communication refers to information sharing and negotiation of commitments between subjects, coordination involves the part of managing people, activities and

resources with the purpose of resolving conflicts and organize to avoid the waste of effort, and cooperation is related to the involvement of group members in achieving the common goal (Correia, 2011).

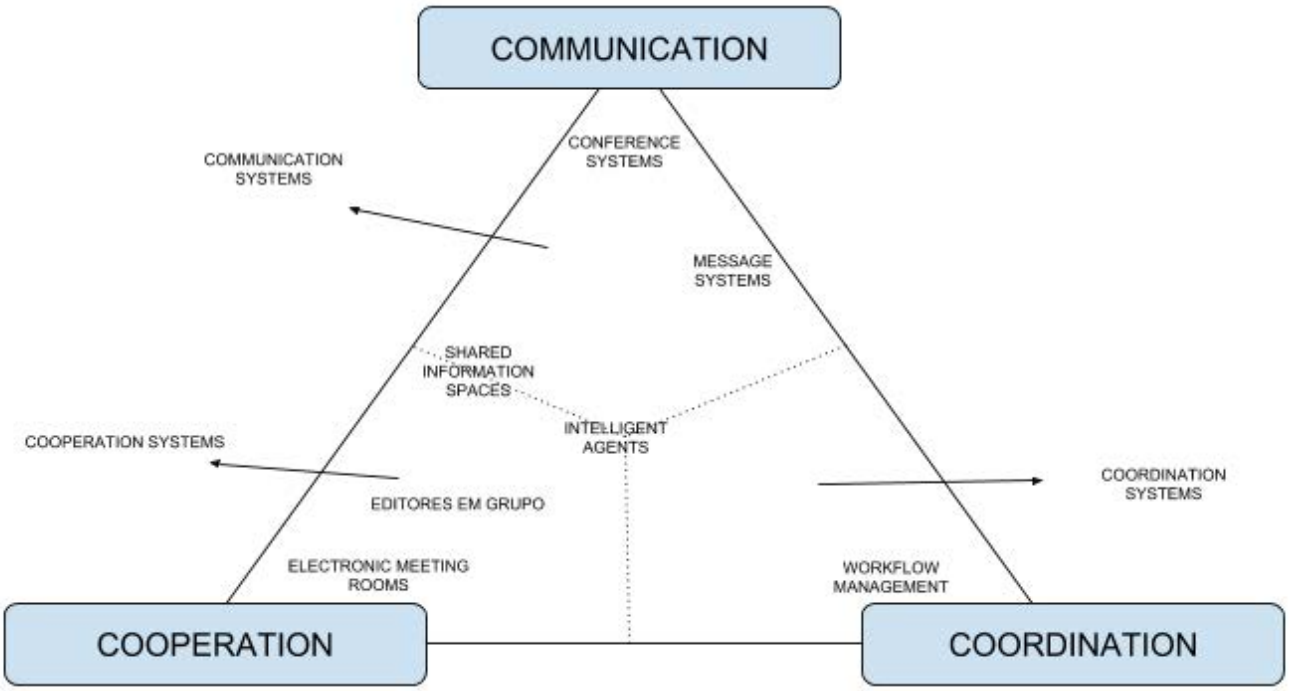

Figure 1. Classification of systems according to 3C model (adapted from Borghoff and Schlichter, 2000)

As we can see in Figure 1, collaborative systems are positioned in a triangular space where vertices are the collaborative domains, the positioning of collaborative systems in the triangular space emphasizes the contiguity between the 3Cs. Although the objective of a tool can be turned to the specific support of one of the Cs, it will still contemplate aspects of the other Cs (PIMENTEL et al., 2006).

2.1 Communication

Communication involves negotiation and establishing compromise. A computer-mediated communication tool supports interactions among participants, and can manage state transitions, dialogue events, and the commitments of each participant (Fuks, Raposo and Gerosa, 2003).

The communication represents an action between the sender whom, according to their goals and commitments, produces and sends a message to the recipient that, when receiving and interpreting the message, can cause their commitments and knowledge to be modified. In order to transmit the content of the information, the sender transmits signals in an appropriate and perceptible language for interaction with the receiver, so that everyone can perceive it (Costa, Loureiro and Reis, 2014).

There are several purposes for group communications, Fuks, Raposo and Gerosa (2003) affirm that the tools of asynchronous communication are used when one wishes to value the reflection of the receivers, because they will have more time to act. Synchronous tools value the speed of interaction by providing immediate communication. Communication will succeed if the sender's goal results in the expected commitments. The only way to obtain evidence of successful communication is through the receiver's speech and actions.

2.2 Coordination

Coordination is responsible for organizing the tasks to meet the commitments generated by the communication, assigning tasks, objectives and constraints so that efforts are not wasted on repeated or conflicting tasks.

Coordination aims at ensuring the productivity and success of the group's objectives, keeping the group cohesive, the participants aware of their role in the group and focused on their specific objectives and the group's overall goal (Santos, 2006). Coordination is essential to keep the group together and motivated to achieve common goals.

Fuks, Raposo and Gerosa (2002) emphasize that perceptual information is essential for group coordination. It is important that each one knows the progress of the work of their companions: what was done, how it was done, what is missing for the conclusion, what are the preliminary results, and so on.

2.3 Cooperation

Tasks originate from the commitments negotiated during the communication, are managed by the coordination and are carried out during the cooperation. Through mechanisms of awareness the individual gets feedback from his actions and feedthrough the actions of his colleagues. When cooperating, it is necessary to renegotiate and make decisions on unexpected situations, which requires new rounds of communication and coordination (Gerosa, 2006).

Cooperation is directly associated with the joint execution of tasks by group members. For this, an environment is necessary that allows to generate and manipulate shared artifacts, essential for the accomplishment of the objectives of the tasks (Santos, 2006). Cooperative environments should provide appropriate tools for the accomplishment of the tasks, such as co-authoring tools, for example.

2.4 Awareness

Fuks, Raposo and Gerosa (2003) also cite awareness as an essential concept in the 3C model, which permeates the three domains of the 3C model. awareness is generated by the interactions that occur in the group, serving to mediate the entire collaboration. It is through the awareness that individuals become aware of the common goal and the role of each within the context.

awareness is an understanding of the activities of others, which provides a context for one's own activities. This context is used to ensure that individual contributions are relevant to the group's activities as a whole, and to evaluate individual actions in relation to the group's goals and progress (Dourish and Bellotti, 1992).

Perceiving the activities of other individuals is essential for the flow and naturalness of work and for reducing the feelings of impersonality and distance, common in virtual environments (Gerosa, Fuks and Lucena, 2001).

In this way, perception can be interpreted as the knowledge and understanding of everything that occurs inside and outside a group that are relevant to the development of the activities of its participants. Perception is achieved when the other people involved in an activity receive, process and understand the actions of others (Santos, 2006).

3. Collaborative System Development

Fuks, Raposo and Gerosa (2002) affirm that a collaborative system usually consists of a set of tools, which allows the interaction between multiple users. The collaborative system must be flexible to adapt to the needs of each group, enabling them to set up their work context and configure a specific set of collaborative tools that meet their needs.

Fuks, Raposo and Gerosa (2002) further claim that the use of component-based development techniques is a way to facilitate the development of groupware to make it more flexible. Considering that these techniques develop modular systems, that can be adapted and combined to meet the specific needs of each group.

3.1 Component Based Development

Component-based development addresses the development of systems by the composition of reusable components through the creation of constructive software blocks. These blocks are often called components and require patterns for interaction, composition, infrastructure and services (Hernandez, 2005).

A software component is an independent, replaceable part that communicates with the environment through interfaces. Szyperski (2002) defines a software component as a composite unit of which we know only the interfaces, specified in the form of contracts, and the context dependencies. Therefore, its implementation is encapsulated and is not directly linked to the system.

The components are defined by their interfaces, one of which defines the services provided by the component, and the second specifies what services should be available (Hernandez, 2005).

The components of collaborative systems implement tools with which individuals operate on the objects of cooperation Fuks, Raposo and Gerosa (2002). These components are coupled into an architecture following the component model, which define the communication patterns capable of incorporating and extending the component functionalities of different developers.

There are several component models such as OMG/CORBA, the Microsoft COM family and Sun's JavaBeans/Enterprise JavaBeans (Fuks, Raposo and Gerosa, 2002; Hernandez, 2005). Recently the web service has proved to be a model that allows several solutions to problems presented by other standards (SZPERSKI, 2002).

4. Proposed solution

This work proposes the architecture of a web system for project management of educational electronic games production. This architecture provide components aiming to offer the resources for developers and project educators to work collaboratively and on a distributed basis. This architecture group together various tools to support all areas of collaboration (communication, coordination, cooperation).

Figure 2 shows an overview of the system architecture and the relationships involved in the production of digital electronic games.

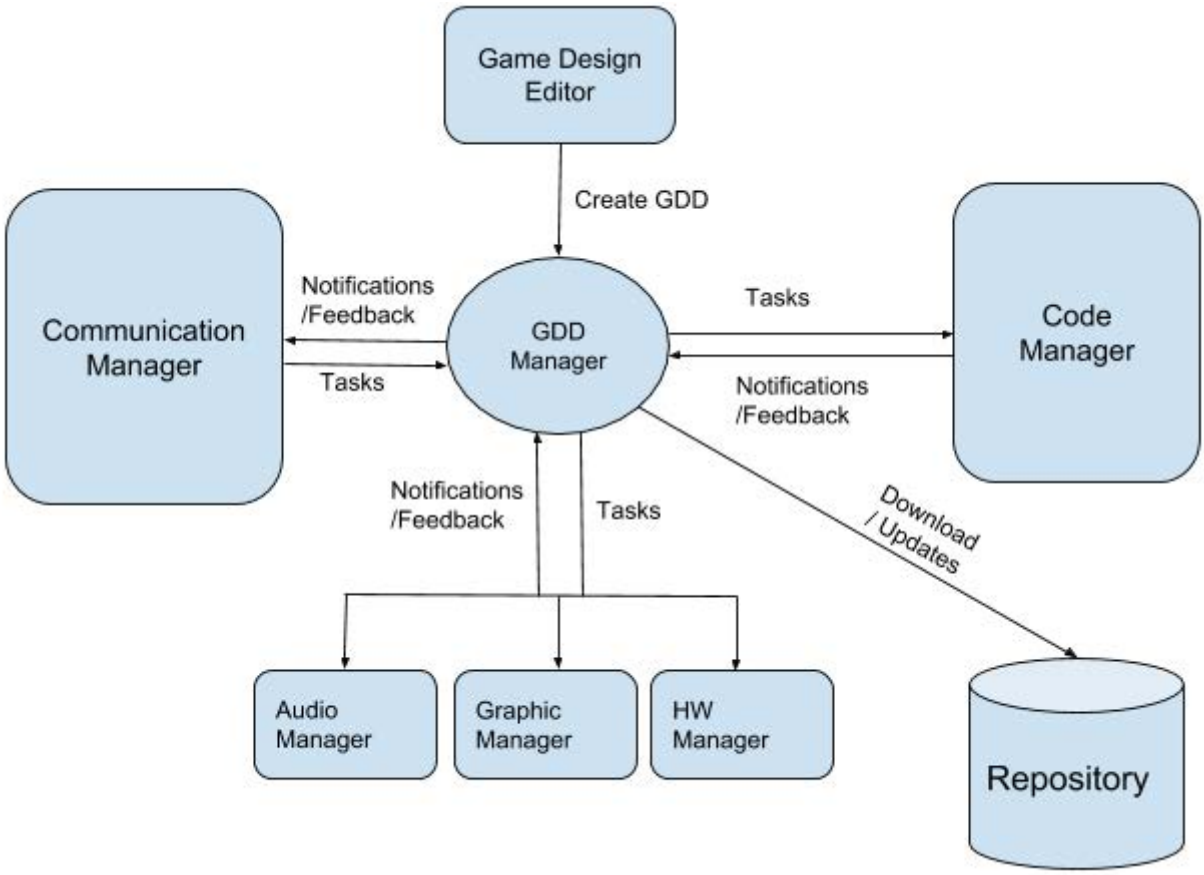

Figure 2. Overview of the system architecture

The system is completely online, available on any device that the user has access to a web browser. The environment feature an educational game description editor that will be available to anyone interested in proposing the production of a game. From it it will be possible, in a simple way, to generate a game description document, known as GDD (game design document).

The system architecture provide a collaborative environment where developers, designers, pedagogical staff and other members involved in game production can exchange information, experiences and feedback, contributing to the game's development.

From the generated GDD the developers registered in the system can select the document and start a new project or join a project already started. In the sections below you will specify some features that will be used in each of the collaboration domains. Each topic includes the components that provide the collaborative services used to support the dynamics of collaboration.

4.1 Communication services

The communication aims to provide the exchange of information, argumentation and negotiation of stakeholders. This function shall enable synchronous and asynchronous communication. The communication tools incorporated into this system are: instant messenger, forum, e-mail and comment on tasks.

The instant messenger enables synchronous communication, through text messages, with other users that are logged into the system. This tool enables group communication, with all users involved in the project, or with any specific user.

The forum maintains question and answer records divided into topics, functioning as a space for sharing experiences, exchanging ideas, solving doubts and providing a source of information.

Email provides users with the exchange of text messages asynchronously. You can attach other types of files to the message.

The comment in the tasks allows to report problems and to give suggestions during the development of the activities. It is a form of asynchronous communication for team members.

4.2 Coordination services

The coordination services have the function of managing the activities of the group. They will have activity management, notification and monitoring tools for group participation.

The activity management tool enables the creation of tasks, which can range from implementing a system requirement to solving a problem. The user must create a name for the activity and then a description and priority (high, medium or low). The task will be available to be assigned to one of the group members. Information about the activity can be updated at any time. This tool also generates the data to follow the task, such as the percentage that has already been completed, responsible and files involved.

The notification tool enables everyone in the group to receive important prompts about project progress. It passes on the information and alerts needed to organize the members' participation in the project, such as completing or adding new tasks, making new versions available or receiving messages.

The monitoring of the participation registers the progress of the activities and generates reports allowing the management of the users of the environment, also offers personal information and keeps records of the contributions of each member.

4.3 Cooperation services

The cooperation tools are responsible for the support in the execution of the tasks. These include sharing and publishing of documents, versioning tools and authoring.

Sharing of documents will provide a repository of images, audios and other documents that will be made available for the production of the games. All documents produced in the system will be part of this documentation and will be made available with Creative Commons Attribution license CC BY, which allows others to distribute, remix, adapt and create from your work, even for commercial purposes, as long as they give you due credit by the authorship.

The code will be controlled by a version control system, preferably by developers such as GIT or SVN for example. The version control system allows multiple people to collaborate on the same project simultaneously, it controls the changes avoiding the risk that they are overwritten.

4.4 System requirements

In this section we present the system requirements divided into two tables, one for functional requirements and one for non-functional requirements. the table shows the identifier of the requirement, its name, a description and the priority that can be (E) essential, (I) important or (D) desirable.

4.4.1 Functional requirements

Table 1. System functional requirements

ID	Requirement	Description	Priority
RF1	User registration	Enable the registration and maintenance of users in the system.	E
RF2	User Authentication	Users must authenticate to be able to use the system.	E
RF3	Define the user profile	Users should be ranked according to their profile in the community (educator, developer, designer). A user can have more than one profile.	D
RF4	Educational game description editor	The system should provide an interface for creating educational game design documents.	E
RF5	Manage game design files	The system should organize and make game design files available to users.	E
RF6	Creation of projects	The system should enable the creation of projects from the available game design documents.	E
RF7	Join users to projects	The system must allow the association of users with the projects in the system.	E
RF8	Creation of tasks within projects	The system should provide the creation of tasks within the projects.	E
RF9	Assigning tasks to users	The system must allow assignment of tasks to users. Activities can be assigned at the time of creation or later selected among the available activities.	E
RF10	Priority	The system should allow the prioritization of	I

	classification of tasks	activities. the priorities can be changed according to the evolution of the activity.	
RF11	Monitoring project progress	The system should provide information about the progress of the project.	I
RF12	Monitoring progress of tasks	The system should provide information about the progress of the tasks.	I
RF13	Notes on tasks	The system should allow annotation of observations in tasks.	I
RF14	Providing forum for users	The system should provide for the creation of discussion forums, both public and within the project.	I
RF15	Providing chat to users	The system should provide a chat chat for users logged into the system. Chat can be started in a group or between two users.	I
RF16	Email delivery	The system must provide e-mail to all users.	I
RF17	Notification	The system must notify all users involved about relevant changes to the project or tasks.	I
RF18	Document Repository	The system must organize a repository and share all the generated documents in the production of the games (images, audios, codes ...).	E
RF19	source code control	The system must provide versioning information for the source code.	E
RF20	Availability of test versions	The system must allow the release of test versions during project development.	I
RF21	Notes on test versions.	The system should allow feedback annotations in the trial version by users.	D
RF22	Generate activity report.	The system must generate and maintain generate reports of the activities in the system, such as changes in the project, contribution of users, login, changes in files...	D

RF23	Game availability after finalization.	The system must have an area, online, to make the finished games available.	I

4.4.2 Non-functional requirements

Table 2. System Non-functional requirements

ID	Requirements	Description	Priority
NF1	Web system	The system should be web.	E
NF2	Developed in Javascript and HTML	The system should be developed with HTML and Javascript.	E
NF3	Compatible with all major browsers.	The system must support the major web browsers (Chrome, Firefox and Safari).	I
NF4	Responsive	The system should work on any device that has a compatible web browser.	I
NF5	Register log	Record all actions performed on the system.	D

4.5 System Operation

Understanding the system's operating cycle is essential to achieve the objective of this work. When finalizing the description of a game the system generates a GDD, which already includes the basic tasks for the production of the game in question. The GDD is made available and any of the collaborators can join an ongoing project or start their version of this GDD.

The project consists of a series of tasks, each task being the implementation or modification of a software functionality. At the beginning of a new project, the system will inform you the profiles of collaborators needed to develop the game in the new project, based on the basic tasks already specified in the GDD.

In addition to tasks already added automatically by GDD users can register new tasks, necessary for implementation, fixes or adaptations. Each Created, Changed, or Finished task will generate notifications for the members involved and feed the tracking data and activity report into the system.

Members can check their peers' tasks and make suggestions through notes. Whenever you have a new version the system can generate a test version. when there are no more tasks and the final version is approved by the group the game is finalized and made available to the repository.

Figure 3 shows the flowchart of the development process of a digital electronic game project in this system.

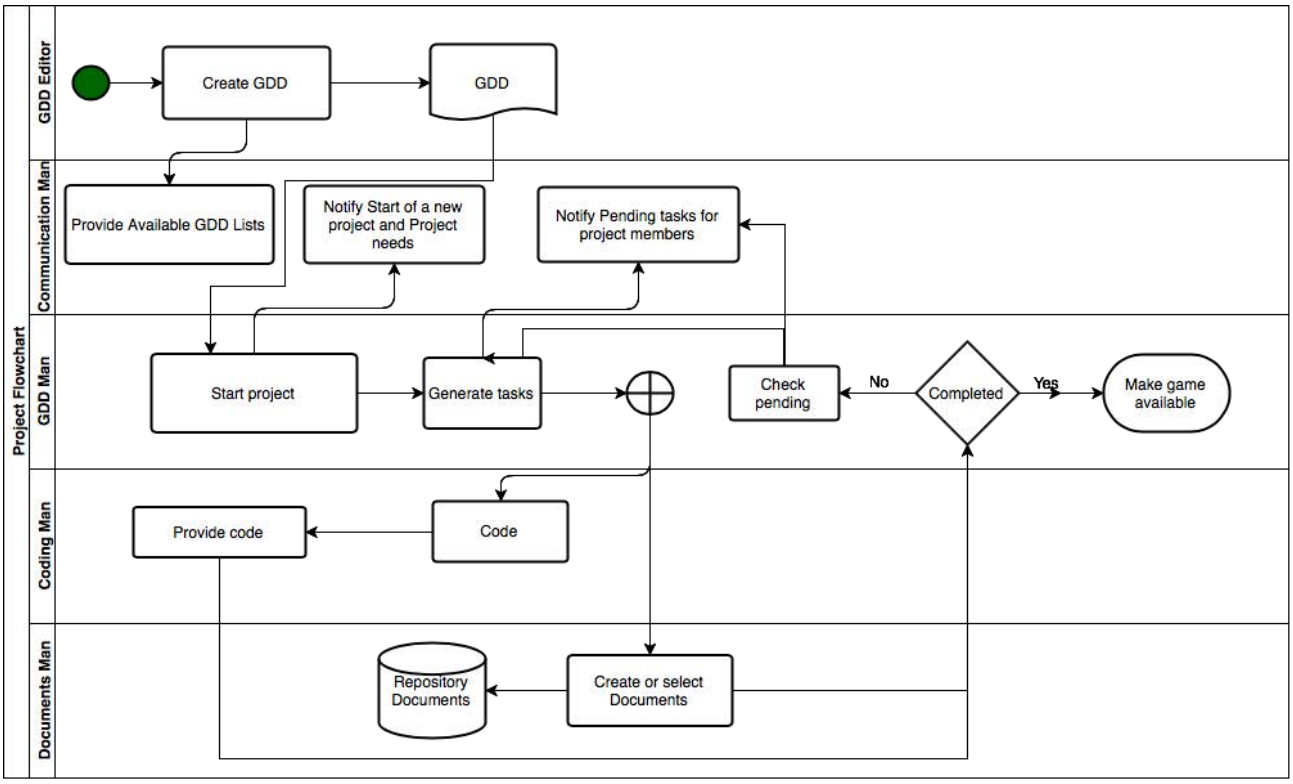

Figure 3. System flowchart

5. Conclusion

In a collaborative community individuals are encouraged to apply their personal talents in group projects. As a rule this type of community seeks, from the singular experiences, to obtain solutions to common problems. For collaboration to take place, it is necessary to offer spaces, be they physical or virtual, that will potentiate and stimulate the interaction among the members of the community.

The current context, characterized by accelerated technological development and expanded access to these technologies, favors the emergence of new paradigms, which should be used to contribute to the improvement of our society. In this sense, collaborative work can benefit greatly from the integration of ICTs, especially in the educational field. Enabling the improvement of new developers and providing access to more resources, with a strong pedagogical foundation, that favor learning and digital integration.

It is hoped that this project can provide conditions for collaborative development focused on the educational area, as well as assisting in the management of the entire software production process. Contributing to the entire community through the provision of quality open educational games and at various levels of education, offering support to educators who need technological support to put their ideas into practice and to enable learning in practice in a collaborative environment, of students interested in hone or developing skills in digital game programming and production.

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SGDDEdu: A Model of Short Game Design Document for Digital Educational Games

Raiane dos Santos Martins (Corresponding author)
Universidade Federal do Rio Grande do Norte
Natal (RN), Brazil
raimartins@gmail.com
+55 (84) 988163264

Filipe de Carvalho Pinto Raulino
Universidade Federal do Rio Grande do Norte
Natal (RN), Brazil

Aquiles Medeiros Filgueira Burlamaqui
Universidade Federal do Rio Grande do Norte
Natal (RN), Brazil

Akynara Aglaé Rodrigues Santos da Silva Burlamaqui
Universidade Federal Rural do Semi-Árido
Angicos (RN), Brazil

Abstract

The use of games in education has become an increasingly present practice in contemporary society. For so-called "digital natives", learning through electronic games becomes more significant. Digital educational games are often seen as boring, non-motivational, that fail to bring in some essential elements that promote engagement, making the learning goal is not achieved either. Game Design is a game project. It describes how the game should be, defining its mechanics and interactions between player and the virtual world of the game and how they can affect the game environment. In order to document the design of a game, there is the Game Design Document (GDD), whose one of the main objectives, besides registration, is to help in communication between the different production teams of a game, allowing the game designer a broad view of that is being produced. However, because it is a large document that brings in detail all the main elements for the production of a game, it turns out to be little used, especially if the focus is the elaboration of small games, which are the majority of the digital educational games that exist. For these short games, which can often be worked out within a few hours, there are Short Game Design Document (SGDD). The SGDD, unlike GDD, will describe the elements of the game in a simplified way possible, whereas the game to be drawn from it is also a simple game. Thus, the proposal of this work is to elaborate a model of SGDD for educational games (the SGDDEdu), specifying elements of art, sound, mechanics and game programming, as well as educational elements in accordance

with the new BNCC (National Curricular Common Base) of Elementary School, so that there is a standardization and better categorization of educational games aligned with the proposed pedagogical objectives and the skills and competences described in each level of education. This work will be developed from the study and analysis of some models of already existing SGDD and the BNCC of Elementary School in general, causing in SGDDEdu. The research will be applied with teachers and educators requesting that they specify an educational game in the SGDDEdu template. With this, we intend to verify if the SGDDEdu has relevance and if it facilitates in the production of digital educational games, providing the teaching and learning process through the games, as well as trying to identify how the NCCB can contribute in the development of educational games.

Keywords: Educational games, Game Design, SGDD, BNCC

1. Introduction

The use of games in education has become an increasingly present practice in contemporary society. For so-called "digital natives" learning through electronic games becomes more meaningful, through tangential learning [1].

Digital educational games, still timid, are present in educational institutions and show a new society that believes in the efficiency of games for the teaching and learning process, but still needs to have a greater connection with the school curriculum. The use of these games in the teaching and learning process favors the dynamism and stimulates the interest of the students, however, one of the main challenges of this practice is to align the game with the didactic content without losing the playfulness and learning objective to be reached [2].

Educational games are often seen as boring games because, for the most part, they lack the essential elements used in the development of digital games, such as the aesthetics, the dynamics and the mechanics. In addition, they do not have elements that promote engagement: plot, goals and objectives, difficulty levels, scores, rankings and feedbacks [3], making the learning objective of the game is not reached.

Game Design is the design of a game. It describes how the game should be, defining its mechanics and the interactions between the player and the virtual world of the game and how they can affect the game environment and the player [4]. In the game development process, it is necessary to document everything that should be done. This documentation is given through the Game Design Document (GDD), whose main objective is to help in communication between the different production teams of the game, allowing the game designer a broad view of what is being produced. The GDD is a "reference document, which development team members should consult frequently" [1] (p. 88) and which contains all the information about the game to be developed, from its initial design to its techniques and functionalities, described in detail.

Despite the importance of GDD in the development of a game, it is rarely used because it is a very large document, which contains many pages, sometimes becoming difficult to consult. The way of documenting a game should be thought out according to the type of game being developed. Due to this, there is the SGDD (Short Game Design Document), which is a type of document that describes the elements of the game in a simplified way, whose main elements to be described are: the history of the game, the

programming and the visual and sound artistic elements. Because of its simplicity in the description, the SGDDs are more used to document short games.

The proposal of this article is to elaborate a model of SGDD for educational games (SGDDEdu), in which besides being specified elements of art, sound, mechanics, game programming and plot, the pedagogical elements in accordance with the new BNCC (National Curricular Common Base) of Brazil will also be specified, for the purpose of standardization and better categorization of educational games aligned with the proposed pedagogical objectives and the skills and competences described in each level or year of teaching.

2. Theoretical Basis

2.1 Digital Educational Games

Regarding technological tools, the use of digital games in education stands out as an imminent and potent contribution to teaching. Through games, students feel more motivated and engaged in the teaching and learning process. According to [5], because there are many theoretical concepts and school contents without a methodology more directed to a playful learning, students' assimilation and learning becomes difficult and tedious.

For [6], the teaching of digital games as a means for the student's learning process offers advantages such as playfulness, cooperation, participation, pleasure and motivation. And because of the great acceptance of this type of tool, mainly by the young public, the adoption of the games in the educational area represents a natural process [7]. The focus is on an effective learning model which should make possible the representation and elaboration of digital games as a viable educational technology.

The main objective of a good educational game is to teach the player while having fun with the game, and for that to happen, it is necessary for the student-player to feel interested and motivated to play. Thus, "the choice of an Educative (or Educational) Game should consider its content, but without forgetting the way it presents itself to the student-player" [8] (p. 839).

Nowadays, there is still a certain challenge for the use of educational games, no longer related to their ability to teach, but often due to the lack of mastery by teachers, as well as the lack of educational games that can integrate the learning objectives to be achieved with the engaging, motivating and playful feature of the game [9].

Besides educational games should be strictly related to the pedagogical goals to be achieved, it is also important that the game has one or more Learning Theories that base its conception. In the context of this work, we consider the following Pedagogical Theories: Innated-maturational of Binet and Gesell, Behaviorist of Watson and Skinner, Genetic Epistemology (Constructivism) of Piaget, Cultural-historical (Sociocultural) of Vygotsky and, finally, Meaningful Learning of Ausubel.

2.2 Game Design

In order for the goal of instruction to be successfully achieved, in addition to the game having to bring didactic elements, it must also bring elements inherent in the digital games that make the student feel motivated to play (and learn), which are related to mechanics, dynamics and aesthetics of the game, such

as: rules, points, rewards, gameplay, layout, game strategies, interaction with the game environment and with other players, time, risk and punishments [4].

These elements are closely related to Game Design. Thus, game design is the activity that defines the interaction of the player with the virtual world of the game, the actions that the player can perform, how they affect the game environment and how they are presented to the player [4]. According to [10] game design is a set of rules in which there is the means and motivation to play, creating a combination of challenge, competition and interaction, that is, elements that build fun by the game.

On the role of game designer, [4] further says that it can be developed by anyone who can make the decisions that define how the game should be, not needing a very thorough knowledge about it, just "one understanding of the principles of game design" (p. xxv). This opens the door to the insertion of digital educational games, since it allows the teacher himself to be the designer of a game that best meets the educational needs required.

One of the initial stages in the conception of the game idea and in the developing digital games is the development of a Game Design Document (GDD). In GDD should be described all the planning of the game, from the plot to the more technical features. According to [11] the GDD is the "floor plan layout" of a digital game, containing all its structural and functional description. The main function of GDD is to facilitate communication between teams, so this document should contain every detail of the game to be developed, helping to keep the project overview in a solid and coherent way, in addition to having all the planning documentation, making it possible to be consulted at any time. By thoroughly portraying the game in its entirety, GDD often becomes a very lengthy document and difficult to read. However, there is no specific template for writing a Game Design Document. Each game and each team has different needs and specificities. The document should be appropriate to the project and not the other way around.

2.3 BNCC (National Curricular Common Base)

For the purpose of giving pedagogical bases to the model of SGDD to be proposed, the BNCC (National Curricular Common Base of Brazil) was chosen because it is a current document of reference that establishes the set of fundamental and indispensable learning for students of Basic Education.

From the BNCC, all educational institutions, whether public or private, have compulsory guidelines and recommendations for the elaboration and adaptation of their curriculum and pedagogical proposals for the teaching and learning process [12], making an articulated and integrated education policy with all the community, which was thought, elaborated and approved by pedagogical professionals, teachers and educators of all Brazilian society.

The BNCC defines the essential learnings that students must have from the development of ten general competences that corroborate with the learning and development rights in the pedagogical scope. For BNCC, competence is "the mobilization of knowledge (concepts and procedures), skills (practical, cognitive and social-emotional), attitudes and values to solve complex demands of daily life, the full exercise of citizenship and the world of work" [12] (p. 8). That is, from the competences, education raises values and actions that collaborate so that the society becoming more just, human and that preserves the nature and the social environment where it is inserted, being aligned as much with the Notebook of

Education in Human Rights [13], as with the 2030 Agenda of the United Nations (UN) [14].

In addition to the general competences, the BNCC is structured to specify the specific competences that the students must develop throughout the Basic Education. This work will use only the Elementary School as a reference for the elaboration of the SGDD model for Educational Games, in this way, the BNCC of Elementary School is a key piece for the development of the proposal.

Figure 1 exemplifies the organization of BNCC. In it, one has the Mathematical Knowledge Area of Elementary School. This area has only one curricular component: Mathematics. Each elementary school curriculum component is also divided into Initial Years (1st to 5th year) and Final Years (6th to 9th grade), with their levels of education. Figure 1 shows some of the thematic units, objects of knowledge and skills related to the curricular component of Mathematics of the 9th grade.

MATEMÁTICA – 9º ANO

UNIDADES TEMÁTICAS	OBJETOS DE CONHECIMENTO	HABILIDADES
Números	Necessidade dos números reais para medir qualquer segmento de reta Números irracionais: reconhecimento e localização de alguns na reta numérica	**(EF09MA01)** Reconhecer que, uma vez fixada uma unidade de comprimento, existem segmentos de reta cujo comprimento não é expresso por número racional (como as medidas de diagonais de um polígono e alturas de um triângulo, quando se toma a medida de cada lado como unidade). **(EF09MA02)** Reconhecer um número irracional como um número real cuja representação decimal é infinita e não periódica, e estimar a localização de alguns deles na reta numérica.
	Potências com expoentes negativos e fracionários	**(EF09MA03)** Efetuar cálculos com números reais, inclusive potências com expoentes fracionários.
	Números reais: notação científica e problemas	**(EF09MA04)** Resolver e elaborar problemas com números reais, inclusive em notação científica, envolvendo diferentes operações.
	Porcentagens: problemas que envolvem cálculo de percentuais sucessivos	**(EF09MA05)** Resolver e elaborar problemas que envolvam porcentagens, com a ideia de aplicação de percentuais sucessivos e a determinação das taxas percentuais, preferencialmente com o uso de tecnologias digitais, no contexto da educação financeira.
Álgebra	Funções: representações numérica, algébrica e gráfica	**(EF09MA06)** Compreender as funções como relações de dependência unívoca entre duas variáveis e suas representações numérica, algébrica e gráfica e utilizar esse conceito para analisar situações que envolvam relações funcionais entre duas variáveis.
	Razão entre grandezas de espécies diferentes	**(EF09MA07)** Resolver problemas que envolvam a razão entre duas grandezas de espécies diferentes, como velocidade e densidade demográfica.
	Grandezas diretamente proporcionais e grandezas inversamente proporcionais	**(EF09MA08)** Resolver e elaborar problemas que envolvam relações de proporcionalidade direta e inversa entre duas ou mais grandezas, inclusive escalas, divisão em partes proporcionais e taxa de variação, em contextos socioculturais, ambientais e de outras áreas.
	Expressões algébricas: fatoração e produtos notáveis Resolução de equações polinomiais do 2º grau por meio de fatorações	**(EF09MA09)** Compreender os processos de fatoração de expressões algébricas, com base em suas relações com os produtos notáveis, para resolver e elaborar problemas que possam ser representados por equações polinomiais do 2º grau.

Figure 1. Thematic Units, Knowledge Objects and Skills - Mathematics of Elementary School - 9th Year.

3. Related Work

3.1 Short game design document (SGDD): Game design document applied to small games and advergames: A case study of the advergame Rockergirl Bikeway

In the work of [15], the authors demonstrate the application of a short game design document as a theoretical-textual tool with characteristics of a GDD for the production process of a small game or advergame.

For such a proposal, the authors relied on the ideas of Rollings and Morris [15] who says that a game design document should be able to describe the game as loyalty so that it can be "played mentally", that is, a document that when is read can create a mental image of the game.

In order to create a short game design document, [15] defined a few steps: 1) Description in a synthetic way the plot of the game; 2) Description of the whole game in a running text; 3) Text marking (with color, bold, italic, etc.) of art, interface, music and mechanics contents; 4) Creation of lists containing the elements

of art, interface, music and programming; 5) Description, in the form of drawings, the level game design (game flow chart), if necessary. With this, the SGDD would consist of basically two main pages: literal description of the game and lists of assets and programming routines of the game.

With a proposal to create a document that is short and easily accessible by all small game planning and development team (SGDD), the authors differed from the long and exhaustive GDDs. However, their proposal also distances itself from the educational scope, in which, at no time was mentioned the possibility of application in educational games, turning to commercial games as well.

The proposal of this article is strongly based on the ideas of [15], however, besides taking into account aspects of art, interface, music and programming, the pedagogical character of an educational game will also be explored and defined based on the BNCC.

3.2 Creating a conceptual model for Game Design Documentation

In this work, the authors [16] develop a way of documenting the idea of the game designer in order to facilitate the communicative process among the teams involved in the production of digital games, whether they of small or large size, attending to the greater variety of games that may exist.

In Chapter 3 of this paper, the authors listed and described the most important elements of a GDD according to a research carried out by [16] and, from these important elements of the GDD, they also defined the essential elements of the GDD. For [16], there are four essential elements that form a game: aesthetics, mechanics, history and technology, named by him as "Elementary Tetrad". The authors considered it possible to adapt elementary tetrad by removing one element, technology, transforming it into an "Elementary Triad", where aesthetics becomes the most visible element and mechanics and history are the least visible elements in the game. After this adaptation, the authors distributed some common elements present in most GDD models among the three elements of the triad. Some other common elements were not possible to fit the triad, causing the authors to define a new category called Add-ons.

In this work it was possible to verify that, although the authors wish to create a GDD model that attends to the greater number of types of games, the proposed model does not meet the requirements of a digital educational game because it does not provide space for the definition of elements related to the pedagogical content, being more oriented to commercial games or Indies games.

3.3 PlayEduc: a conceptual framework for developing digital educational games

The master's thesis defended by [17] proposes a conceptual framework for the development of digital educational games: called PlayEduc. The framework is based on the areas of psychology, pedagogy and design and uses some essential elements of each of these areas to guide the process of building games that combine entertainment with education.

In chapter 5 of [17], the author will present the proposed framework: PlayEduc, which aims to assist in the process of producing digital educational games and help fill the gap in the lack of reasoning and orientation among the teams of development of digital educational games.

PlayEduc is part of the pre-production stage of the game, in which the fundamental principles of the game (entertainment, learning and gameplay) related to psychology, pedagogy and game design are defined, each

containing 7 essential elements, that "are the extract of the fundamental principles and the fuel for development teams to evolve in the design of the game through the use of the framework" [17] (p. 69), which are described throughout the dissertation. At first, three questionnaires, one for each principle, will be used to guide the use of the framework. From what is answered in each questionnaire, one arrives at the GDD, which in the context of [17] is called EGDD (Educational Game Design Document), which "will gather all the information obtained through the application of the essential elements, besides counting other technical data fundamental to the process of development of the game" [17] (p. 79). Once the EGDD is built, the development of the game follows the flow to the next steps: Production, Execution and Evaluation. According to the author, PlayEduc has positively impacted the definition of the mechanics and the educational and psychological aspects of the developed games. In fact, the framework seems to guide the production team better. On the other hand, the product generated by the framework: the EGDD, is a robust and "dynamic document that can of course be updated during the other steps, either by increasing, changing or eliminating information in the document" [17] (p. 80, 81), which can become a long process until one reaches a final version of the document. This EGDD goes against the proposal of this paper, which is to suggest a short and quick document.

3.4 Comparison between works

In view of what has been presented in these three works, one can get the following table (Table 1) with some common characteristics (type of proposal of game design documentation, document size and presence or absence of educational and design aspects) and differentials of each of them, comparing them with the proposal of this article: the SGDDEdu.

Table 1. Comparison of related work

	SGDD	GDD	GDD
	Small	Long	Long
	Absent	Absent	Present
	Present	Present	Present
	- Small document and easily accessible by development teams.	- Proposes an "Elementary Triad" for game design document.	- It involves psychological, pedagogical and game design aspects; - GDD specific for the development of digital educational games.

Fonte: Autoria própria.

Regarding the proposed documentation, the proposals of [16] and [17] bring the GDD model in the most

common way and, therefore, these two proposals have the GDD as an extensive document. The work of [15] is the only one to adopt a short document model. Only in the work of [17] the educational aspects are mentioned and taken into account, since it is the only one that proposes a specific documentation model for digital educational games, called EGDD.

In any case, each of the three papers has its differentials that contribute in some way to the validation of its proposals, as they were listed in Table 1.

The SGDDEdu, proposed in this article, distinguishes itself from the others because it is a short game design document (SGDD) destined to short digital educational games, which brings design aspects and educational aspects, taking as a differential the use of BNCC as pedagogical basis.

4. SGDDEdu

In order to help teachers or educators in the task of choosing and using a game that brings benefits to the students, and in view of all the theoretical foundations brought throughout this work, a Short Game Design Document (SGDD) model is proposed for the elaboration of digital educational games in accordance with the National Curricular Common Base (BNCC), taking into account the competences and abilities and with the principles of Game Design, becoming an engaging game that reaches the proposed pedagogical objectives. This model will be called SGDDEdu.

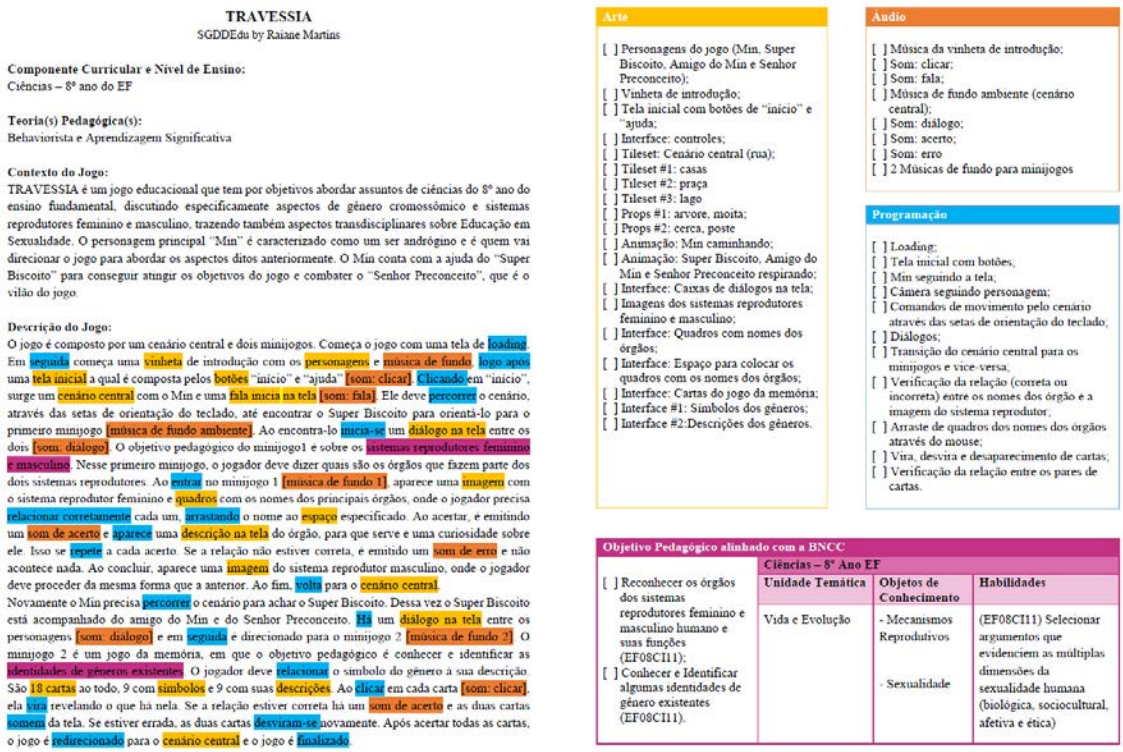
SGDDEdu is a short game design document specifically for educational games. It was elaborated from the model proposed by [15]. In addition to specifying the elements of art, sound, mechanics, game programming and plot [15], the pedagogical elements will also be defined according to the BNCC of Elementary School, with the purpose of standardization and better categorization of educational games in line with the proposed pedagogical objectives and the skills and competences described in each level or year of teaching.

The great differential of this document model is the "Educational" category that will specify the pedagogical theories that guide the game and the general and specific skills and abilities, according to the BNCC, that the student must attain while playing. The idea is that the teacher, or educator, or education enthusiast can design a digital educational game that best meets their real pedagogical needs.

In the next section it will be better explained how the structure of SGDDEdu is given, showing a prototype of this document.

4.1 The SGDDEdu in practice

The SGDDEdu below (Figure 2) was elaborated by Reverse Engineering, in which from a final product, one can arrive at how it may have been elaborated [18]. The game Travessia, prepared by a group of students, is already finished, and from it was created the SGDDEdu model in the proposed form. The model present in Figure 2 is also found in Appendix 1 for better visualization.



TRAVESSIA

SGDDEdu by Raiane Martins

Componente Curricular e Nível de Ensino:
Ciências – 8º ano do EF

Teoria(s) Pedagógica(s):
Behaviorista e Aprendizagem Significativa

Contexto do Jogo:
TRAVESSIA é um jogo educacional que tem por objetivos abordar assuntos de ciências do 8º ano do ensino fundamental, discutindo especificamente aspectos de gênero cromossômico e sistemas reprodutores feminino e masculino, trazendo também aspectos transdisciplinares sobre Educação em Sexualidade. O personagem principal "Min" é caracterizado como um ser andrógino e é quem vai direcionar o jogo para abordar os aspectos ditos anteriormente. O Min conta com a ajuda do "Super Biscoito" para conseguir atingir os objetivos do jogo e combater o "Senhor Preconceito", que é o vilão do jogo.

Descrição do Jogo:
O jogo é composto por um cenário central e dois minijogos. Começa o jogo com uma tela de loading. Em seguida começa uma vinheta de introdução com os personagens e música de fundo, logo após uma tela inicial a qual é composta pelos botões "início" e "ajuda" [som: clicar]. Clicando em "início", surge um cenário central com o Min e uma fala inicia na tela [som: fala]. Ele deve percorrer o cenário, através das setas de orientação do teclado, até encontrar o Super Biscoito para orientá-lo para o primeiro minijogo [música de fundo ambiente]. Ao encontra-lo inicia-se um diálogo na tela entre os dois [som: diálogo]. O objetivo pedagógico do minijogo1 é sobre os sistemas reprodutores feminino e masculino. Nesse primeiro minijogo, o jogador deve dizer quais são os órgãos que fazem parte dos dois sistemas reprodutores. Ao entrar no minijogo 1 [música de fundo 1], aparece uma imagem com o sistema reprodutor feminino e quadros com os nomes dos principais órgãos, onde o jogador precisa relacionar corretamente cada um, arrastando o nome ao espaço especificado. Ao acertar, é emitindo um som de acerto e aparece uma descrição na tela do órgão, para que serve e uma curiosidade sobre ele. Isso se repete a cada acerto. Se a relação não estiver correta, é emitido um som de erro e não acontece nada. Ao concluir, aparece uma imagem do sistema reprodutor masculino, onde o jogador deve proceder da mesma forma que a anterior. Ao fim, volta para o cenário central.
Novamente o Min precisa percorrer o cenário para achar o Super Biscoito. Dessa vez o Super Biscoito está acompanhado do amigo do Min e do Senhor Preconceito. Há um diálogo na tela entre os personagens [som: diálogo] e em seguida é direcionado para o minijogo 2 [música de fundo 2]. O minijogo 2 é um jogo da memória, em que o objetivo pedagógico é conhecer e identificar as identidades de gêneros existentes. O jogador deve relacionar o símbolo do gênero à sua descrição. São 18 cartas ao todo, 9 com símbolos e 9 com suas descrições. Ao clicar em cada carta [som: clicar], ela vira revelando o que há nela. Se a relação estiver correta há um som de acerto e as duas cartas somem da tela. Se estiver errada, as duas cartas desviram-se novamente. Após acertar todas as cartas, o jogo é redirecionado para o cenário central e o jogo é finalizado.

Arte

[ ] Personagens do jogo (Min, Super Biscoito, Amigo do Min e Senhor Preconceito);
[ ] Vinheta de introdução;
[ ] Tela inicial com botões de "início" e "ajuda;
[ ] Interface: controles;
[ ] Tileset: Cenário central (rua);
[ ] Tileset #1: casas
[ ] Tileset #2: praça
[ ] Tileset #3: lago
[ ] Props #1: arvore, moita;
[ ] Props #2: cerca, poste
[ ] Animação: Min caminhando;
[ ] Animação: Super Biscoito, Amigo do Min e Senhor Preconceito respirando;
[ ] Interface: Caixas de diálogos na tela;
[ ] Imagens dos sistemas reprodutores feminino e masculino;
[ ] Interface: Quadros com nomes dos órgãos;
[ ] Interface: Espaço para colocar os quadros com os nomes dos órgãos;
[ ] Interface: Cartas do jogo da memória;
[ ] Interface #1: Símbolos dos gêneros;
[ ] Interface #2:Descrições dos gêneros.

Audio

[ ] Música da vinheta de introdução;
[ ] Som: clicar;
[ ] Som: fala;
[ ] Música de fundo ambiente (cenário central);
[ ] Som: diálogo;
[ ] Som: acerto;
[ ] Som: erro
[ ] 2 Músicas de fundo para minijogos

Programação

[ ] Loading;
[ ] Tela inicial com botões;
[ ] Min seguindo a tela;
[ ] Câmera seguindo personagem;
[ ] Comandos de movimento pelo cenário através das setas de orientação do teclado;
[ ] Diálogos;
[ ] Transição do cenário central para os minijogos e vice-versa;
[ ] Verificação da relação (correta ou incorreta) entre os nomes dos órgão e a imagem do sistema reprodutor;
[ ] Arraste de quadros dos nomes dos órgãos através do mouse;
[ ] Vira, desvira e desaparecimento de cartas;
[ ] Verificação da relação entre os pares de cartas.

Objetivo Pedagógico alinhado com a BNCC

	Ciências – 8º Ano EF		
	Unidade Temática	Objetos de Conhecimento	Habilidades
[ ] Reconhecer os órgãos dos sistemas reprodutores feminino e masculino humano e suas funções (EF08CI11); [ ] Conhecer e Identificar algumas identidades de gênero existentes (EF08CI11).	Vida e Evolução	- Mecanismos Reprodutivos - Sexualidade	(EF08CI11) Selecionar argumentos que evidenciem as múltiplas dimensões da sexualidade humana (biológica, sociocultural, afetiva e ética)

Figure 2. *SGDDEdu of the game "Travessia"*
Fonte: Autoria própria.

Following the steps proposed by [15], but differentiating by adding information related to education, on the first page are the title of the game and the authorship, the curricular component and the level of education for which the game is intended, the pedagogical theories that base the conception of the game, the context of the game, containing information about what is the game, type of game, goals, themes covered, characters and the plot synthetically. Below is the description of the game in a more detailed way, describing the operation of each stage of the game and character characteristics, scenarios, sounds and pedagogical objectives. At the end of this description, markings were made in different colors to differentiate the elements related to the game's programming (mechanics), art and audio elements (design) and the pedagogical objectives present.

The second page of SGDDEdu is composed of four tables: the first three lists the elements of art/interface, music/sounds and programming that should be elaborated for the game; the fourth table is related to the pedagogical objectives of the game with skills and abilities according to the BNCC. In the first column of the table concerning the educational part are the pedagogical objectives that must be present in the game, in the second column, subdivided into three more columns, is the part related to the BNCC, containing the Curricular Component and the Level of Education (in this case, Science - 8th year of Elementary School), the Thematic Unit, Knowledge Objects and Skills, all related to the pedagogical objectives of the game. Skills are identified by a code defined by BNCC (in this case, skill EF08CI11 has been contemplated).

As future works, the idea is to create an electronic editor in which the game designer (or teacher, or educator) can write their SGDDEdu according to predefined fields and make this document available so that

programmers and developers can create the requested game through of a Collaborative System of Development of Educational Games.

5. Conclusion

The student of the 21st century strives for an education that is more in keeping with the reality in which it is inserted. A more meaningful learning that engages you in the teaching and learning process.

The Digital Educational Games has become a tool used to attract attention and motivation to studies and appear as a great facilitator of the teaching and learning process, capable of integrating different resources and media in order to promote greater engagement and better results. However, the development process of these games can become complicated due to the long time, high financial costs and lack of knowledge, as well as the little resource and importance given to this game genre. In addition, they demand constant changes in the way of thinking about education, both by the institution and teachers, as well as by students. For the purpose of making the teaching and learning process more relevant to all actors (school, teachers, students and community), this paper intends to make this connection through digital educational games, in the form of a document that specifies in a simple way a game that can meet the real needs of the teacher and the student.

The SGDDEdu was thought of as a reference model for the specification and documentation of digital educational games, both for bringing pedagogical elements from the BNCC and for facilitating the planning and design of a simple educational game that can be elaborated by any teacher/educator, reducing the lack of digital educational games that meet both the pedagogical objectives that are intended to achieve and the premises that promote the engagement related to the areas of Game Design.

From the application of the SGDDEdu, it is intended to identify how, in fact, the BNCC, since it is a common national basis that defines the necessary learning at all levels of education, can contribute to the development of digital educational games and also verify if the SGDDEdu has relevance for the production of these games, providing the teaching and learning process.

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Appendix

Appendix 1. SGDDEdu Travessia

TRAVESSIA

SGDDEdu by Raiane Martins

Componente Curricular e Nível de Ensino:
Ciências – 8º ano do EF

Teoria(s) Pedagógica(s):
Behaviorista e Aprendizagem Significativa

Contexto do Jogo:
TRAVESSIA é um jogo educacional que tem por objetivos abordar assuntos de ciências do 8º ano do ensino fundamental, discutindo especificamente aspectos de gênero cromossômico e sistemas reprodutores feminino e masculino, trazendo também aspectos transdisciplinares sobre Educação em Sexualidade. O personagem principal "Min" é caracterizado como um ser andrógino e é quem vai direcionar o jogo para abordar os aspectos ditos anteriormente. O Min conta com a ajuda do "Super Biscoito" para conseguir atingir os objetivos do jogo e combater o "Senhor Preconceito", que é o vilão do jogo.

Descrição do Jogo:
O jogo é composto por um cenário central e dois minijogos. Começa o jogo com uma tela de loading. Em seguida começa uma vinheta de introdução com os personagens e música de fundo, logo após uma tela inicial a qual é composta pelos botões "início" e "ajuda" [som: clicar]. Clicando em "início", surge um cenário central com o Min e uma fala inicia na tela [som: fala]. Ele deve percorrer o cenário, através das setas de orientação do teclado, até encontrar o Super Biscoito para orientá-lo para o primeiro minijogo [música de fundo ambiente]. Ao encontra-lo inicia-se um diálogo na tela entre os dois [som: diálogo]. O objetivo pedagógico do minijogo1 é sobre os sistemas reprodutores feminino e masculino. Nesse primeiro minijogo, o jogador deve dizer quais são os órgãos que fazem parte dos dois sistemas reprodutores. Ao entrar no minijogo 1 [música de fundo 1], aparece uma imagem com o sistema reprodutor feminino e quadros com os nomes dos principais órgãos, onde o jogador precisa relacionar corretamente cada um, arrastando o nome ao espaço especificado. Ao acertar, é emitindo um som de acerto e aparece uma descrição na tela do órgão, para que serve e uma curiosidade sobre ele. Isso se repete a cada acerto. Se a relação não estiver correta, é emitido um som de erro e não acontece nada. Ao concluir, aparece uma imagem do sistema reprodutor masculino, onde o jogador deve proceder da mesma forma que a anterior. Ao fim, volta para o cenário central.
Novamente o Min precisa percorrer o cenário para achar o Super Biscoito. Dessa vez o Super Biscoito está acompanhado do amigo do Min e do Senhor Preconceito. Há um diálogo na tela entre os personagens [som: diálogo] e em seguida é direcionado para o minijogo 2 [música de fundo 2]. O minijogo 2 é um jogo da memória, em que o objetivo pedagógico é conhecer e identificar as identidades de gêneros existentes. O jogador deve relacionar o símbolo do gênero à sua descrição. São 18 cartas ao todo, 9 com símbolos e 9 com suas descrições. Ao clicar em cada carta [som: clicar], ela vira revelando o que há nela. Se a relação estiver correta há um som de acerto e as duas cartas somem da tela. Se estiver errada, as duas cartas desviram-se novamente. Após acertar todas as cartas, o jogo é redirecionado para o cenário central e o jogo é finalizado.

Arte

[ ] Personagens do jogo (Min, Super Biscoito, Amigo do Min e Senhor Preconceito);
[ ] Vinheta de introdução;
[ ] Tela inicial com botões de "início" e "ajuda;
[ ] Interface: controles;
[ ] Tileset: Cenário central (rua);
[ ] Tileset #1: casas
[ ] Tileset #2: praça
[ ] Tileset #3: lago
[ ] Props #1: arvore, moita;
[ ] Props #2: cerca, poste
[ ] Animação: Min caminhando;
[ ] Animação: Super Biscoito, Amigo do Min e Senhor Preconceito respirando;
[ ] Interface: Caixas de diálogos na tela;
[ ] Imagens dos sistemas reprodutores feminino e masculino;
[ ] Interface: Quadros com nomes dos órgãos;
[ ] Interface: Espaço para colocar os quadros com os nomes dos órgãos;
[ ] Interface: Cartas do jogo da memória;
[ ] Interface #1: Símbolos dos gêneros;
[ ] Interface #2:Descrições dos gêneros.

Áudio

[ ] Música da vinheta de introdução;
[ ] Som: clicar;
[ ] Som: fala;
[ ] Música de fundo ambiente (cenário central);
[ ] Som: diálogo;
[ ] Som: acerto;
[ ] Som: erro
[ ] 2 Músicas de fundo para minijogos

Programação

[ ] Loading;
[ ] Tela inicial com botões;
[ ] Min seguindo a tela;
[ ] Câmera seguindo personagem;
[ ] Comandos de movimento pelo cenário através das setas de orientação do teclado;
[ ] Diálogos;
[ ] Transição do cenário central para os minijogos e vice-versa;
[ ] Verificação da relação (correta ou incorreta) entre os nomes dos órgão e a imagem do sistema reprodutor;
[ ] Arraste de quadros dos nomes dos órgãos através do mouse;
[ ] Vira, desvira e desaparecimento de cartas;
[ ] Verificação da relação entre os pares de cartas.

Objetivo Pedagógico alinhado com a BNCC

	Ciências – 8° Ano EF		
	Unidade Temática	**Objetos de Conhecimento**	**Habilidades**
[ ] Reconhecer os órgãos dos sistemas reprodutores feminino e masculino humano e suas funções (EF08CI11); [ ] Conhecer e Identificar algumas identidades de gênero existentes (EF08CI11).	Vida e Evolução	- Mecanismos Reprodutivos - Sexualidade	(EF08CI11) Selecionar argumentos que evidenciem as múltiplas dimensões da sexualidade humana (biológica, sociocultural, afetiva e ética)

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Negligence and invisibility: perceptions on obesity in the school context

Denise Bolzan Berlese, PhD, Gustavo Roese Sanfelice, Daiane Bolzan Berlse, PhD, André Luiz dos Santos Silva, PhD, Valéria Zanetto Ney, PhD, Jacinta Sidegun Renner, PhD
Feevale University, Brazil

Abstract

The aim of this study was to investigate how it manifests obesity in the school context. The study included 21 obese and 10 directors. Research instruments used were semi-structured interviews with adolescents and questionnaire with the directors. The results show that there is little dialogue between the families of obese and school; the directors are unaware of the treatments performed for obesity by his students, directors attribute the responsibility of feeding the nutritionist at the Department of Education; bullying was presented as a factor in the school context as well, obesity is not regarded as a disease or as a factor of social exclusion, the educators also disclaim any responsibility or interference in this matter. Finally, it appears that obese adolescents are neglected in the context studied.

Keywords: (Virtual Library in Health (BVS)): obesity, adolescents, school.

1. Introduction

With the significant increase in overweight and obesity rates in Brazil, as well as in economically developed and developing countries, strategies for the control of chronic noncommunicable diseases are currently being defined, one of which is the promotion of healthy eating and the encouragement of practice of physical activities[1]. Behavioral changes from technological progress and access to fast foods have altered the patterns of physical activity and the nutritional status of individuals, leading to overweight[2]. Thus, the school appears as a coadjutant in the treatment and control of this epidemic.

In the 1930s, a national education system was established in Brazil, but only after the constitution of 1934 the Brazilian State was appointed as responsible for the education of the Brazilian population. With the creation of the Ministry of Education and Public Health in 1930, the naturalized conjugation between education and public health was immediately established. In the configuration of the modern educational institution, the task of education, hygienic and alimentary measures aiming at physical and moral health are combined, forming a veritable crusade on children's bodies[3].

In fact, the level of people's health reflects the way they live, in a dynamic interaction between individual potentialities and living conditions. Thus, school plays a prominent role in the training of citizens for a healthy life, since the degree of schooling has a proven association with the level of health of individuals and population groups[4]. Mohr and Schall[5], discussing health education in Brazilian elementary schools, emphasize the lack of preparation of teachers in this area of knowledge, the lack of quality of most textbooks available and the scarcity of alternative materials.

Despite this dissociation between theory and practice, it is observed that the government's proposals

for health education presuppose measures, exercises, the elaboration of new snacks and, above all, the diffusion of a lean and healthy life[6]. Especially in the last decade, good form and lean body begin to take an important place in school concerns. Although health has never ceased to be an important focus in school, since the actions of measuring and weighing the bodies were constitutive of the pedagogies hygienists during the nineteenth and twentieth centuries[7].

We now see a more incisive shift towards the production of lean and healthy bodies. Soares[7] shows that in the current school, the taking of measures is updated through scientific and technological transformations, together with an increasing concern with youth, health and obesity. Thus, new educational programs permeate school and non-school discourse and practices on health. Once the new parameters for thinness and health have been defined, new hygiene is the focus of school programs against childhood obesity[8].

The body, which was already the support and the product of disciplinary matter, now assumes a new centrality. The production of subjectivity is now almost completely occupied by the rule of eating practices and active life, for eating properly and putting the body into motion have become essential elements. Healthy eating practices, as subjective forms of production, depend on a set of modulatory norms attributed to the subject, both through institutions, as the school, and in the absence of such institutions, that is, through the demands and demands of the market itself[6.]

Ortega[9], in his analysis of the body, defines this new biopolitical determination about the lean and healthy body in terms of a bioascess, and the present school could not pass over these new biopolitical processes. In the context of the crisis of disciplinary institutions and recent national reforms, which instituted the pedagogy of control, the school institution tries to sketch a new meaning for itself. On the other hand, there is also the definite entrance of new themes and problems that come to inhabit and to definitively colonize the old curricular programs, such as ethics, consumption, the environment, sexuality, ethnic-racial relations, gender relations, prevention of sexually transmitted diseases, and, more recently, food issues for projects to combat obesity at school. Due to the nutritional transition that occurred in Brazil, new ways of providing food are now being observed within the school. In this sense, the proposal that education be the matrix of the strategy to improve the conditions of food and nutrition is aligned with the commitment of the various segments of society[10].

The National School Feeding Program (PNAE) is one of the oldest public programs of food supplementation, standing out for continuing significant investments. Assured by the 1988 Constitution, the PNAE has a universal character and, according to the National Fund for the Development of Education - FNDE, in 2004 it served about 36.4 million students from the pre-school and elementary schools of the public and philanthropic network during school days and with investments in the order of R$ 1.266 billion. The National School Feeding Program, aimed at nourishing a population that presented a risk of death due to hunger, began to worry about the caloric balance of school meals, due to the growing identification of obesity in schools. Schools, together with other institutional bodies responsible for school feeding in Brazil, such as ABESO (Brazilian Association for the Study of Obesity), SBEM (Brazilian Society of Endocrinology and Metabology) and SBP (Brazilian Society of Pediatrics) develop and implement programs for the eradication of obesity[11].

At school, we now take measurements of the waist, abdomen, thighs, chest, calculate the BMI and the equation is performed on the waist circumference, in the same way as the procedure of gymnasiums, doctors' offices and nutritionists. Experts come out of their offices, their research centers and set out for school in a crusade against obesity at school: the motto is "closing the siege" against fat and lack of physical activity. However, such measures can provoke a series of reactions, because the school is a place of socialization, classifying the students according to some physical differences, such as obesity, ends up excluding them and creating constraints in front of the others. In this logic, students resistant to the "norm" are pharmacologically treated and sedated, thus, the title "abnormal" falls on the obese child and adolescent, and can generate serious disorders to the health and social interaction of this individual[12].

In this way, the school should give the opportunity to live and learn healthy habits, so that its students acquire independence to distinguish the best way to lead a healthy life. Despite the efforts of the school environment to promote health, it is observed that, in Brazil, as well as in other countries, overweight and obesity have been increasing alarmingly, the increase in the percentage of obese Brazilians increased 370% in the last 15 years (from 2.9% to 16.6%), and from obese Brazilian women, 450% (from 1.8% to 11.8%). Because of this epidemic, the most recent national research estimate indicates that half of the adults will be overweight[13]. Therefore, the school has a long way to go so that the goals in relation to education and health are achieved. The economically developed and developing countries are defining strategies for the control of chronic noncommunicable diseases, such as obesity, in a wide variety of contexts, especially in the school context. Thus, it is up to Brazil to create and encourage public policies in order to alleviate the health problems faced within the school context, since it is in this context that children and adolescents spend much of their day and reinforce their affective ties of friendship. Therefore, the present study aims to identify how obesity is manifested in the school context[14].

2. Methodology

Ten school principals and 21 obese adolescents, aged between 12 and 18 years, of both sexes, were treated in the Obesity Outpatient Clinic of Childhood and Adolescence of a Hospital of High Complexity, of the Central Region of Rio Grande do Sul. All school principals where obese adolescents are regularly enrolled were included in this survey. Table 1 shows the order of the interviews conducted with adolescents and their respective gender

Table 1 *– Interview order and day, gender and code name*

Interview	Day	Gender	Code name
I1	08/05/2014	M	A1
I2	08/05/2014	F	A2
I3	08/05/2014	F	A3
I4	17/11/2014	F	A4
I5	17/11/2014	F	A5
I6	24/12/2014	M	A6
I7	24/11/2017	M	A7

I8	24/11/2014	F	A8
I9	27/11/2014	F	A9
I10	27/11/2014	M	A10
I11	01/12/2014	M	A11
I12	01/12/2014	F	A12
I13	04/12/2014	F	A13
I14	04/12/2014	F	A14
I15	04/12/2014	M	A15
I16	04/12/2014	M	A16
I17	15/12/2014	F	A17
I18	18/12/2014	M	A18
I19	18/12/2014	M	A19
I20	18/12/2014	M	A20
I21	18/12/2014	M	A21

At Table 2 we have the principals' interview.

***Table 2** – Principal interview order, code names, gender, city and the number of enrolled students at scholl*

I1	D1	F	Santa Maria	4
I2	D2	M	Santa Maria	3
I3	D3	F	Santa Maria	3
I4	D4	F	Jaguari	1
I5	D5	F	Tupanciretã	2
I6	D6	M	Ivorá	2
I7	D7	F	Formigueiro	1
I8	D8	F	Santiago	1
I9	D9	F	Silveira Martins	1
I10	D10	F	São Francisco de Assis	3

The evaluation was performed after the signing of the Free and Informed Consent Term by the school administrators, in accordance with the provisions of Resolution 466 of December of the National Health Council. Participants received information regarding their right to participate and guarantees of anonymity. As a tool, a questionnaire was conducted with school principals where obese adolescents who participated in the study were regularly enrolled. The identity was kept confidential, code names being designated for all participants. The study was approved by the Research Ethics Committee, under registration number 37542814.0.0000.5346.

3. Discussion and Results

Food is fundamental for the development of the human being throughout individuals cycle of life.

Among the different phases of life, we can highlight, for example, the school age, which is characterized by a period in which the individual presents an accelerated metabolism in relation to other life stages[11]. In this sense, school plays a primordial role in eating habits of its students, since, during a good part of the day, these kids are inserted within that context. In the school space, theoretical and practical knowledge about health and disease was constructed according to the ideological scenario of the time, and health issues were approached based on the theoretical reference of each moment. With the increasing incidence of overweight and obese children and adolescents, the school must seek a readjustment of its food supply, as well as review its attitudes towards its relationship with the other contexts, where these subjects are inserted, to meet their needs[15].

Table 1 shows the code names of the principals interviewed and years of working at school.

***Table 1** – Directors and years of working at school*

Interviwee	Number of working years
1- D1	12
2- D2	32
3- D3	11
4- D4	06
5- D5	07
6- D6	17
7- D7	22
8- D8	07
9- D9	13
10- D10	20

It can be seen in Table 1 that the principals present an average time of performance in the school of 26 years. In this sense, we sought to explore several facets of this context to understand how obesity manifests itself and how it is understood by these principals and adolescents. In this perspective, when principals were questioned about some changes in the behavior of obese adolescents in relation to students who did not present obesity, we obtained the following answers:

> "I realize that many respect their colleagues. They are considered friends, for they share family / love problems with them. However, it is also possible to see a significant number of students who have great difficulties of relationships manifesting this mainly through verbal and physical violence. " (D1)

D6 states that: "... some suffer from bullying and they end up isolating themselves."

The above statements can be evidenced, according to the discourse of the adolescents, for example, the comment of the adolescent A12, that brings a very expressive report of the causes and consequences of the bullying in his life. The aggression caused the teenager to change schools, in order to minimize the consequences of this type of violence.

> "The problem was bullying. They give us a lot of nicknames, too. They called me Jabulani (name of the ball of the 2012 World Cup). They called me everything and nothing was done. They just called the secretary, and I had to stay away from high school. They left me at home one day because they saw that I was no longer able to stand and that I was already aggressive leaving for the fight "(A12).

In any culture there is prejudice and violence, attitudes that cause psychic and emotional suffering, isolation and learning difficulties. The victims, in this case, obese adolescents who, because of their insecurity, do not have the courage to ask for help. Faced with the stigma in the school by his supposed friends, the individual with obesity becomes disinterested in the school, avoiding attendance and, in some cases, simulating illnesses not to leave home, nor to find their aggressors, or leaving for physical aggression[16].

Bullying has a high potential for corrosion of self-esteem because the victim needs to remain in school, despite the anguish of daily humiliation before hundreds of colleagues who do not try to prevent aggression because they interpret the treatment given to the victim as joke or opt for invisibility so as not to become the target of bullies. As teenager A15 says, sometimes he does not carry out activities because he feels excluded due to being overweight. "So, sometimes, I feel excluded by my weight. Sometimes yes, I do not do the activities, but it is not always[17].

According to Mattos and Luz[18] obese people self-understand as stigmatized because they cannot perform everyday activities with the same functionality and practicality as the others do, or because they are jokes, wherever they are, by their disfiguring appearance. Regarding A15 and A12, it is noted that there is a mismatch between the student / school / family relationships, since in the case of A12 the aggressors were only referred to be registered and nothing else happened. A15 comments on another serious problem of this mismatch, while after being excluded, he only tells what happens at school to his mother. It is observed that teachers have little perception of bullying, because the victims do not defend themselves or do not speak about the subject, and that the acts, for the most part, happen without the presence of an adult. In this sense, Almeida[19] points out that the child's revelation about the occurrence of mistreatment is rare, for being ashamed and afraid of suffering any kind of retaliation.

Due to the lack of dialogue between the contexts, it is noticed that some principals do not recognize bullying, or any other type of aggression within the school context, as an obvious problem, since they do not associate obesity with the exclusion processes. To this observation, D8 reports: "Some exclude themselves, I think no one excludes anyone inside the school, much less because they are fat. It is a matter of personality not of obesity "(D8). D3 corroborates that "I realize that there is a bit of respect for the colleague's situation. I do not see cases of prejudices in the classroom and in the intervals." D9, however, cannot identify if the difference in the behavior of adolescents in relation to the others occurs because they are obese. He says: "Most people have the same behavior as others, but I see that some are shyer, but I do not know if it's because they're obese or because they're shy."

D8 also does not seem to identify problems with obese students and addresses: "Some of them are quieter, do not interact much. Others are thinner and have no problem being obese."

Some principals, however, do not perceive any kind of discrimination regarding obese adolescents

in school. Thus, D10 states, "No, here at school they can relate to each other equally."
D5 corroborates, stating: "All are friends".

In D5's response, it is observed that, despite his seven years working at school, he does not seem to notice a difference in behavior, but his other colleagues say they perceive changes, mainly those related to bullying. With this, it is evident that the perceptions of the principals are distinct and may be related to the type of management that they seek to develop within the school context.

Another factor of the mismatch in the family / school relationship to be evidenced is whether the schools had received information from their families about the treatment for obesity of the students and about giving some special attention to these adolescents. On this issue, the directors answered:
"No, I've never been informed" (D1).
"I've never been wanted to deal with obesity issues" (D2)
"No, they never told me anything. Does any student at the school do it? "(D8).
"No, I only know that some use medicine for anxiety" (D9)

In relation to the speeches discussed above, the lack of dialogue (mismatch) between families and schools becomes evident. All the investigated principals in this study are linked to the obese adolescents seen at the Obesity and Obesity Outpatient Clinic, because it was sought to evaluate the principals of the schools where these adolescents are regularly enrolled.

Faced with this reading, it is very important to emphasize that the school knows the ties of its students, because, in this way, it can adequately understand their need. In other words, if the school can envisage the structured and consolidated links in the school environment as well as in the family and in the different social contexts where its students are inserted, they will give them the autonomy to deal with conflicts, approaches and situations arising from these links, solve problems jointly or separately. However, from the report of the principals, it is verified that the families do not get involved effectively with the school subjects of the adolescents. The school has no answer when it asks for the presence of the parents, when communicating the family about the change of behavior of the adolescent, when they perceive that something is bothering him or bringing him some loss[20].

In this sense, D9 addresses:

> "Sometimes I see that a student is very uncomfortable with his colleagues. We have already called those who bother this student here in the direction, but we do not have any kind of support from families. It's all in the hands of the school and in that sense, we have become a bit impotent, because it's no use talking to students today unless we have the support of their parents. "

D9 report shows that the school seeks to promote actions to minimize this distance between contexts, however, there seem to be barriers that generate discontinuity and conflicts in the integration between these two microsystems. One of the difficulties in integration is that sometimes the school does not have the different segments of the community in its academic, social and interaction spaces and therefore does not allow an equitable distribution of skills and the sharing of responsibilities. Carneiro[21] affirms that the change of this paradigm will only occur if there is a transformation in the current culture of the school and that the political-pedagogical project could be one of the means to promote this insertion. As a way of

ensuring their understanding and effecting parental involvement, which is still a critical point in the educational sphere, the family must be present in the school context. If the family becomes involved in the issues that contemplate the school context, the approximation with the other social spheres of the adolescent's life will be understood more effectively[22].

Finally, it is believed that the school and the family should share social, political and educational functions, and contribute to the formation of the citizen. Both contexts are responsible for the transmission and construction of culturally organized knowledge, modifying the forms of psychological functioning according to the expectations of each environment. Therefore, the family and the school constitute two fundamental institutions to trigger the evolutionary processes of people, acting as propellants or inhibitors of physical, intellectual, emotional and social growth[21].

Regarding the supervision of what adolescents consume in the meals offered by the school, if there is a differentiated Menu for them and if principals believe that it is important to offer this distinct Menu, all the interviewees emphasized that there is no relation of dishes or differentiated foods, since the menu is stipulated by the State Education Department. About the menu, D6 mentions: "The menu is sent by SMED (Municipal Education Department) and we cannot modify it. I think it would be important to have a healthier menu with less food and more fruit."

D4 Corroborates, saying, "There is a menu prescribed by the state secretary of education, we cannot intervene in the school context in this regard." It is noticed that the schools do not have autonomy in front of the menu of their students. However, they recognize the importance of a readjustment of this front to the new nutritional needs of their students.

In this perspective, D1 comments that: "I would say that food is not adequate. The food is usually very salty and greasy. The juices are artificial, in addition, they use sugar in an exaggerated way and there are few fruits in the menu. As for supervision, I do not see any concern in that regard. I believe that due attention is paid to food, since it is directly related to the good or bad health of people. I see that most teachers are badly fed. So as many do not have healthy eating habits (not to mention physical exercise) do not emphasize this issue with students."

It is noticed that although some principals have a concern about what is served, little has changed in relation to the menu stipulated years ago when the percentage of undernourished students was higher than those who were overweight and obese.

Mascarenhas and Santos[23], in a study in the State of Bahia, found that the meals offered in the schools are unsatisfactory, since they present little presence of fruits, vegetables, vegetables in natura and the vegetables, most of the time, were not bought regularly, for school feeding, which interfered in the quality of the composition of the menu. The few vegetable growers who came to some schools were donated by staff or school friends, who planted, or bought, and brought in to temper the dishes offered. With this, it is evident that foods rich in vitamins, minerals and fibers and proteins are little offered in school feeding, corroborating with the findings of this study.

Despite this finding, some principals believe that a change in the menu is not necessary because, as D8 states: "I do not think I should make a differentiated menu, otherwise we will end up excluding these adolescents."

D7 puts it: "I think the menu is appropriate, because the same is done by a nutritionist." It is noticed that some principals seem not to worry about what is served on the menu of their school, since, according to them, the ratio of food served is prepared by a qualified professional. In this sense, school meals should be a well-being provided to the students during their stay in school, and their main objective is to partially meet the nutritional needs of the students in order to improve learning capacity, to form good eating habits, keep the student in school.

The schools investigated are assisted by a nutritionist who prescribes the menu weekly according to the availability of food offered by city halls or by the state. With this, it is understood that although the menu is prescribed by a qualified professional, there is no certainty that the nutritional values of the snacks offered in schools are adequate to the real needs of the students. Another relevant factor refers to the quality of food offered, because, through this evaluation, the impact of public policies on the quality of life of the students is visualized.

From the interview responses, it is noted that the menu is lacking in vitamins, fiber and minerals required for good school performance, as well as an expressive supply of high-fat foods and carbohydrates. In this way, it is perceived that it is a great challenge to develop a school nutrition policy that provides a healthy and nutritionally balanced diet that meets the needs and at the same time does not contribute to obesity. With the current social changes, there was a change in the eating habits of schoolchildren, but the Brazilian school feeding program in some places, such as the one presented in this study, did not fit the political, economic and health issues of the population. Therefore, there is still a long way to go, once we realize the need for better planning and improvement of school feeding programs, in order to meet the nutritional demand of schoolchildren. It is believed that for a school nutrition program to meet the demands of schoolchildren, it is necessary to consider the socioeconomic characteristics of the region where the school is located, to use local resources to improve the quality of food, and to offer non-industrialized products to order to develop good eating habits in the school population.

4. Final Considerations

Regarding the mentioned, one can observe that there is little dialogue between obese adolescents and school, with the adolescents being the most affected, since the principals are unaware of the treatments performed for obesity by their students. In relation to school feeding, there is little concern on the part of the principals, while they assign responsibility only to the nutritionist of the Education Department. This indicates that a policy with action strategies focused on health care is necessary.

It is important to emphasize bullying as a factor that is present in the school context. The school, which is represented in this study by the governing body, shows little interest in the subject of teenage obesity. There seems to be no effective concern with bullying, which occurs expressively in the school context, as well as, obesity is not understood as a disease, nor as a factor of social exclusion, so, like the family, educators also exempt themselves from any responsibility or interference in this matter. Finally, it is inferred that obese adolescents are neglected in the context studied.

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INVESTIGATION INTO MOTIVATION AND JOB SATISFACTION AMONG TEACHERS IN THE COLLEGE EDUCATION SYSTEM

Parmanov Nurislam[1, a], Junjuan Hu[1, b, *], Qiong Lou[1, c]
[1]School of Science/Shuguang Big Data Science, Zhejiang University of Science and Technology, Hangzhou 310023, China
[a]nurislam.parmanov@mail.ru, [b]hujunjuan@163.com, [c]bearqiong@163.com

Abstract

This paper aims to investigate the important factors affecting job satisfaction and motivation of teachers in college. The statistical population of this study includes 67 teachers at Zhejiang University of Science and Technology who have answered the questionnaire. The results of the study show the group of people whose age is above 46 show greater levels of job satisfaction and factors such as work experience have an impact on job satisfaction. Furthermore, we figure out the most essential factor is an increase in the teachers and professors' salary. The study also showed that teachers are satisfied with work conditions and have identified that they need to raise their teaching level by further studies. According to the further analysis, a strict evaluation system does not give a suitable result in improving motivation.

Keywords: Job satisfaction, motivation, questionnaire, salary, ANOVA test, Tamhane T2 Test.

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∗ Corresponding author. E-mail address: hujunjuan@163.com, +8615314648400.

1. INTRODUCTION

What is it motivation? Eventually, people understand it as actions which bring unexpected results in the future. For some people motivation primarily means a sequence of moves with rewards in the end. Meanwhile, others claim that motivation is just a sequence of remuneration for employees due to their workflow and as a result, productivity increased day by day.

The study of the problem of labor motivation occupies a special place among other studies on labor activity. It is the object of study of many scientists in the world. But it should be noted that the historical primacy in the study of the problem of motivation and motives that determine the process of motivation belongs to the foreign scientist.

In modern society, there are a lot of people and organizations which are trying to find what is the best form of motivation. The majority of people agree that an increase in salary can rise the productivity of their

workers, while the minority claim that a high salary is not enough to keep their productivity at a high level. Obviously, both of these 2 groups of people are right, for example, some people could be truly satisfied with a high level of income, but at the same time more and more people debate what will be more convenient for the employee; a high salary, the type of social package or even a privilege to satisfy their psychological side. For instance, in Compensation and Performance in Major League Baseball (Yu-Li Tao, Hwei-Lin Chuang, Eric S. Lin, 2015) the study investigated the salary disparity in a baseball league[1]. Whereas, in Motivation and Performance in Higher Education (Stefania Zlate, Gabriel Cucui, 2015) revealed methods of motivation which are incredibly important[2]. Meanwhile Hooman Khoshvenis and Abbas Tahmasebi (2016) evaluated the effective factors which influence employee job satisfaction and motivation system in the governmental organization[3].

The purpose of this paper is to identify what the government should provide and what motivates teachers from higher education in their daily life. The main target here is to show correlations between gender and all employees' salary which they have, in addition with job satisfaction and qualifications. Another purpose of this research is to show the percentage of teachers that think that improve educational status is more important than just increase their basic salary. Primarily, as the government has a huge influence on the educational process, in order to achieve results, it cannot be done in short term.

2. RESEARCH DESIGN AND QUESTIONNAIRE

Based on the idea of Taylor (1911)[11], it is believed that job satisfaction is an important aspect of motivation. Firstly, the questionnaire focuses on evaluating the participants' job satisfaction and factors affecting their satisfaction are listed. Secondly, the questions focus on factors that affect teacher's motivation and their professional development in the future. In the questionnaire, there are 5 questions which tell us what can motivate teachers and professors. The main reason why a questionnaire was chosen as the main form of research in this study is because it is one of the most direct ways to gather data; including to investigate the best forms of motivation for employees from the higher education system, and which factors have an important influence on job satisfaction. Questionnaires were distributed randomly and anonymously to ensure the authenticity of information. A total of 67 valid samples of questionnaires were received. Thereby, all answers can be separated and sorted.

The questionnaire was designed to display options which can satisfy all participants. The next step was to approach teachers and professors in person to participate in the questionnaire. The questions were also designed to reveal what the teachers and professors want from their job and if they think that there is something the government should do to assist teachers that are not satisfied with their job, for example providing more improved social packages. This study attempts to clarify whether the majority of respondents are absolutely satisfied with their job or not.

3. QUESTIONNAIRE MAIN FINDINGS

One of the main findings of the questionnaire was that most of the participants were satisfied with their job, a total of 84%, and only 16% of participants revealed to be partly satisfied with their job. Among those that

revealed to be satisfied with their job, 49% of respondents expressed that they find their job to be interesting, and 28% of respondents showed that they have a lot of free time. The least common answer of reasons why respondents are satisfied with their job was 'good salary', 14%, it was also found that 51% of all respondents earn less than 100 thousand CNY per year. Therefore, only 15% of them earn up to 250,000 CNY per year.

The average age of respondents was 35 years, and a total of 37 males and 30 females took part in the study, that's 55.2% male to 44.8% female. In addition, the majority of respondents revealed to possess "L" and "O" qualifications, 33% possessing L qualifications and 34% holding O qualifications, meanwhile only 19% of participants had "A.P." (assistant professor) status and 7% showed to have "P" (professor) status. All teachers and professors were chosen randomly. Based on articles which I found on research methods, it is better to find respondents at random who will not be prepared to answer questions, as respondents who have had time to prepare might answer differently.

4. STATISTIC METHODS AND ANALYSIS

In this part, statistical analysis and regression analysis was carried out using SPSS software. It can be seen from Fig. 1 that 84% of respondents are absolutely satisfied with their job and 16% satisfied partly, with this evidence it is clear that all employees satisfied or satisfied partly, there are no any teachers and professors who chose "not satisfied". It means that the main part of all employees is contented with their job. However, so many employees agree that their job is interesting, in the same way, people who chose answer "satisfied partly" is an employee who has less than 6 years work experience.

Fig.2 represents the percentage of all employees that would like to go in abroad. Most of respondents, 87% showed that they would prefer to go abroad to improve their knowledge for less than a year and for 1 to 2 years. Only 13% of respondents chose to stay in China and 4% who want to go abroad for more than 3 years. Furthermore, most of the respondent's who chose answer "b" which means do not go abroad are more than 40 years old (only 2 of them are 25 years old) and almost all of them have huge work experience, not to mention that fact that these employees already achieved a lot like a high position.

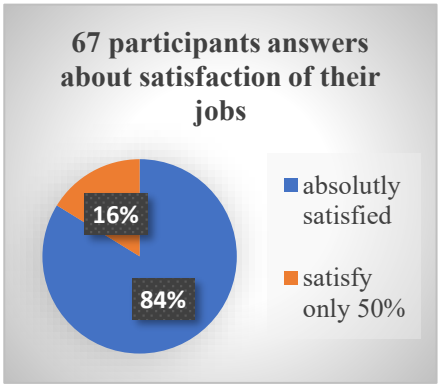

Figure1 Proportion of participants

Figure 2 Proportion of people who want to go abroad

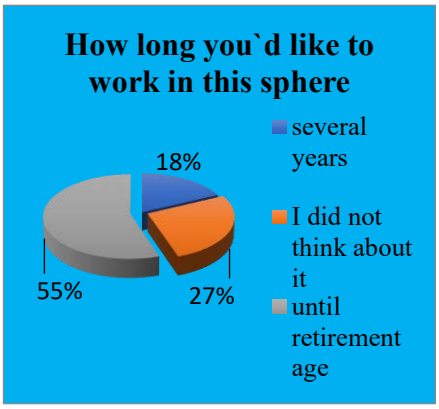

Figure3 How long people would like to stay in this position Figure 4 Salary per year

Meanwhile, Fig. 3 is showing how long respondents would like to work in this area. From the results it is shown that 55% of all respondents prefer to work "until retirement age". Typically, all employees understand that this job is stable and they would like to work until retirement age. However only 27% of all teachers and professors did not think about how long they want to stay in their job and only 18% of all respondents who are considering this work for "several years". To put it briefly, teachers who preferred answer "for several years" are less than 40 years.

As we can see from Fig. 4, more than 85% of teachers earn less than 150,000 CNY per year and only 4.5% possess a high salary and whose positions are professor status. For Hangzhou, where consumption is higher, the pressure on young teachers is conceivable.

Firstly, the study is investigating if the different age groups have a different impact on job satisfaction. Since the probability of the homogenus variance test is less than 0.05, which means the variance is non-homogenous, we use Tamhene T2 test to compare the influence of job satisfaction on a different age group. As we can see from Table 1, the probability is equal to 0.036 which is lower than 0.05, meaning the age group of 32-46 years and the group of above 40 years have a different impact on job satisfaction. In addition, employees above 46 years are more satisfied with their work than workers whose age 32-46 years. Relatively speaking, the younger participants in the study showed to be less satisfied with their jobs.

Table 1 Age comparisons according to Tamhane T^2 test

(I) Age	(J) Age	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
under 31	32-46	-.17544	.15426	.616	-.5893	.2384
	46 above	-.33333	.14213	.112	-.7328	.0661
32-46	under 31	.17544	.15426	.616	-.2384	.5893
	46 above	-.15789*	.05995	.036	-.3078	-.0080

46 above	under 31	.33333	.14213	.112	-.0661	.7328
	32-46	.15789*	.05995	.036	.0080	.3078

*. The mean difference is significant at the 0.05 level.

Table 2 Work experience comparisons according to Tamhane T^2 test

(I) work_experience	(J) work_experience	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
less than 5 years	6-15 years	-.19294	.14097	.700	-.5918	.2059
	16-26 year	-.35294	.11947	.055	-.7111	.0053
	27 and more	-.35294	.11947	.055	-.7111	.0053
6-15 years	less than 5 years	.19294	.14097	.700	-.2059	.5918
	16-26 year	-.16000	.07483	.231	-.3745	.0545
	27 and more	-.16000	.07483	.231	-.3745	.0545
16-26 year	less than 5 years	.35294	.11947	.055	-.0053	.7111
	6-15 ye ars	.16000	.07483	.231	-.0545	.3745
	27 and more	.00000	.00000	.	.0000	.0000
27 and more	less than 5 years	.35294	.11947	.055	-.0053	.7111
	6-15 years	.16000	.07483	.231	-.0545	.3745
	16-26 year	.00000	.00000	.	.0000	.0000

Since there is a non-homogenous variance of work experience, we use the Tamhane T^2 test to compare the influence of deferent groups of work experience on job satisfaction. As it can be seen from Table 2, some probabilities have value 0.055 meaning that the group of less than 5 years and the group of 16-26 years have a different influence on job satisfaction at significant level 0.1 also the group of less than 5 years and the group of 27 years. As can be seen from the mean difference, the longer the work experience, the more satisfied participants are with their job. However, after certain years of work experience, there is no difference in job satisfaction since the mean difference of 16-26 years and 27 years and more are close to zero.

According to Table 3, we find their salary per year does not have any significant impact on job satisfaction. It is easy to understand that teachers choose their job because of their personal preference in this profession instead of a high salary. It is possible to get the probability which is equal to 0.047 value and it depicts that men and women have a different view on job satisfaction and their qualification hasn`t had a different effect on job satisfaction (These results are not listed in this paper due to the limitation of space) Surprisingly, men prefer the job of college teachers to that of women. After in-depth research, it is found that women usually spend more time at looking after their kids and their families, while men spend very little time so they can concentrate more on their research and enjoy what they study on.

Table 3. Salary per year comparisons according to Tamhane T^2 test

(I) salary per year	(J) salary per year	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Lower Bound
less then 100 000	100 000 - 150 000	.04092	.10203	.690	-.1630	.2449
	150 000 - 200 000	-.17647	.19976	.380	-.5758	.2228
	200 000-250 000	-.17647	.22760	.441	-.6314	.2785
	250 000 - 300 000	-.17647	.22760	.441	-.6314	.2785
100 000 - 150 000	less than 100 000	-.04092	.10203	.690	-.2449	.1630
	150 000 - 200 000	-.21739	.20472	.292	-.6266	.1918
	200 000-250 000	-.21739	.23198	.352	-.6811	.2463
	250 000 - 300 000	-.21739	.23198	.352	-.6811	.2463
150 000 - 200 000	less than 100 000	.17647	.19976	.380	-.2228	.5758
	100 000 - 150 000	.21739	.20472	.292	-.1918	.6266
	200 000-250 000	.00000	.28863	1.000	-.5770	.5770
	250 000 - 300 000	.00000	.28863	1.000	-.5770	.5770
200 000-250 000	less than 100 000	.17647	.22760	.441	-.2785	.6314
	100 000 - 150 000	.21739	.23198	.352	-.2463	.6811
	150 000 - 200 000	.00000	.28863	1.000	-.5770	.5770
	250 000 - 300 000	.00000	.30856	1.000	-.6168	.6168
250 000 - 300 000	less than 100 000	.17647	.22760	.441	-.2785	.6314
	100 000 - 150 000	.21739	.23198	.352	-.2463	.6811
	150 000 - 200 000	.00000	.28863	1.000	-.5770	.5770
	200 000-250 000	.00000	.30856	1.000	-.6168	.6168

Considering that the satisfaction variable is categorical, it is better to use a logistical regression model instead of the general regression model. According to the correlations of explanatory variables, we ignore the work experience since there is a high correlation between age and work experience which is equal to 0.765 The result of the Logistic model can be seen below (Since the constant in the model is not significant, we remove it).

Table 4 Logistic model

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	gender	-.604	.801	.567	1	.451	.547
	Work experience	1.420	.604	5.532	1	.019	4.139

a. Variable(s) entered on step 1: gender, work experience.

From the results of this questionnaire it is shown that work experience has a significant influence on job satisfaction. Table 4 shows that people with different work experience have various opinions. Generally speaking, the longer the work experience, the more satisfied the respondents feel. Meanwhile, gender as a factor has no significant effects on job satisfaction since the probability 0.201 is large than 0.05, that means although men and women differ in job satisfaction, gender is not an important factor of job satisfaction. The accuracy of the Logistic model is 84% so the model is reliable.

Motivation factors are of our greatest concern. Five options are given to choose in reference to the basis of existing literature and we use 0-1 to indicate whether this option has been selected or not. In Table 5 which is present below it is clear that most teachers and professors are eager to raise their salary. Although in general the salary of teachers and professors is not high enough, I can agree that some professors have a high salary.

All in all, the most preferable answer was to "raise your salary" which accounts for 68.7% of respondents and most of them are under 30 or 40 years. This is easy to understand because at this age there is a lot of financial burdens, such as buying a house, buying a car, raising children and so on. Not surprisingly, 86% of participants would go abroad to improve their knowledge and skill. In my perspective, one of the reasons for this is due to the low salary. Although they are satisfied with their job, the fact of low wages really puts a lot of pressure on them. If the government can raise their salaries, they will be more motivated to work instead of changing jobs. Furthermore, 49.3% of all respondents think that support in the education system and improve educational status is one of the most important things in motivation and the other half think the educational status is good. About 91% of all respondents neglect a strict evaluation mechanism and only 6 teachers hope to enforce evaluation criteria. Only 20.9% of all think to relax an evaluation mechanism can make people reduce stress and become more productive, while others think the current evaluation mechanism is suitable. Our suggestion is that the government raises salaries to increase teacher motivation levels and continue to apply the current evaluation method.

Table 5 Descriptive Statistics

	frequency	Mean	Std. Deviation
Relax assessment mechanism		.2121	.41194
Value .00	53		
1.00	14		
Strict evaluation mechanism		.0909	.28968
Value .00	61		
1.00	6		

Rise your salary		.6818	.46934
Value .00	21		
1.00	46		
Support education and improve educational status		.5000	.50383
Value .00	34		
1.00	33		

5. CONCLUSION

In this paper, we demonstrate that the motivation of teachers and professors as employers is a very important factor which should be paid more attention. According to the findings of this research, salary levels are one of the most important factors, which can motivate and inspire almost all employees, while others prefer to keep the current evaluation mechanism. In addition, a strict evaluation system does not give a favorable result in improving motivation. Furthermore, according to the logistic regression, this research finds that the group of people whose age is above 46 are more satisfied with their job and work experience has a significant impact on job satisfaction. In order for teachers to stay in this field longer and produce more output, our suggestion is that the government raises salaries to increase teacher motivation levels and continue to apply the current evaluation method

6. ACKNOWLEDGMENTS

This thesis is an original piece and has not been issued in any other publication. A special thanks to my supervisor for sharing her professional skill and knowledge with me, and many thanks to friends who also helped in this research. I hope this article will not be my last one. A lot of work was carried out to produce this research but nevertheless it was a good experience for me. I gained new skills, knowledge and experience which will be valuable for my future career.

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Enhancing students´ engagement, learning and knowledge generation: the RISE case study

[1] **Agueda Benito, PhD**
Laureate International Universities, Chief Academic Officer for EMEAA region

[2] **Shailey Singhal, PhD**
University of Petroleum & Energy Studies (UPES), Department of Chemistry, School of Engineering.

Abstract

The present case study illustrates an example of how universities can develop initiatives that enhance the learning effectiveness of their students and, at the same time, help them become more innovative and generate knowledge that improves research outcomes and contributes to scientific advancement. Research & Innovation in Science and Engineering (RISE) constitutes an initiative implemented by an Indian comprehensive university, through which multidisciplinary teams of students present their project ideas and, if selected, they get the institutional support to develop them: some funds, the university facilities and equipment and, more than anything, the guidance of a dedicated faculty mentor, and the involvement of the industry. The students´ learning experience is totally collaborative, interdisciplinary, applied and experiential, in good alignment with the needs of the present and future labor market. Additionally, the outcomes of the program include research papers, patents and industry partnerships that clearly benefit the institution and all its stakeholders.

Key words: Student engagement; Innovation Research skills; Applied knowledge; Learning community

1. Urgent changes are required in Higher Education

Headlines concerning the lack of preparedness of college graduates for the workforce are nothing new. Nearly one decade ago, the article titled "Grave New World? Workplace Skills or Today's College Graduates" (Eisner, 2010) described how university graduates are facing evolving skill needs and increasing competition, and identifies through the voice of employers what are the key competencies for a successful career in the 21st century. The report by Hart Associates (2015) constitutes one of many examples where employers give students very low grades on competencies, some of which they consider absolutely relevant for career success. One more example can be found in a 2015 article in the Chronicle of Higher Education titled "College Graduates Aren't Ready for the Real World" the author manifests how employers are not satisfied with their novice employees, in particular when it comes to

delaying gratification and thinking long term (Levine, 2015). Despite this disconnection and low appreciation levels of the university outcomes, one of the Gallup studies for Inside Higher Ed finds that 96% of chief academic officers at higher education institutions say their institution is very or somewhat effective at preparing students for the world of work (Gallup, 2014), which clearly contradicts the perceptions of business leaders.

Taking a more positive view, there are numerous instances where very interesting efforts to reduce this gap can be found, like the work carried out by the Laurate network of universities, to define the key competencies for recent graduates to be successful in the labor market today, which involved more than 5000 professionals and employers from around the globe, and identified the following competencies as essential for a new professional entering the workplace: Communication, Analyzing and Solving Problems, Working well with others, Achieving objectives, Working well with others, Learning and self-development and Adapting to change (Laurate, 2016).

Even further, recent reports like *Skill Shift: Automation and the future of Workforce* elaborated by McKinsey Global Institute (Bughin et al, 2018) present the need of instilling a culture of life-long learning, defining more agile corporate structures with less hierarchy and more collaborative team works or the expected rise in the use of independent contractors and freelancers.

The voice of employers results loud and clear and, in essence, seems to require a very different approach to Higher Education than the traditional models. It is time to effectively transform the traditional, passive 'Talk and Chalk' approaches into new educational models, that provide students with more engaging learning experiences whose outcomes, measured in terms of the profile of the future graduates, will constitute a more effective response to the needs of the global labor market and to each one of its specific industries.

2. New learning needs

The development of the competencies that the market place requires in university graduates cannot effectively occur if only the old traditional teaching methods are utilized. Fortunately, there is an increasing number of innovative practices that take place in numerous Higher Education institutions, which incorporate active learning, and result in much more engaging, satisfactory and effective experiences.

If we think about the future professional world, we can probably agree that it would be good to make our university graduates apply their knowledge effectively, to be able to find solutions to complex, interdisciplinary problems, to be able to collaborate with others and learn from their own experience to continue to develop and grow. Under this assumption, we believe that collaborative, interdisciplinary, applied and experiential learning could be interesting pedagogical approaches that can contribute very positively to the enhancement of the learning experience, and to the improvement of the final outcomes reflected in the profile of university graduates.

- The benefits of collaborative learning are well addressed in the Education literature. Laal and Ghodsi (2012) conclude that collaborative learning can be much more beneficial than competitive and individualistic learning activities, generally resulting in not only better academic outcomes, but also enhanced social skills and personal confidence.
- According to Holley (2017), interdisciplinarity explores questions and problems that do not exist within disciplines. The same author highlights how the diversity of views related to a particular topic promotes the inclusion of a range of perspectives while cultivating the skills needed for collaboration and integration.
- Applied Learning is also widely accepted as an effective educational method. Rabidoux and Rottmann (2017) believe that it is a practical approach for which research demonstrates that student motivation increases, which fosters student centered instruction and provides real world applications. For these authors, it is also an opportunity for high impact learning where students explore content and directly apply new knowledge.
- The valuable benefits of Experiential Learning are nothing new either. So many references and historical maxims: *I hear and I forget, when I see and I remember, if I do and I understand*; *Tell me and I will forget, Teach me and I will remember, Involve me and I will learn*, attributed respectively to Confucius in year 450 BC and to Benjamin Franklin, in 1750. Experiential learning is also referred to as learning by doing, or learning through action, even though all these names might be unconsciously inviting teachers and learners to neglect the thinking component that an effective learning process requires, the reflection that needs to go hand in hand with the action itself. Based on the abundant research and personal experiences, it is our assumption that through experiential learning, "direct experience and focused reflection", students can effectively develop the knowledge, competencies, and values that the present and future labor market will require. The solid pedagogical foundations of the theory of experiential learning, which Kolb proposed decades ago are broadly accepted and recognized. According to Kolb (2014): '*Experiential learning theory has been widely accepted as a useful framework for learning-centered educational innovation, including instructional design, curriculum development, and life-long learning*'.

The initiative presented in this paper constitutes an example of integration of the pedagogical methods described above, and illustrates how universities can provide students with highly effective learning experiences, positively appreciated by employers too.

3. Making the most of a learning community

It is amazing to think how much talent a Higher Education institution can contain! And it is not only the knowledge and experience of professors, but the untapped ideas and solutions to complex problems that our students can provide. One could think that the role of the University is basically to provide students with the right conditions for them to learn, grow and get ready for a successful career. Conditions that will always be related to the curriculum we offer them in their programs of study, and to the essential

contribution of faculty. Furthermore, the role of the learning resources, the spaces and opportunities universities create for students to experience deeper learning and fully live the academic spirit are also key. Additionally, the creation of a real learning community implies an active role of the students, and requires peer interactions to a much greater extent than we would normally see in many universities today.
Research & Innovation in Science and Engineering (RISE), the initiative that we describe in the following sections is an intentional attempt to create the kind of learning community described, where the learning outcomes and even the scientific production reaches levels of extraordinary achievement.

4. Enhancing innovation through the introduction of RISE

Youth of today is very talented and full of ideas. They often come up with interesting concepts, but probably due to lack of funds and proper guidance, they find it difficult to develop and execute them practically. Keeping this need in view, an India based university launched a specific program in 2015, called 'Research & Innovation in Science and Engineering' (RISE), with a goal to encourage research activities amongst all the undergraduate and postgraduate students of Engineering, Design and Planning. The main objectives of RISE included:

- To create a research and learning environment for the students, where interdisciplinarity and collaboration were basic principles.
- To foster a culture of scientific inquiry, effort and rigor by promoting research skills and competencies within the student community.
- To enhance the publication of quality research in peer reviewed, highly respected, academic journals.
- To stimulate innovation, and an active role in local and global problem solving
- To promote association with the relevant industries to bring up the research work to the consumers.

RISE serves as guidepost for the university students to reach its full potential in research and scholarly activity, acting as a catalyst to promote and improve research activities amongst the participating students. After going through the selection process, students are facilitated with financial support (approx. $ 3,000), infrastructural support (in terms of lab facilities) and intellectual support (in terms of faculty guidance) to work upon their ideas and shape them up.
A holistic approach is adopted while short-listing, awarding and executing the projects to the students, which helps them to learn more and guides them to complete their projects towards the expected outcome. The complete process is shown in the flow chart given in the figure below:

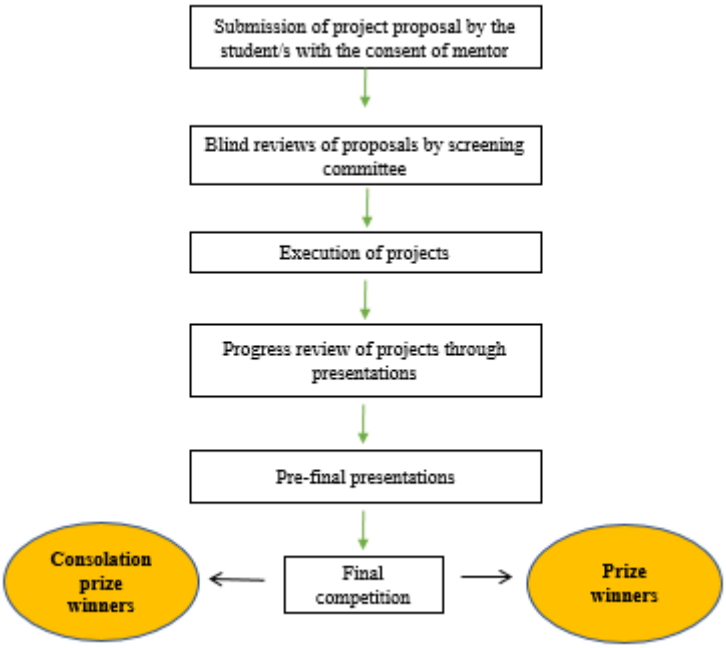

Figure 1.
Process flow for execution of RISE

Since 2015, the program has evolved considerably, always incorporating a continuous improvement approach that makes it more effective and aligned with the needs of students. For instance, since 2017 two theme based categories of RISE have been launched, Category-I for the students who are submitting their fresh idea to work upon, and Category-II for the students who have already developed some prototype or have come up with some potential results in a previous cycle of RISE and want to upgrade it in terms of components, precision, or performance. External competitions and awards have had a national focus until 2018, but the institution will provide additional support towards international recognition starting in 2019.

5. Student response and outcomes

Benefitted by this initiative, students explore all the possible areas of research, such as chemical industry, automobile industry, renewable energy, polymer industry, petroleum industry, electronics & communication, IT/IOT based devices, automation and others. It is noteworthy that most of teams mainly work on the application part of the research, focusing on particular problems or challenges of our daily life. To mention a few, some of the projects include railway crack detection system, quadcopter for studying environmental patterns in disaster affected areas, image processing devices for various applications, auto-gear vehicle, OBDAS for capturing data, or a language converter for visually impaired people, some of them shown in figure 2.

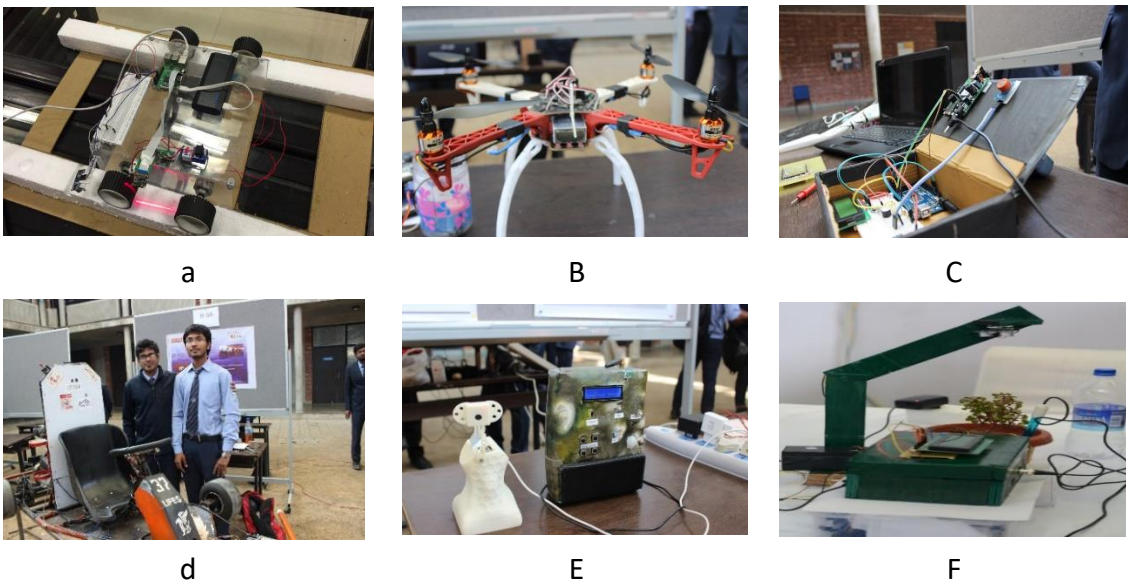

Figure 2.
(a) Railway Crack Detection System, (b) Quadcopter, (c) Image Processing for fruit/vegetable quality, (d) Auto-gear Vehicle, (e) On Board Data Analysis System (OBDAS), (f) Language converter for visually disabled people

It is a matter of pride to share that the RISE projects have resulted in wonderful outcomes, in the form of working prototypes developed by students, patents, publications and various awards won by them at various prestigious platforms outside the university. During last 3 cycles of RISE, a total 14 patents have been filed and 23 research publications have been produced as the outcome of these projects. And even some projects have moved forward towards commercialization with the support of the institutional R&D and incubation centers of the university. Along with this, several awards have been won by the students outside the institution, like the very prestigious *Gandhian Young Technological Innovation* (GYTI) Award at President's House, New Delhi, in March 2018.

Additionally, promotion of association with the relevant industries has also been a direct benefit of this initiative. Through RISE, industrial relations have been built up for preparing students to the next level. Some industries, such as Mahindra & Mahindra (automobile), Aircel (mobile), Leanapps (software), etc. have been at the panel of RISE for providing qualitative inputs to the students to make their products ready for commercialization. Students are in touch with them for upgrading their products and launching them with the help of the university incubation center.

Regarding students´ impressions, their feedback about RISE is expressed by complementing a survey at the end of the process. The following figure captures the information regarding a total number of 79 students that have completed the survey since RISE was launched. Students´ feedback could be excellent, very good, average or poor. And, as it can be appreciated in the figure below, the majority rated the experience as excellent followed by numerous very good impressions. No students have ever rated the experience as poor.

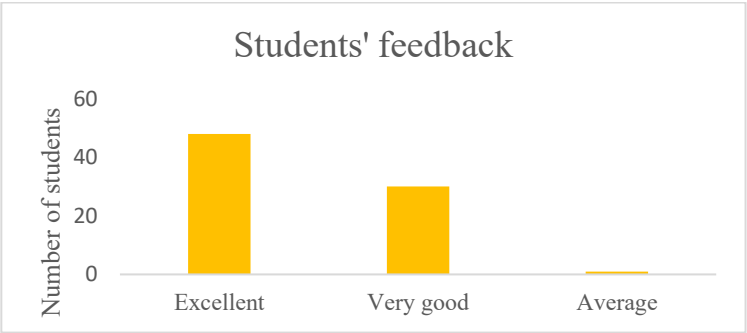

Figure 3.

Results of student survey

To complement the quantitative information, students were invited to participate in a focus group, where a semi-structured conversation took place with 17 participants. The conversation was extremely positive and all the students manifested high levels of satisfaction with the experience. The last two questions were a) if they would recommend their university that this program is continued and b) if they would recommend other universities in the country to do the same. In both cases, 100% of the students answered affirmatively. The participating students used the words shown on Figure 4 to describe RISE:

Figure 4.

Words utilized by the students to describe RISE during the focus group

The conversation that took place during the focus group was recorded and analyzed, with the following concepts emerging from the discourse:

Table 1.

Topics addressed	*Emerging ideas*
Experience	*Very positive; opportunity for students; opportunity for the country; rigor; scientific method; available resources*
Mentors	*Guiding; supportive; enhance creativity*
Learning	*Practical; applied; interdisciplinary; effective; helps with other academic subjects*
Job	*Helps discover career interests; connection with real professional world; very valuable in internships*
Key competencies	*Communication; team work; problem solving; creativity; resilience*

Table1: Discourse analysis of focus group with students (16/11/2018)

6. Conclusions and recommendations

The development of this initiative has proved itself as a successful instrument to achieve the goals that were established, having not only resulted in very interesting research production, but in the enhancement of students´ engagement and initiative, and in a very positive institutional contribution to address a few of the challenges the world of today.

The economic growth of a nation depends upon its capacity to educate & nurture its young population. It also needs inculcation of seeds of learning and exploring the opportunities to innovate in them. Trusting new generation is a bliss and they are indeed making their organizations, societies and countries to be proud of them by experimenting wonderfully and finding out the solutions of the standing problems of the day. Just, the need of the hour is to recognize and provide them with the proper required support and prospect. RISE has come up as a successful platform for university students to achieve their aspirations and a chance to convert their dreams into reality, and its results speak of the success of the idea. The enthusiasm of the students and outcomes of RISE have been a driving force for bringing it at national level, and then at international platforms too. Considering the achievements through RISE, it is recommended to invest on R&D activities in academic organizations, trusting the skills of youth and promoting young scientist to win the problems through their innovations across the world.

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Teachers' Preparedness Towards Implementation of Free Primary Education in Bungoma County, Kenya

Carolyne Nabwoba Simiyu
Kibabii University, Bungoma Kenya
cwabwoba@kibu.ac.ke

Abstract

The launch of the Free Primary Education (FPE) in 2003 by the Kenyan government lead to an increase in enrolment of learners in primary schools which posed a challenge to the teacher preparation of handling large number of learners. This paper therefore discusses teacher preparedness with reference to FPE in Bungoma East District in Kenya. A descriptive survey design was used in this study. The target population was head teachers, teachers and the school management committee chair persons. Since there are rural and urban schools, stratified sampling was done to get a more representative sample. Instruments for data collection were questionnaires, interview schedule, and document analysis and observation schedules. Most teachers feel inadequate in handling challenges of FPE on resource utilization due to inadequate in-service programmes. The findings will inform the policy makers in making informed decisions towards proper teacher preparation for FPE implementation.

Key words: Free primary education, Teacher management, Teacher readiness

1.1 Background to the study

Education has an immense impact on the human society. One can safely assume that a person is not in the proper sense till he is educated. Man becomes a rational being when he is educated. An uneducated person is shut off from the outside world. Education has the function of transmitting skills, knowledge, norms and values from generation to generation (Eshiwani 1993). Education therefore becomes a liberating phenomenon. Education is a must if a nation aspires to achieve growth and development and its sustenance. It is an absolute necessity for economic and social development. Nelson Mandela once said that "education is the most powerful weapon you can use to change the world." Efforts therefore should be made to set a conducive environment in which education will take place most effectively. It is through education that man is prepared for life to deal with every day's challenges. Education therefore is considered as a basic human need.

In 2001, the Kenyan parliament enacted the Children Act which recognizes education as a basic right for all children. In this act, it is the responsibility of parents and the government to provide education for the child. The climax of the government's effort to attain UPE was the introduction of free primary education in 2003.

On 10th January 2003, a task force to work on the implementation of free primary education held a conference. It constituted stakeholders in education to identify the immediate needs for the implementation of the Free Primary Education (FPE). Six sub committees were formed which comprised of: - curriculum implementation, human resource, physical facilities, needs of disadvantaged groups, public information, media relations and advocacy and financial and other resource implications. The emphasis was on the need for clear policies, strategic planning and strict prioritization of activities at all levels. FPE is a reform geared towards the overall goals of the national economic recovery strategy (ERS), poverty alleviation and national development. It is also one way of contributing to the achievement of millennium goals (MDGS) as discussed at the millennium summit in 2000.

The introduction of FPE saw unprecedented influx of children to schools, putting a lot of pressure on the existing teaching and learning resources. The government undertook funding of all public primary schools. Since the introduction of FPE in 2003, enrolment has been on the upward trend in most areas as shown in table 1.1.

Table 1: Primary Schools Net Enrolment rates by province 2003-2007 (%)

Source: Ministry of Education. *Provisional

	2003			2004			2005			2006			2007		
Province	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
Coast	66.9	60.1	66.9	63.5	72.8	67.7	75.1	73.3	74.2	72.3	71.2	71.8	84.6	77.0	80.0
Central	83.6	84.2	83.6	83.9	81.4	81.8	87.9	87.0	87.4	83.0	83.0	83.0	84.4	80.7	82.5
Eastern	90.4	90.3	90.4	91.4	91.5	94.9	93.8	94.3	97.4	97.5	97.5	98.7	97.8	97.8	98.3
Nairobi	35.5	40.3	35.5	37.7	35.9	41.1	39.2	40.9	40.1	31.2	34.7	32.9	28.6	29.3	29.0
Rift Valley	84.1	82.0	84.1	83.1	87.8	85.4	87.9	85.3	86.6	91.8	89.8	90.8	98.3	94.0	97.8
Western	97.5	93.2	97.5	95.3	99.3	97.2	99.1	94.6	96.8	98.9	98.5	98.6	99.1	98.9	99.0
Nyanza	96.2	95.4	96.2	95.8	96.9	96.2	98.4	97.2	97.8	99.5	99.2	99.4	98.4	98.2	98.3
North Eastern	26.1	16.2	26.1	21.6	23.6	14.9	26.6	18.8	23.0	24.3	16.5	20.8	33.1	20.8	27.5
Total	80.8	80.0	80.4	80.4	82.2	82.1	83.8	82.6	83.2	86.5	86.5	86.5	94.1	89.0	91.6

On human resources, there was need for mobilization of educational personnel, teachers and school committees and parents in order to improve access at primary level. The policy recommended proper and optimal utilisation of existing teachers as an immediate intervention to address the influx of additional pupils. The teachers were to teach in neighbouring schools and all private tuition was to be banned. The policy recommended further the merging of non viable schools in order to utilise teachers appropriately in the course of the programme. Teachers with heavy work loads were to be given incentives. All these measures were aimed at using the available resources in the most cost effective way. There was need for

capacity building through in-service and re-designing of teacher training programme to cope with challenges of FPE. There was also need for rationalization of functions and deployment before recruitment of additional staff so as to fill the shortfalls (Report of the task force on implementation of free primary education 2003).

1.2 Statement of the problem

The Kenya governments aim since independence has been to provide every Kenyan child with basic rights such as education. It is in this respect that the government provided Free primary education (F.P.E) in 2003. FPE was received with a lot of enthusiasm by stakeholders in education. However, the massive enrolment put pressure on the teacher adequacy and capacity. For effective learning to take place there must be quality teaching and learning which calls for an understanding of the teachers' level of preparedness for FPE implementation. At the same time the teachers should be aware of the policy guidelines on the implementation. The study therefore sought to assess teacher preparedness in resource utilization in the programme in classroom in Bungoma East district

2.0 LITERATURE REVIEW

2.1 Free Primary Education in Kenya

Provision of quality basic education to all children is a challenge many a country are grasping with (Gravenir et al 2006). Reports and studies show that FPE is currently faced by a number of challenges that undermine the quality of education (UNESCO 2004; Mugenda 2004; GOK 2005). To better understand the challenges of free primary education, a trace of the history of its implementation is worth discussing.

Since the achievement of independence in 1963, the government and the people of Kenya have been committed to expanding the education system to enable greater participation. This has been in response to a number of concerns. Among the main concerns have been the desire to combat ignorance, disease and poverty; provided every Kenyan child the right of access to basic welfare provisions, including education, and that the government has the obligation to provide its citizens with the opportunity to take part fully in the socio-economic and political development of the country and to attain a decent standard of living. Education has also been seen as a fundamental factor for human capital development. The effort to expand educational opportunities has been reflected in the various policy documents and development plans.

The Kenya government policy to achieve Universal Primary Education (UPE) has to been seen within developments in the wider international context. The Universal Declaration of Human Rights, adopted in 1948, declared that "everyone has a right to education." The World Conference on Education for All (EFA), held in Jomtien, Thailand in 1990, sparked off a new impetus towards basic education especially with its so-called vision and renewed commitment. It noted, "that to serve the basic needs for all requires more than a recommitment to basic education as now exists. What is needed is an expanded vision that surpasses resource levels, institutional structures, curricula and conventional delivery systems, while building on the best in the practices."

As a result of the free primary education, the situation of the teaching force in most of the districts is generally bad. Teachers complain of increased pupil teacher ratios. Many primary schools are understaffed

as a result of the free primary education programme. This does not augur well for the quality of education being delivered. Many school management committees are of the opinion that as a result on the ban of levies, they are unable to recruit extra teachers through the PTAs and this has also seriously affected the pre-school units.

2.2 Teacher preparation

Teachers have been labeled as the single most important tool for educational effectiveness (Hernes 2001). The teacher is the designer, implementer and evaluator of instruction (Dick and Carey 1996). This makes the teacher a vital element in the success of any instructional programme. He/she is also a resource by virtue of the knowledge, training and expertise. The teachers' own competence in handling learning resources is crucial for the achievement of the curriculum goals. Teacher preparation is therefore key to curriculum implementation. The current Government programmes for teacher education aims at providing qualified teachers. The policy regarding primary teacher education has been for a long time that primary school teachers are trained to teach all the subjects offered in the primary curriculum. This has only changed about four years ago where teachers are allowed to specialize in arts orientation or science orientation. The two years of teacher training is not adequate for the teacher trainee to acquire mastery in content and skills of pedagogy (Session Paper No.1 of 2005). The paper still identifies inadequate inservice for teachers as an impediment to FPE.

The report of the task force on the implementation of FPE had suggested the rationalization of functions and deployment of teachers before recruitment of additional staff to fill shortfalls (GOK 2003). Capacity building through in-service and re-designing of pre-service programmes to cope with the challenges of FPE was also suggested. According to the report, there was need for proper and optimal utilization of existing teachers and also to review the existing staffing norms to incorporate double shift, multi grade teaching and average pupil-teacher ratio. Continuous improvement in the quality of education services should entail continuous skills upgrading for teachers (GOK 2003).

From survey findings many teachers still feel they were not prepared for the introduction of FPE (UNESCO 2004). According to many stakeholders, the implementation of FPE was rather a matter of political expediency rather than a well thought out and planned reform (Sifuna 2003).

Teachers' attitudes also have a role in how they implement the education curriculum. In as much as the teachers' command of their field is vital, their perception of how they are treated, managed and supported professionally may highly enhance or undermine the achievements of FPE (Shiundu and Mutsotso 2008).

3.0 RESEARCH DESIGN AND METHODOLOGY

The study used descriptive survey design. The purpose of this design in the study was to describe the characteristics of a phenomenon like the attitude of the people (Kothari 2004). Descriptive survey design is flexible and versatile. According to Mugenda and Mugenda, 2012, descriptive survey lets meaning of the research problem emerge from the respondents hence giving voice to those who are being studied as a way of empowering them.

The proposed study was carried out in Bungoma East district in Western Province. The district is divided into two administrative divisions of Webuye and Ndivisi. It is located between latitude $0^0$25' North and $0^0$53' North and latitude 34^0 east and 35^0 east. It lies at a height of approximately 2000 meters above sea level. The Great North road pass through the district making it fairly accessible.

The study population consisted of all public primary schools in Bungoma East district. The district had ninety nine public primary schools as at March 2010, all of which were mixed primary schools. The sample population was drawn from 20 public schools. All the schools were mixed schools. Four schools were boarding whereas sixteen schools were day schools. Eight schools were urban whereas twelve were rural schools. The study population Consisted of the school head teachers, deputy head teachers, teachers, committee chair-persons from public primary schools and the District Quality Assurance and Standards Officer in the district.

The study employed stratified simple random sampling technique to select twenty schools for the purpose of gathering data. These were both rural schools and urban schools. Another grouping was based on boarding schools and day schools. Purposive sampling was used in the case of selecting the class of pupils to participate in the study. The methods were chosen because every category of the population had to be represented. The head teachers, deputy head teachers, school committee chair-persons of selected schools also formed part of the study population. The DQASO was also selected to participate in the study.

Table 2: Table showing stratification of schools selected within each division

Division	Total No. of schools	Total No. to be Sampled	% of sampled schools
Ndivisi	39	8	20%
Webuye	60	12	20%

According to Kerlinger, 1983, 10% to 30% is a good representative sample from which findings can be drawn about a given population. For the purpose of this study a sample of 20% was taken. Therefore out of the total 99 schools in the district 20 schools were selected for the study. The accessible study population and sampled population are shown on table 3

Table 3: Table showing the sample size in each category

Group	Population (N)	Total No. to be Sampled (Population (n)	Sampling Techniques	% of sampled
Head teachers	99	20	Random	20%
D/head teachers	99	20	Random	20%
School committee chair persons	99	20	Random	20%

Teachers	400	112	Simple random	20%
DQASO	1	1	Purposive	100%
Total	**698**	**153**		**21.9%**

This study employed four instruments of data collection namely; questionnaires, interviews, observations and document analysis.

4.0 DATA PRESENTATION, INTERPRETATION AND DISCUSSION

The study sought to establish the teacher preparedness towards implementing FPE. To achieve this, the teachers were required to respond to questions with regard to in-service courses, their qualifications. The teacher, deputy head teacher and head teacher tools had items which needed their responses to their professional experience, the training they had under gone, and their roles in FPE facilitation and what was their perception of the facilities in regard to FPE.

From the interviews with head teachers, deputy head teachers and chair persons of the schools, it was clear that FPE was introduced without prior arrangements to deal with subsequent challenges. This finding is complemented by the findings of UNESCO study in collaboration with the ministry of education, science and technology which for example reports with reference to teachers' morale that teachers were overwhelmed by the uncontrolled admissions which undermined their morale (UNESCO, 2005). Such uncontrolled admissions definitely would outstretch the learning resource. The teachers were not prepared for such challenges to the implementation of FPE.

All teachers whose views were sought felt that the FPE programme was implemented without adequate preparation on their side to deal with resource utilization. The lack of preparation of teachers is further a firmed by the DQASO report where it is stated that there was no preparation on the part of teachers and other stake holders. This implied that stake holders took it normally like they were to continue with what they were accustomed to. The policy saw unprecedented influx of pupils. The government gave funds which were not enough leading to numerous challenges. It is after the launching of FPE that the government started in-service programmes on procurement of learning materials. Teachers and the school management team were brought on board to undergo in-service programme. The frequency at which teachers had attended in-service programmes in line with implementation of FPE was as given in figure 1

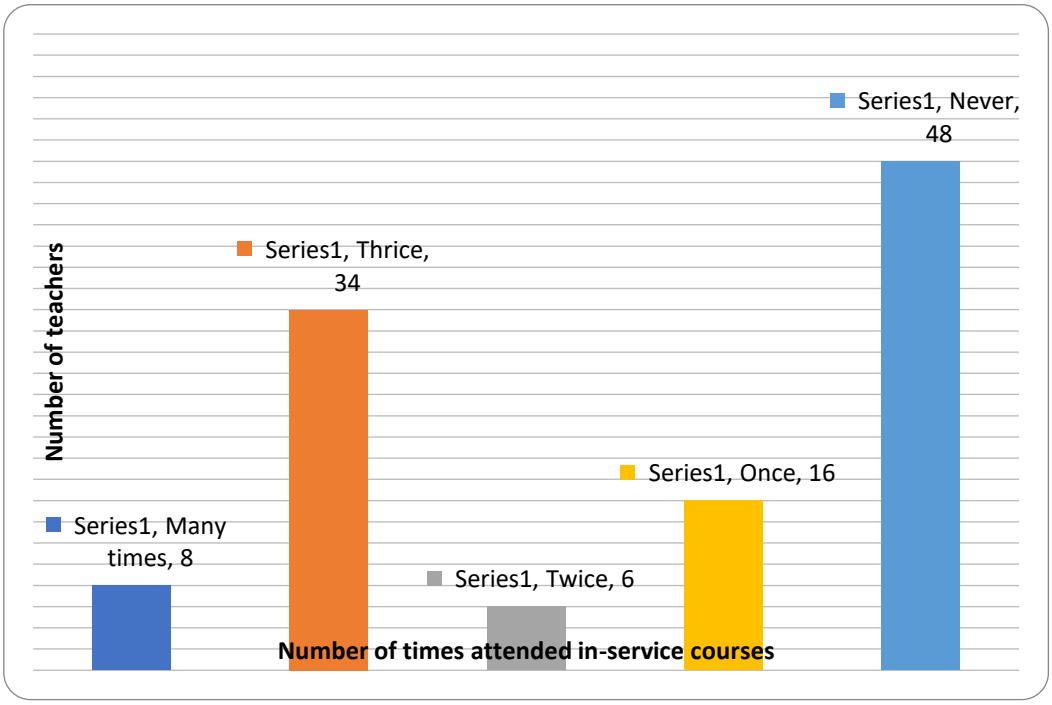

Figure 1: Teachers frequency of in-service course attendance

From figure 1, out of the 112 teachers who were involved in the survey, 64 (57%) have attended in service programmes in line with FPE. Given the complexity of the programme, there is need for more in service to make teachers more innovative in resource utilization. 34 (30%) have attended the programmes thrice (3 times) 6 (5%) have had the in-service twice, (2 times) 16 (14%) once and 8 (7%) teachers have attended the programme many times. However, 48 (44%) teachers have not had any in-service training in line with FPE. 44% of teachers stating that they have not attend any in-service program is a pointer to the fact that teachers were not well prepared towards the implementation of FPE hence the utilisation of resource in an innovative way. This is in line with the findings of a UNESCO study that found that teachers were not trained on multi-grade and double shift methods yet they were required to use them (UNESCO, 2005). The findings are also in line with the findings of another study conducted in Keiyo district by Kipkoech. With regard to teachers, head teachers and education officers preparedness in terms of training for the implementation of FPE program Kipkoech reports that even though 60.8% of the teachers had prior knowledge of the implementation of the FPE policy they had not been adequately prepared (Kipkoech, 2011).

From the interview with DQASO at the District Education office it was found out that many of the education officials to facilitate the in-service programmes for teachers had been redeployed. Teacher Advisory Centres (TAC) Tutors who were mandated to facilitate the in-service programmes on resource use had redeployed from the divisions to other districts. This created shortage of manpower. Before the introduction of FPE we had more officers at the grassroots. However with launch of the programme there are more schools but with fewer education officers which has interfered with their efficiency. This greatly interfered with the preparation of teachers towards FPE implementation.

From the interview carried out with the Deputy head teachers, data indicates that though they are on ground working closely with the head teachers, they have not undergone any in-service in that capacity

to make them more effective. This finding is in agreement with the findings of a study carried out in Kenya by UNESCO in collaboration with the ministry of education, science and technology. According to the study, teachers admitted having been got off guard with the introduction of FPE (UNESCO, 2005). The study also established that the provision of learning materials aided their teaching by enabling them to complete the syllabus and teaching new concepts easily (UNESCO, 2005). This is also in agreement with the study findings that the were learning resources from both the interviews with teachers as well as students.

Another aspect of teacher preparation is the qualification of a teacher. In the Session Paper No.1 of 2005 on A Policy Framework on Education Training and Research, the government proposed to regularly review the teacher education curriculum and provide teachers support programmes to make them more effective. From the questionnaire given to teachers asking them to make response with reference to their professional qualification it was found that most of them were P1 teachers. The findings were as shown the figure 2.

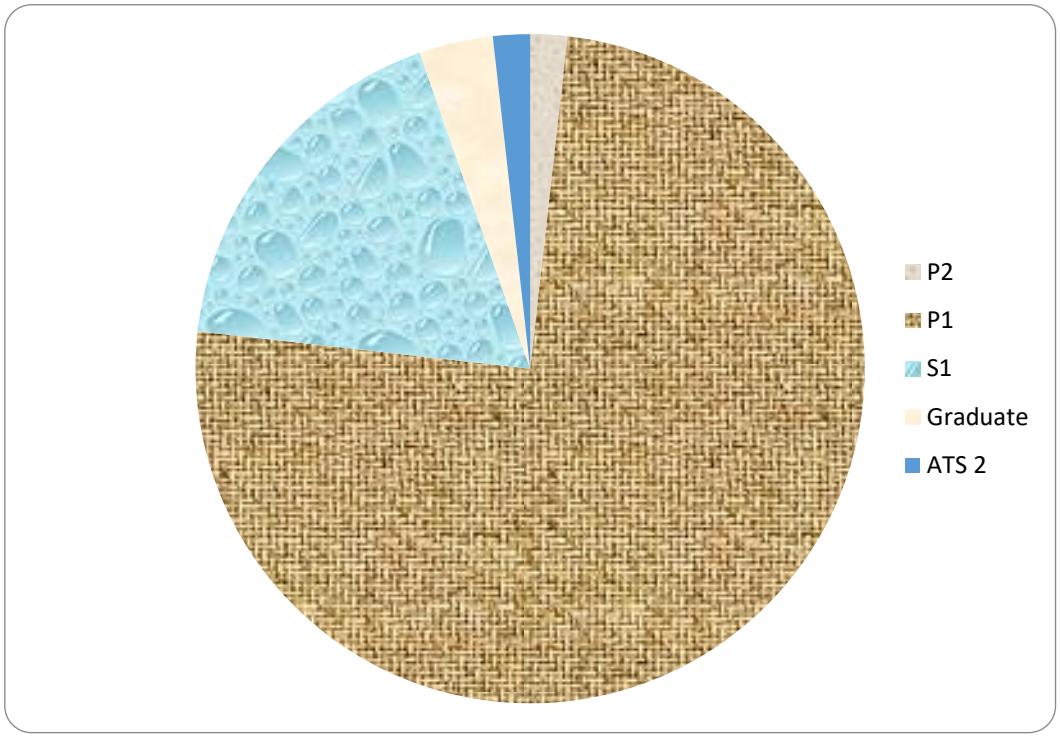

Figure 2: Teachers professional qualifications

According to figure 2, on pre-service training, out of the 112 teachers who responded, 84 (75%) were P1 teachers, 20 (18%) were S1, 4 (4%) were graduates, 2 (2%) was P2 and 2 (2%) was ATS. This means that all teachers have acquired the recommended qualification to facilitate curriculum implementation.

Aside from teachers pre-service training, the experience one has had in teaching also contributes towards how one may be prepared to handle challenges of utilizing learning resources. The findings of the study with regard to the teaching experience the teachers were as presented in figure 3.

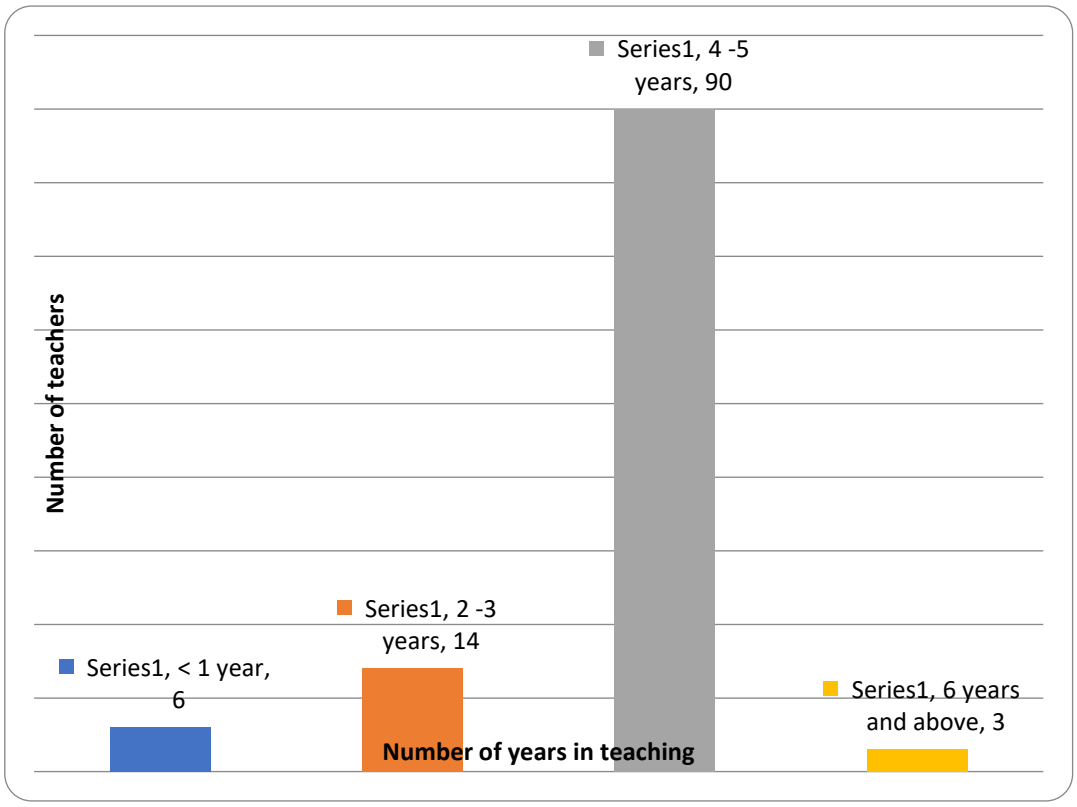

Figure 3: Teachers teaching experience in years

From the figure its clear that 90 (80%) respondents had an experience of 4 years and above, 14 (13%) had an experience of 2 to 3 years, 6 (5%) had an experience of 1 years and less while 2 (2%) had an experience of more than 6 years. Teaching experience has a bearing on effective utilization of learning resources. The longer the experience the more innovative a teacher is in resource utilization. From the teachers' teaching experience, the researcher concluded that most of the teachers had gained enough experience to help them facilitate curriculum implementation.

A part from the teachers teaching experience the interview carried out by the researcher on the head teachers and deputy head teachers revealed that all had long teaching experiences. However all the Head teachers interviewed said that they were not prepared when the FPE programme began. This is in agreement with the UNESCO study findings that found that teachers were not prepared for FPE introduction (UNESCO, 2005). However, the in-service programme began when FPE had already taken off. In-service programmes are mounted almost yearly or when need arises especially on financial management and resources utilization.

5.0 SUMMARY OF FINDINGS

The study sought to assess teacher preparedness in resource utilization in the FPE programme in the classroom in Bungoma East district. From the interviews with head teachers, deputy head teachers and chair persons of the schools, it was clear that FPE was introduced without prior arrangements to deal with subsequent challenges or preparing the teachers accordingly. It is after the launching of FPE that the

government started in-service programmes. Teachers and the school management team were brought on board to undergo the in-service programme.

On teacher preparedness on utilisation of learning resource utilization under FPE program, the research revealed that most teachers feel inadequately prepared in handling the programme. The teachers felt that they require more in-service to enable them be more innovative in resource utilization given the complexity of FPE programme. It is after the launching of FPE that the government started in-service programmes. Teachers and the school management team were brought on board to undergo the in-service programme. The teachers also felt that more in-service programmes should be mounted to equip them with skills on resource utilization.

As much as this was meant to facilitate the training of teachers to prepare them to implement FPE, the programme suffered due to logistics on personnel balancing. It was found out that many of the education officials to facilitate the in-service programmes suffered as a result of Teacher Advisory Centres (TAC) Tutors who were to facilitate the in-service programmes having been redeployed elsewhere. This created shortage of manpower.

The TACs were initially based at the divisional level. However, they are now at the district level manned by fewer education officers. Before the introduction of FPE, many officers were at the grassroots. However with launch of the programme there were more schools but with fewer education officers. This greatly interfered with the preparation of teachers towards FPE implementation further. Despite the shortage of TAC, all teachers interviewed were professionally trained hence had the ability to facilitate curriculum implementation. This was a great boast to FPE. Aside from the teachers' pre-service training, most had good experience in the teaching career. The experience of has had in teaching also contributes towards how one may be prepare to handle challenges of utilizing learning resources.

The FPE programme implementation overwhelmed teachers due to the drastic increase in pupils in contrast to scarce resources. Though in-service programmes were mounted, teachers feel they are not adequate and there is need for more to prepare them effectively for the programme. The head teachers feel that there is need for the government to in-service them more on financial management. A number of them feel it were better if the government would provide learning resources in material form instead of money.

6.0 CONCLUSIONS

Most teachers feel inadequate in handling challenges of FPE on resource utilization due to inadequate in-service programmes. The teacher preparation program towards handling through in-service programmes has been greatly retarded as a result of the shortage of the manpower that had to facilitate them. The head teachers and their deputies feel that there is need for more in-service on financial management.

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Research on Intelligent transportation system course reform about vehicles related major

Wei Dan*, Luo Yiping, Ren Hongjuan, Ma Qihua
Shanghai University of Engineering Science, Shanghai, 201620, China

Abstract
In this paper, according to the discipline characteristic of the course of intelligent transportation system, we discussed on the problems existing in the teaching of vehicles related majors. The reform methods of the course is discussed in two aspects of teaching content and teaching method. Points out that the teaching content should be closer to the vehicles related majors; Teaching methods focus on interactive teaching, and cases should be throughout the classroom teaching; The classroom teaching and extracurricular learning should be combined, and practical teaching should be strengthen. We need to mobilize students' enthusiasm and creativity, in improving the efficiency of teaching and strengthen students' research interest in intelligent transportation system.

Key words: intelligent transportation system, vehicles related majors, teaching content, teaching method

1. Introduction

The course of intelligent transportation system is an interdisciplinary course, involving sensor, communication, computer, control and other disciplines[1]. At present, the development of automobiles is divided into three major development directions: lightweight, electrification and intelligence. Intelligent vehicle technology is one of the most important components of intelligent transportation system. According to the training objectives of the vehicle engineering, automobile service engineering and graduation requirements for students, the training can be based on scientific principles and scientific methods to study complex problems which including designing experiments, analyzing and interpreting data, and obtaining reasonable effective conclusion the automobile technology service the manufacture and so on work engineering application talented person request through the information synthesis. This course is of great significance to the achievement of students' training objectives and graduation requirements[2].

To be engaged in the work of intelligent transportation system needs to know more than one professional knowledge who is a compound professional talent. Many colleges and universities in China , have set up the course of intelligent transportation system for students majoring in transportation， vehicle engineering and other professional and junior college. Some colleges and universities even set up specialized courses to learn knowledge and technology related to intelligent transportation system, which plays a positive role in cultivating inter-disciplinary senior talents related to intelligent transportation system that are urgently needed by the society. The teaching contents of domestic universities that offer courses on intelligent transportation system are basically the same. Different universities have different teaching focuses according to their own situations. For example, tongji university's course on intelligent transportation system emphasizes on traffic intelligence, while wuhan university of technology's course on intelligent

transportation system emphasizes on automobile intelligence[3,4]. At present, there are two main problems in the teaching contents and methods of the course of intelligent transportation system:

① **The content is broad and archaic.** The main content of the course of intelligent transportation system includes the concept, origin, development history, system framework, basic theory, key technologies, and the structure framework, working principle and basic functions of the representative service subsystem of intelligent transportation system. It involves many disciplines and covers a wide range of contents, involving various aspects of the field of transportation, without focusing on vehicle majors. In terms of teaching content, students majoring in automobile should pay more attention to the study of automobile intelligent technology, such as the content of vehicle auxiliary safety system, automatic driving system, etc., which is also the important technical support for the major of vehicle engineering. Therefore, combined with the discipline of the college of automotive engineering, the advanced vehicle information system (avis) in the course of intelligent transportation system (its) is deeply excavated. On the basis of the traditional course content of intelligent transportation, the course construction of relevant content of intelligent vehicle is added[5].

② **The teaching method is simple and old-fashioned**. The teaching is mainly based on systematic teaching by teachers, that is, teachers prepare lessons in advance, make courseware, and mainly use PPT to explain in class. Teachers can transfer abundant knowledge of intelligent transportation system to students in a relatively short period of time. The main problem is that the teaching methods are old-fashioned, which cannot mobilize students' learning enthusiasm. Therefore, attention should be paid to interactive teaching and cases should be added to classroom teaching. Combining classroom teaching with extracurricular learning, we should strengthen practical teaching to arouse students' learning enthusiasm[6].

Reform of course content

The traditional course of *Intelligent transportation system* mainly introduces integrated traffic control system, advanced vehicle information system, vehicle operation control system, dynamic route guidance system, public transportation priority system, environmental protection management system and other aspects.

Combining the expertise of automotive disciplines, this paper deeply excavates the automobile intelligent technology in the advanced vehicle information system in the course of intelligent transportation system, on the basis of the content of traditional intelligent transportation course, it adds relevant content such as the safe driving of automobile and the intelligent technology of automobile. Communication technology, network technology and database technology in the course are basic courses in the computer course, so they are self-study contents after the reform. The chapters in the original course that are not required to meet the graduation requirements of vehicle engineering students are also self-study parts in the new course.

Table 1. Comparison between the original content of the course of intelligent transportation system and the teaching content after the reform.

Chapters	Original course content	Latest course content
Chapter 1	Overview of intelligent transportation systems	Overview of intelligent transportation systems
Chapter 2	The framework system of intelligent transportation system	Traffic information collection and processing technology
Chapter 3	Traffic information collection and	Intelligent transportation system

	processing technology	integrated platform
Chapter 4	Communication technology	Traffic information service system
Chapter 5	Network technology	Urban intelligent traffic management system
Chapter 6	Intelligent transportation system integrated platform	Urban traffic signal control system
Chapter 7	Technology database and its application in intelligent transportation system	Traffic demand management system
Chapter 8	Traffic information service system	Advanced urban public transport system
Chapter 9	Urban intelligent traffic management system	Vehicle auxiliary control and automatic vehicle driving system
Chapter 10	Urban traffic signal control system	Intelligent visual sense of vehicle safety driving technology
Chapter 11	Traffic demand management system	Intelligent monitoring technology for dangerous driving
Chapter 12	Advanced urban public transport system	Intelligent monitoring technology of automobile power and transmission system
Chapter 13	Vehicle auxiliary control and automatic vehicle driving system	Intelligent assistant technology of automobile (intelligent control technology of lamp, door and wiper)
Chapter 14	Electronic billing system	Auto position response technology
Chapter 15	Emergency management system	Electronic billing system
Chapter 16	Road facilities management system	Emergency management system

Through the study of this course, students will have an overall understanding of the new technology and new knowledge of intelligent transportation system, have an in-depth understanding of automobile intelligent technology, and master some principles of automobile intelligent technology. In the future work, it is our duty to realize the modern automobile intelligentization, improve the operational efficiency of the transportation system, reduce traffic accidents and reduce environmental pollution, and find a place to use in the future development of intelligent transportation and the development of intelligent automobile technology.

2. Reform of teaching methods

3.1 Emphasis on interactive teaching, cases throughout the whole classroom teaching

The classroom teaching needs to activate the classroom atmosphere and the teaching process needs to guide the student's thought, The discussion and interactive teaching methods are used to stimulate the enthusiasm and enthusiasm of students to listen to the class, causes the student not only to take the ear and the eye to come to class, moreover importantly is to take the brain to come to class. Before learning theoretical knowledge , it introduces a practical case , proposes relevant thinking questions , then explains theoretical knowledge , and then solves previous thinking questions by mastering theoretical knowledge , which will stimulate students ' interest in learning through cases . When explaining boring theoretical problems , cases can be introduced to enhance the understanding of boring theoretical knowledge , improve the classroom atmosphere , and strengthen the interaction between teachers and students . The main purpose of interactive teaching method is to activate classroom teaching , make teaching and learning combine and permeate each other , teachers and students inspire and promote each other , and finally achieve the goal of students ' independent learning . The key to implement such a teaching method is that teachers need to carefully design some problems that can stimulate and guide students ' thinking . In classroom teaching , students should be given a certain amount of thinking space to analyze and solve problems .

3.2 Combine classroom teaching with extracurricular learning to strengthen practical teaching

The goal of university teaching is to encourage students to “study in learning and learn in research” so that students are not satisfied with the knowledge in books, and further research and mastering what is not in books. Therefore, teachers should provide students with documents based on the content of the course and slightly higher than the teaching content of the course or access to the literature in the process of teaching. In order to broaden the horizons of students, not only meet the needs of students at different levels, but also cultivate Students' ability to collect and organize research materials and the ability to read literature. Strengthen practical teaching, for example, it can carry out group development of intelligent transportation system related projects. The plan is to combine the Freescale Smart Car Competition and the Intelligent Transportation Technology Competition. According to the requirements of the competition, the students are guided to conduct practical operations in groups and guide each group to complete one. The intelligent transportation design project enables students to not only learn a wealth of theoretical knowledge, but also have the ability to practice. At the same time, we have established friendly cooperative relations with excellent enterprises in the intelligent transportation industry. We can obtain examples of the actual work of enterprises in teaching, and establish a business-study relationship with the enterprises for the juniors and seniors who study this course. To enable students to gain practical knowledge in internships or cooperation with intelligent transportation companies.

3. Conclusion

The Intelligent Transportation System course is a multidisciplinary cross-curricular course. There are many problems in teaching, such as wide and old teaching methods, single teaching methods and old-fashioned methods. This paper explores the reform methods of the course in terms of teaching content and teaching methods. In terms of teaching content, vehicle subject expertise, in-depth mining of intelligent vehicle technology in advanced vehicle information systems in intelligent transportation system courses,

in traditional intelligent transportation courses On the basis of content, we will increase the safety of car driving, automotive intelligent technology and other related content. In the teaching method, the author puts emphasis on interactive teaching, so that the case runs through the whole classroom teaching; the combination of classroom teaching and extracurricular learning, strengthens practical teaching, allows students to actively participate in the course, cultivate students' interest in the course, and achieve the course assessment. Process, cultivate students' ability to analyze problems and solve problems in academic research, students can truly understand intelligent transportation, in order to achieve the expected teaching effect.

Acknowledgement

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INFLUENCE OF SELECTED ECONOMIC FACTORS IMPACT ON THE RESPONSE OF COLLEGE STUDENTS TOWARDS VCT SERVICES: A CASE OF SELECTED MIDDLE LEVEL COLLEGES IN NAIROBI PROVINCE, KENYA

Macharia Joyce Mghoi

[1] Med. Department of Educational Psychology Counselling and Educational Foundation, Egerton University, Kenya. Senior Student Counsellor and Assistant Dean of Students Chuka University, Kenya.

jmghoi@yahoo.com

Abstract

The researcher sought to find out whether the economic situation of the students has an impact on the way they respond to the VCT services. The researcher sought to find out their monthly income, place of residence, whether they have access to television, radio or newspapers as a source of information and if they have heard of any VCT awareness campaign. The VCT facilities have not however been fully utilized especially by the youth. Based on this realization the study sought to determine the influence of socio-demographic factors on the response of college students towards VCT services. Purposive sampling was used to select three colleges to be used in the study out of nine major colleges. This being a descriptive research, a stratified random sampling design was appropriate. More female students were aware of the VCT services 82.6% as opposed to 68.2% male while less than half of the population 45.7% were aware of the location of this facility. The study concludes that the percentage of college students who are tested for HIV is relatively low considering the effort that has been made by the government, non-governmental organizations and other stakeholders in creating awareness on HIV/AIDS campaigns. One of the recommendations by the authors is that college students should be helped to deal with stigmatisation, fear and discriminations.

Keywords: College students, economic factors, Kenya.

1. Introduction

The World Health Organization's (WHO, 1997) estimates indicated that the number of people living with the virus was 30.6 million, while new infections stood at 5.8 million in the world per year. Of the new infections, about 40% occurred among women while more than 55% was recorded for young adults aged 15-25 (WHO, 1998). While about 2.3 million AIDS deaths were recorded in 1997, it was estimated that about 12 million people have already died from the pandemic since it was first diagnosed.

Learning that you are HIV-positive can be one of the most difficult experiences one can go through in life.

With time, it is evident that the right treatment and care, one can live a long and healthy life with HIV.

Globally, the number of newly infected persons keeps increasing (WHO, 1997). In 2009, 2.9 million people were newly infected with the virus while 33.3 million people around the world are now living with HIV/AIDS (UNAIDS, 2010). In Africa the impact is severe, at the end of 2009 one out of every ten people was infected with HIV in nine of the African counties (UNAIDS, 2010).

In Kenya, HIV/AIDS has become a critical public health problem and poses serious challenges to the country's health-care system. According to the Government of Kenya (2001), AIDS is caused by a Human Immune-deficiency Virus (HIV) that weakens the immune system, making the body susceptible to and unable to recover from secondary opportunistic diseases such as tuberculosis, pneumonia, stomach disorders among others that eventually lead to death. The virus was first diagnosed in Kenya in 1984. It was anticipated 1.8 million people would be living with HIV by 2003. The national prevalence rate presently stands at 6.3% in 2009 (UNGASS, 2010), down from 10.25 % in 2002, (NASCOP, 2004). The downward revision is largely attributed to the intensive, multi-sectoral interventions spear-headed by the Government of Kenya (GoK, 2001) in collaboration with complementary sectors targeting awareness creation and sexual behaviour change.

VCT programmes were established in Kenya in 2001 and the government embarked on an intensive programme to avail VCT services to majority of the population as a component of first-line strategies to reverse HIV/AIDS trends in the country through behaviour change. Despite this, the National HIV/AIDS prevalence rate still continues to rise especially among the youth. This, therefore, means that either these services are being under-utilised or they are not making the impact that they ought to be making towards curbing the spread of HIV/AIDS. This is a sign that there is a gap of knowledge and so the determination of the impact of selected Socio-demographic factors on the response of college students towards VCT services in selected middle level colleges in Nairobi Kenya is crucial.

In Kenya, the burden of HIV/AIDS in not just a major challenge to the health-care system but also an increasing impediment to socio-economic prosperity, as it relentlessly undermines national resources and frustrates development efforts in all sectors of the economy. It has been noted that young people account for the majority of all new infections in East and Central Africa (Population Council, 2003). Consequently efforts to curtail the spread of the infection during the youthful age will go a long way to reduce the prevalence.

The specific objective of the study was to establish the extent to which the following selected economic factors impact on the response of college students towards VCT services (a) Income per month (b) Place of residence when not in college (c) Awareness of VCT services through Television.

2. Methodology

This being a descriptive survey study, an ex-post facto design was used to help the researcher determine the impact of selected factors on the response of college students towards VCT services. According to UNGASS, (2010), an ex-post factor design describes and interprets the situation the way it is at that particular time. One cannot manipulate or assign subjects or treatments, because the independent variables have already occurred. This design is appropriate for the study because the researcher does not manipulate any of the variables of interest and the data resulting to all variables are collected simultaneously (Bryman & Cramer, 1997). The effects have already manifested themselves.

3. Location of Study

The study was conducted in selected public middle level colleges in Nairobi Kenya. These colleges are Kenya Technical Teachers College, Kabete Technical Training College and Kenya Medical Training College. The three colleges were purposefully selected based on the willingness of the respective administration to participate in this study. Middle level public colleges were also found to be the best for this study because they have students from all socio-economic background. They were also found to have a higher representation of students from different parts of the county unlike the private commercial colleges that are only accessible to people of higher socio-economic class and those who reside in Nairobi. Nairobi Province was also selected because of ease in accessibility during data collection it was also convenient to the researcher.

4. Population of the Study

The total population of this study was 1000 college students. Kenya Technical Teachers College had 350 students, Kabete Technical Training College 250 students and Kenya Medical Training College 400 students (Table 1).

Table 1 breakdown of male to female students in each college.

Selected Colleges	Male	Female	Total
Kenya TTC	220	130	350
Kabete TTC	160	90	250
Kenya MTC	180	220	400
Total Students	560	440	1000

Source: Admissions office; Kenya TTC, Kabete TTC, Kenya MTC

5. Sampling Procedures and Sample Size

It is imperative that samples be as representative as possible, because too small a sample is likely to yield under-estimated information due to the effect of sampling error. Samples are drawn from well-defined lists

of the target population known as the sampling frame. According to Nassiuma (2000), a representative sample size can be drawn using the relation:

$$n = \frac{NC^2}{C^2 + (N-1)e^2}$$

Where N= Population size=1000, n=sample size, C= Co-efficient of variation, and
e= the error margin. In this study, C=30% and e=2%.
This leads to a sample size of 190 which was rounded up to 190 college students, out of the population of 1000 college students.

A stratified random sampling frame was prepared in consultation with the institutional authorities based on gender. In stratified sampling, the population is divided into two or more groups then a given number of cases are randomly selected from each population subgroup (Mugenda and Mugenda, 1999). The total sample size for Kenya TTC 65, Kabete TTC was 47, Kenya MTC 78 (table 2). The total questionnaires distributed were 190.

Table 2. Targeted Number of Students in the Three Colleges

Targeted no	Male	Female	Total
Kenya TTC	41	24	65
Kabete TTC	30	17	47
Kenya MTC	33	45	78
Total	104	86	190

Questionnaires were used in this study. Self-administered questionnaires provided some degree of confidentiality and they motivated the college students to inscribe their thoughts and opinions freely. The data was qualitatively explained according to the questions and objectives of this study. Comparisons between responses were also done to bring out similarities and dissimilarities among them. The data was analyzed by use of frequencies, percentages, means, tables and graphs. The data collected was recorded and analyzed by use of computer programme Statistical Package for Social Sciences (SPSS). Obure (2002) claims that SPSS for widows is the most commonly used statistical software package for statistical analysis of data.

6. Research Findings

A total of 188 questionnaires were returned out of the 190 distributed.

Table 3 Year of Study and Testing for HIV/AIDS

Year of study	Response Yes	No
First year	14 (87.5%)	2 (12.5%)
Second year	36 (58.1%	26 (41.9%)
Third year	47 (49.0%	49 (51.0%)
Total	97 (51.6%	77 (40.9%)

From Table 3, 87.5% of first year have been tested. It is important to note that the frequency was low. The third year students were expected to have acquired more knowledge with time. However, the study reveals that barely half of them (49.0%) are tested. The assertion that, "there is less acceptance of testing among the educated" maybe applicable in this study.

7. Level of Income per Month

Income is money or other gain or return resulting from goods or services produced in a given period of time, usually measured annually or monthly. Income may be received by an individual or by an entity, such as a corporation or a government. The various types of income are usually described within the private or the public sector of an economic activity. The results in Table 4 summarize income levels for this study. Majority of the students (47.1%) have a monthly income of Ksh1000-4999.Those who receive an income of Ksh5000-9999 are (38.5%). This shows that the students in this research receive relatively good allowances per month.

Table 4 Average Monthly Incomes for College Students per Month

Monthly income in Kshs	Frequency	Percentage
Below 1000	18	9.6
1000-4999	88	47.1
5000-9999	72	38.5
Above 10000	9	4.8
Total	187	100

Figure 1 results show that majority of those who were single were within average monthly income of 1000-4999 Kshs (68%). This was different from the married 30 (52.6 %) who were within 5000-9999 Kshs. the divorced group were also on this category 3 (75%) the same case to the separated group. It shows that a majority of the student have allowances of 5000 Kshs and above. Based on this income and their view, the assumption that the VCT services are expensive and unaffordable was ruled out. They can all access these services considering that some have minimal charges and yet some are free.

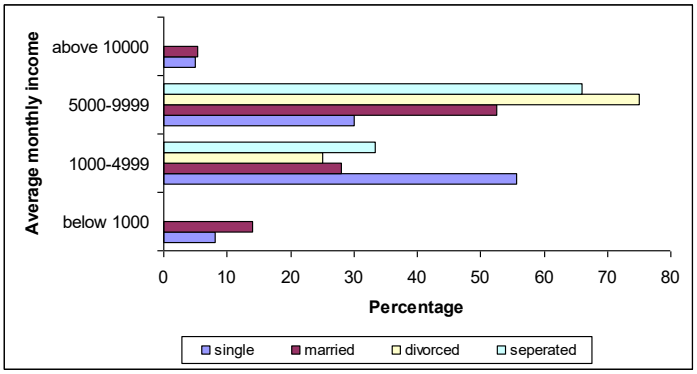

Figure 1. Average Monthly Incomes

The majority of those who were single 68% were within average monthly income of Kshs. 1000-4999). This was different from the married 52.6 % who were within Kshs. 5000-9999. The divorced group 75% was also in this category as well as the separated group. Table 15 gives a summary of monthly income and testing this shows that the response to VCT services was not impacted on by the economic status. This is because 68% had a monthly income of above 5000 per month. It is important to also note the respondents thought VCT centers are not costly, meaning the services were affordable. This correlates with the government directive which states; VCT sites located within public health facilities provide testing and counseling services free of charge for anyone willing to be tested. However, an affordable fee can be charged to enhance sustainability of VCT services; but the fees must be approved by the facility management- the District Health Management Board (DHMB) and the District AIDS Committee (DAC) guided by the National policies. Stand-alone VCT sites may charge a fee if approved by the agency running the site. The fee must be posted clearly so that clients visiting the site know in advance what they are expected to pay. If a fee is charged measures such as free days should be put in place so that clients who are unable to pay can access service. Counselors should be able to waive fees if they determine that a client is unable to pay, but there will be personal or public health benefit if test is provided. The District Health Management Board and the District AIDS committee should discourage overcharging in such sites (GoK, 2001, page 56).

Table 5 Monthly Income and Testing for HIV/AIDS

Monthly Income in Kshs		Response	
	Freq	Yes	No
Below 1000	(18)	2 (11.1%)	5 (27.8%)
1000-4999	(88)	55 (62.5%)	32 (36.4%)
5000-9999	(72)	40 (55.6%)	39 (54.2%)
Above 10000	(9)	1 (11.1%)	2 (22.2%)
Total	(187)	98 (52.4%)	78 (41.7%)

From the results in Table 15, the general testing of both high income earners 55.6% and low income earners 62.5% is high. This shows that their response to testing has not been impacted on by their income. This means there are other factors at play other than financial.

8. Place of residence when not in college

Although the respondents were picked randomly, the results in Table 6 show that 45 (23.8%) are from rural, 81 (43.2%) from Nairobi and 62 (32.8%) from other urban areas. The findings show that the majority of the students come from rural and other urban area combined. This shows that the results of this study represent views from across the county as the respondents are from different areas of the country.

Table 6
Place of Residence When not in College

Place of residence	Freq	%
Rural	45	23.9
Nairobi	81	43.2
Other urban areas	62	32.9
Total	188	100

In Table 7, the results show that 55.5% of those who reside in rural areas are tested as opposed to 49.4% from Nairobi. There is more accessibility of services in Nairobi than in rural areas. Other than that awareness campaigns and education is surely more in Nairobi than rural areas, this confirms that knowledge does not necessarily translate to behaviour change. Incidentally other rural areas have responded more positively than Nairobi which other than being the Capital city, is headquarter to both governmental and non- governmental organisation dealing with HIV/AIDS and testing.

Table 7 Place of Residence and Testing

Place of residence	Response			
	Yes	No	No Response	Total
Rural	25 (55.5%)	18 (40.1%)	2 (4.4%)	45 (100%)
Nairobi	40 (49.4%)	29 (35.8%)	12 (14.8%)	81 (100%)
Other urban areas	34 (54.8%)	28 (45.2%)	0 (0.0%)	62 (100%)

9. **Awareness of VCT services through newspaper, television and radio**

There is a lot of advertisement of VCT services in the media. The researcher wanted to find out how this awareness has impacted on the youth. If they watch TV, listen to radio or read newspapers it means they are not ignorant of the VCT services. It was also possible to get more and latest information related to HIV and VCT services; hence getting informed (becoming aware) more than those who lacked the facilities.

The study sought to find out the respondents source of information especially current news. The results in Table 8 show that 69.3% occasionally read newspapers, 21.2% always and 4.5% never read newspapers as a source of information.

Table 8

Percentages of Those Who Read Newspaper

Response	Frequency	Percent
Never	8	4.2
Occasionally	131	69.3
Always	40	21.2
No Response	9	5.3
Total	188	100.0

The study also revealed that 12.7% never listen to the radio, 46.0% occasionally listen to the radio and 34.9%s always listened to the radio as a source of information as shown in Table 9.

Table 9

Percentages of Those Who Listen to Radio

Listening to Radio	Frequency	Percent
Never	24	12.7
Occasionally	87	46.3
Always	66	35.1
No Response	11	5.9
Total	188	100

Lastly, the group that watched TV, 2.6% never watched TVs, 28.6% occasionally watched TV, and 62.4% always watched TV as a source of information. Out of those who watched television as a source of information, 61.0% have been tested for HIV; and 44.0% have not been tested. The results in Table 20 show the relationship between those who watch television and testing.

Table 20
Percentages of Those who Watch TV and Testing for HIV/AIDS

Watch TV	Freq(Percent)	Testing Response	
		Yes	No
Never	5 (2.6%)	1 (20.0%)	0 (0.0%)
Occasionally	54 (28.6%)	19 (35.2%)	23 (42.6%)
Always	118 (62.4%)	72 (61.0%)	52 (44.0%)
No response	11 (6.4%)		
Total	188 (100%)	92 (48.9%)	75 (39.9%)

From the findings, more students always watch television unlike listening to radio. This shows that television can be used more to convey VCT services information to students in all the colleges of study. Integration of radio, newspaper and the television can therefore give better results of information delivery. Figure 7 below shows comparison between newspaper, radio and television as a source of information.

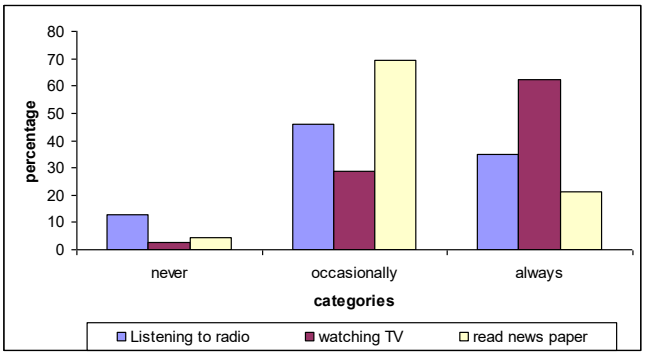

Figure 2. Choices of Media for Current News

Figure 2 shows that most of the respondents watched television. This study was therefore in agreement with other studies that observed that most of the information had been obtained from the TV, campaigns, newspapers, and the information packages. The television was found to be the most important information source of HIV/AIDS in several studies (Serlo & Aavarinne 1999).

The study also sought to find out whether the respondent was aware of any advent about VCT services in Kenya. This study notes that about a half 54% (102) of respondents were aware of an advert about VCT services in Kenya, they were aware of adverts promoting VCT services in Kenya. Surprisingly, 90% could not remember the message slogan or what the advert talked about. This shows that we may be advertising or passing information but the information is not either understood or no communication takes place. The use of mass media such as television, radio, magazines and posters, audio-visuals such as videos and films as a means of promoting VCT services among students should be encouraged.

10. Conclusion

Although the response of the college students towards VCT services is relatively low, it was noted that the response of female students towards VCT services is lower than that of male. Only 54.2% of female have been tested as compared to male 58.9%. Incidentally women showed better awareness of the VCT services but still their response is low. This can only be attributed to cultural view of the fact that issues of sexuality are a responsibility of men. Most women who tested gave reasons for testing such as child birth, sickness, or to be married. This is Involuntary Counseling and Testing, they were compelled to do the test. Gender has an impact on the response of the college students towards VCT services.

It is clear that television is an effective means of passing information as a majority of the respondents use it as a source of information. However the message adverts about VCT services are not clearly understood. They lack proper communication as most of the respondents could not state one clear slogan or message they get from the adverts. Out of those who watched television as a source of information 61.0% have been tested for HIV and 44.0% have not been tested. Service providers and administrators should continue to use Televisions to provide information but the message has to be clear.

The study revealed that out of those who were aware of the location of a VCT facility 61.6% have been tested for HIV and 36.0% had not been tested despite knowing the location of the VCT facility. It was also noted that 42.9% who were not aware of any VCT centre near have been tested in the past. Since the testing of HIV is not only done in a VCT facility it was assumed that the respondents could have been tested even in hospital or anywhere not necessarily in a VCT facility near their residence. Awareness of the VCT facility and its services was found to have an Impact on testing

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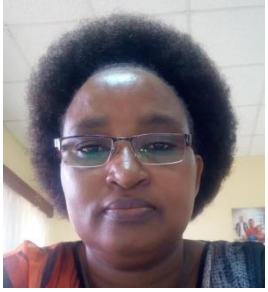
Author's profile



The author Macharia Joyce Mghoi, graduated with Masters degree from the Department of Educational Psychology Counselling and Educational Foundation, Egerton University, Kenya. She is currently the senior Students Counsellor and Assistant Dean of Students Chuka University, Kenya

Anthracological reference collection of palms of the Atlantic Forest (*sensu stricto*) of southern Brazil

João Carlos Ferreira de Melo Júnior[1,2]* and Gustavo Borba de Oliveira[1]
[1]Laboratório de Anatomia da Madeira, Universidade da Região de Joinville – Rua Paulo Malschitzki, 10, Zona Industrial Norte, Joinville, Santa Catarina, Brazil.
[2]Programa de Pós-Graduação em Patrimônio Cultural e Sociedade, Universidade da Região de Joinville – Rua Paulo Malschitzki, 10, Zona Industrial Norte, Joinville, Santa Catarina, Brazil.
*Corresponding author: joao.melo@univille.br

ABSTRACT

Comparative or taphonomic methods that help interpret and identify macro- and microbotanical remains based on reference collections have contributed significantly to expanding Brazilian archaeobotanical and archeological field methods. The present work had the objective of creating a carbonized carpological reference collection that emphasizes fruits from the family Arecaceae that occur in the Atlantic Forest (sensu stricto) of southern Brazil. To create the reference collection, six palm species native to the Atlantic Forest were selected that are widely distributed, occur on the coast of northeastern Santa Catarina and are found at innumerous archeological sites with the sambaqui typology. The selected species were Attalea dubia (Mart.) Burret, Bactris setosa Mart., Butia catarinensis Noblick and Lorenzi, Euterpe edulis Mart., Geonoma schottiana Mart. and Syagrus romanzoffiana (Cham.) Glassman. To conduct the taphonomic tests, 10 fresh fruits (with the pericarp) of each species were selected and submitted to combustion in a muffle furnace set at 400°C and 600°C for 30, 45 and 60 minutes. Ten manually depulped fruits of each species were submitted to the same treatment. The results demonstrated different rates of fragmentation among the carbonized fruits of the selected palm species. The fruits of A. dubia were notable for their well-preserved morphological structures and became completely carbonized after six hours at 600°C in the furnace. Similar results were also found for the fruits S. romanzoffiana.

Keywords: Cultural heritage; Archaeobotany; Anthracology; Reference collection; Sambaquis

INTRODUCTION

Archaeology, like other sciences, requires samples and knowledge about the study subject (Scheel-Ybert *et al*., 2005-2006). In this field, more specifically archaeobotany, this information is obtained using comparative and taphonomic methods to help interpret and identify macro- and microbotanical remains by comparing material from the past with reference collections (Scheel-Ybert *et al*., 2006). Thus, samples of material from the present that have been identified and systematically cataloged are important to make direct comparisons between past (unknown taxon) and present material to infer the taxonomic identity (Scheel-Ybert et al., 2006). However, it is important to consider the type of material being compared. For

example, plant charcoal from archeological matrices requires reference samples in a similar state, since taphonomic processes (i.e., of fossilization and/or preservation) imply there have been innumerous changes to the original condition (Thery-Parisot et al., 2010).

Since charcoal (carbonized wood) is the most representative macrobotanical remain in archeological sites (Scheel-Ybert, 2004), where it is encountered in large quantities (Scheel-Ybert et al., 2006), and because it provides a fairly reliable way to reconstitute the local woody vegetation (Schell-Ybert, 2002), its frequency makes it possible to advance methodological techniques that result in better interpretations, forms of recovery and taxonomic identifications (Pearsall, 2000; Scheel-Ybert, 1996, 2002, 2004; Scheel-Ybert et al., 2005-2006; Melo Júnior, 2009; Silva et al., 2016). Further, this results in important discussions related to taphonomic processes (Théry-Parisot et al., 2010).

In addition to charcoal, other typologies of plant remnants of archeological significance are present at different sites in Brazil. Among these are the following: wooden stakes *in natura*, as recovered in the rock shelter in Santa Elina, Jangada – MG (Ceccantini, 2001) and in the Cubatão I sambaqui in Joinville – SC (Melo Jr. et al., 2016); carbonized fruits, as found in the rock shelter of Lapa das Boleiras in Lagoa Santa - MG (Nakamura et al.,2010); starch grains (Wesolowski et al., 2007); and braided fibers (Peixe, Melo Jr. and Bandeira, 2007). Thus, macrobotanical remains are always present in archeological contexts, preserved by desiccation, carbonization or specific conditions, such as submersion (Peixe et al., 2007; Melo Júnior et al., 2016), making them a viable alternative to subsidize archaeobotanical works.

Curating charcoal from archeological excavations reveals a substantial fraction of carbonized fruits, including those noted by Schell-Ybert (2001) as fragments of *coquinhos* (palm fruits). A study conducted at an archeological site on the central-south coast of Brazil, occupied by fisher-gatherer populations, reported the presence of these carbonized fruits (Lima, 1999, 2000). An assemblage of carbonized botanical remains recovered from the Hatahara site, in central Amazonia, also includes many fruits and seeds, notably palm fruits "*coquinhos*" (Caromano, 2010). When it comes specifically to sites of the sambaqui typology, although there is constant mention of the presence of palm fruits "*coquinhos*" in the archeological sedimentary matrix, associated or not with structures of combustion, taxonomic information about these remains are scarce and there is only one old association with the species *Syagrus romanzoffiana* (Arecaceae) (Beck, 1972).

This important gap in the knowledge about the lifestyle of sambaqui populations and their food habits can result from the following: a) greater emphasis on wood charcoal, making other plant remains, such as carbonized seeds and fruits, less representative; b) lack of field protocols that allow the full recovery of this type of plant remain; or c) lack of reference collections that allow for reliable interpretations and taxonomic identifications.

Nevertheless, there have been advances in the area, such as computerized databases (Scheel-Ybert et al., 2006) and an anthracological atlas (Scheel-Ybert and Gonçalves, 2017). Plant anatomy studies that used reference collections imply the collections are the best way to recognize different species manipulated by past populations, are essential for archeological studies, and serve as a safe comparative basis for other carbonized plant remains (Oliveira and Melo Júnior, 2017). Moreover, the megadiversity of the flora of tropical countries, where in Brazil alone there is an estimated 49.5 thousand plant species or 14% of the

worldwide plant diversity (Peixoto and Morim, 2003), means there are gaps in reference collections. Among the 28 wood collections (xylotheque) in Brazil (Melo Júnior et al., 2014), only 4 have safeguarded material of archaeobotanical interest (Melo Júnior et al., 2014; Scheel-Ybert, 2016b). This scarcity reinforces the need to fill these gaps by developing works that support archaeobotanical research.

Thus, the present work had the objective of creating a carbonized carpological reference collection that emphasizes fruits of the family Arecaceae distributed in the Atlantic Forest (*sensu stricto*) of southern Brazil.

MATERIAL AND METHODS

Species selection

To create the reference collection, six species of Arecaceae were selected that are native to Brazil, have wide distributions in the Atlantic Forest *sensu stricto*, and occur on the coast of northeastern Santa Catarina, where there are innumerous archeological sites of the sambaqui typology. The species are the following: *Attalea dubia* (Mart.) Burret, *Bactris setosa* Mart., *Butia catarinensis* Noblick and Lorenzi, *Euterpe edulis* Mart., *Geonoma schottiana* Mart. and *Syagrus romanzoffiana* (Cham.) Glassman.

The material was collected and treated following standard techniques used in floristics (Fidalgo and Bononi 1989). The botanical material was herborized, identified and archived in the herbarium at the Universidade de Joinville (JOI). The species were identified using specialized literature, comparative morphology and consulting herbaria. To confirm the names of the species and their authors, the Lista de Espécies da Flora do Brasil (BFG, 2015) was used.

Taphonomic Tests

To conduct the taphonomic tests, 10 fresh fruits (with the pericarp) of each species were selected, which were submitted to combustion in a muffle furnace set at 400°C and 600°C, for 30, 45 and 60 minutes, based on a method adapted from Pearsall (2000). Ten manually depulped fruits of each species were submitted to the same treatment. To understand the complete carbonization time, the fruits that were not carbonized after 60 minutes were submitted to longer periods in the muffle furnace (maximum of 6 hours). The carbonized fruits were placed in plastic ziplock bags and labeled with the name of the species, time and burning temperature. The carbonized material was photographed using a Zeis binocular stereomicroscope. All material was incorporated into the anthracological reference collection of the Xiloteca JOIw at the Universidade da Região de Joinville - UNIVILLE.

RESULTS AND DISCUSSION

The taphonomic experiment revealed different rates of fragmentation among the carbonized fruits of the selected palm species in this study, in addition to the formation or non-formation of ash from the burning (table 1).

The fruits of *A. dubia* are larger (6.0-8.5 cm) compared to the other species (Lorenzi et al., 2010), had morphological structures that remained well preserved, and completely carbonized after six hours at 600°C

in the muffle furnace. The fruits of *B. setosa* remained well preserved at both temperatures but exhibited excessive friability when handled. The seeds of the fruits with and without pulp stayed intact and the entire pericarp turned into ash. The fruits of *B. catarinense* partially fragmented at both temperatures and all burning periods in the muffle furnace; 100% fragmented after an hour of burning. The fruits of *E. edulis* presented similar characteristics regarding the reduction of the pericarp and well-preserved seeds. The fruits of *G. schottiana* exhibited 100% fragmentation at 600ºC for all periods. This friability might be related to their small size (1 cm diameter according to Lorenzi et al., 2010). The fruits of *S. romanzoffiana* presented the same characteristic as *A. dubia*, completely carbonizing after six hours in the muffle furnace at 600°C.

Anthracological studies support that under natural depositional conditions the distinct characteristics of each taxon in combination with environmental processes, such as bioturbation caused by roots and animals, or the same post-depositional processes, can influence the fragmentation process of carbonized macrobotanical remains (Thery-Parisot et al. 2010; Scheel-Ybert, 2003; Santana and Carvalho, 2013).

Table 1 – Description of the carbonization processes (taphonomy) with burning period, fragmentation rate and ash formation for palm fruits of the Atlantic Forest *sensu stricto* in southern Brazil. Legend: (+) present; (-) absent.

Species	Type	Temperature	Time (min)	Fragmentation (%)	Ash
Attalea dubia	fresh	400°C	30	0	-
			45	0	-
			60	0	-
	without pericarp	400°C	30	0	-
			45	0	-
			60	0	-
	fresh	600°C	30	0	-
			45	0	-
			60	0	-
	without pericarp	600°C	30	0	-
			45	0	-
			60	0	-
Bactris setosa	fresh	400°C	30	0	+
			45	10	+
			60	10	+
	without pericarp	400°C	30	0	+
			45	0	+
			60	30	+
	fresh	600°C	30	0	+
			45	0	+
			60	20	+

	without pericarp	600°C	30	10	+
			45	20	+
			60	30	+
Butia catarinensis	fresh	400°C	30	80	+
			45	80	+
			60	100	+
	without pericarp	400°C	30	80	+
			45	80	+
			60	100	+
	fresh	600°C	30	80	+
			45	90	+
			60	100	+
	without pericarp	600°C	30	60	+
			45	80	+
			60	100	+
Euterpe edulis	fresh	400°C	30	0	+
			45	0	+
			60	0	+
	without pericarp	400°C	30	0	+
			45	0	+
			60	0	+
	fresh	600°C	30	0	+
			45	0	+
			60	0	+
	without pericarp	600°C	30	0	+
			45	0	+
			60	0	+
Geonoma schottiana	fresh	400°C	30	70	+
			45	80	+
			60	80	+
	without pericarp	400°C	30	70	+
			45	100	+
			60	100	+
	fresh	600°C	30	100	+
			45	100	+
			60	100	+
		600°C	30	100	+

	without pericarp		45	100	+
			60	100	+
Syagrus romanzoffiana	fresh	400°C	30	0	-
			45	0	-
			60	0	-
	without pericarp	400°C	30	0	-
			45	0	-
			60	0	-
	fresh	600°C	30	0	-
			45	0	-
			60	0	+
	without pericarp	600°C	30	0	-
			45	0	-
			60	0	+

Figures 1 to 6 illustrate the carbonized fruits and seeds of the six species and highlight morphological characteristics for taxonomic diagnosis.

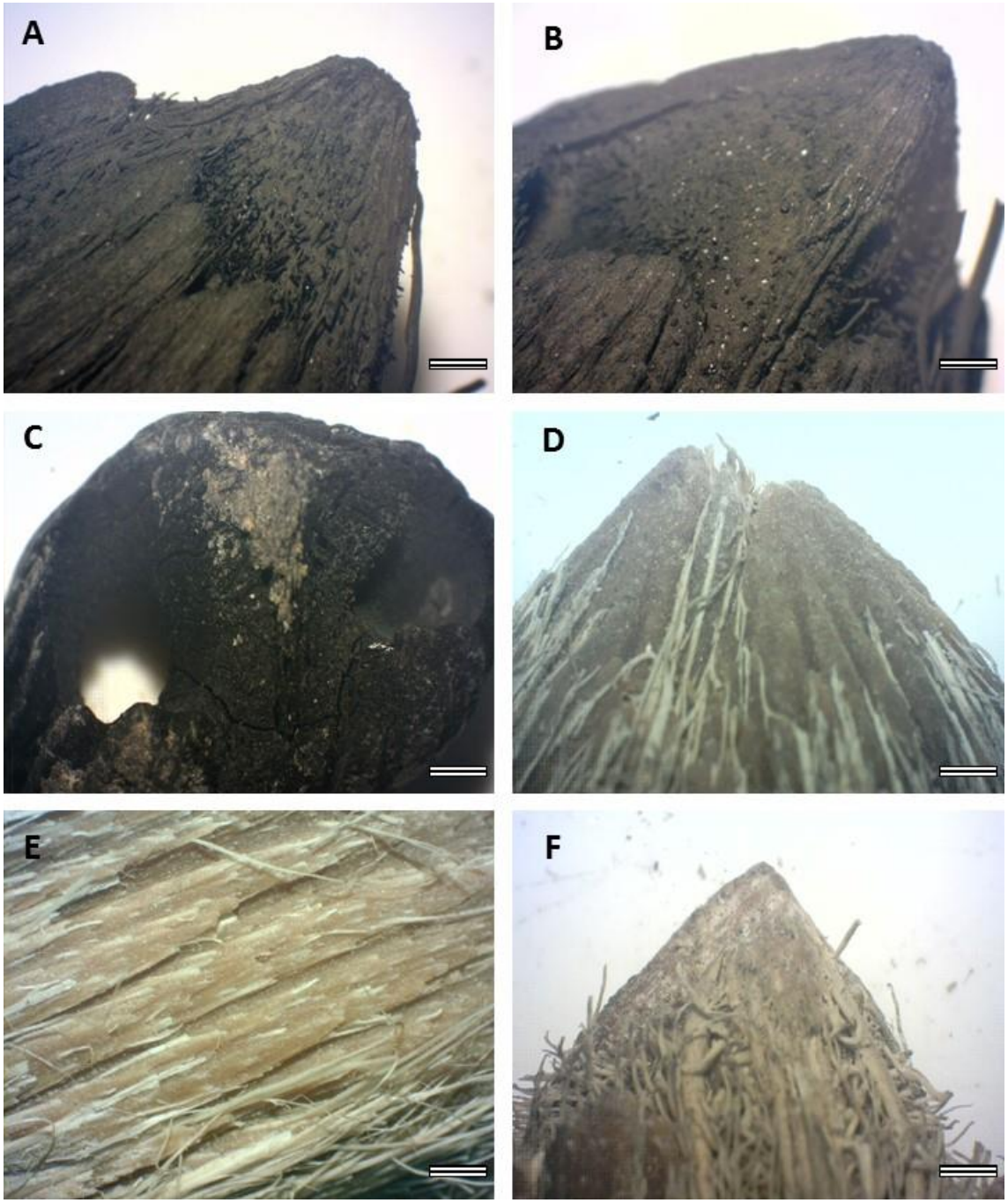


Figure 1 – Taphonomic process of the seeds of *Attalea dubia* from the Atlantic Forest *sensu stricto* in southern Brazil. A – C: carbonized seed, detail of germination pore; D – F: non-carbonized seeds, detail of endocarp and endocarp fibers. Scale bar = 10 mm.

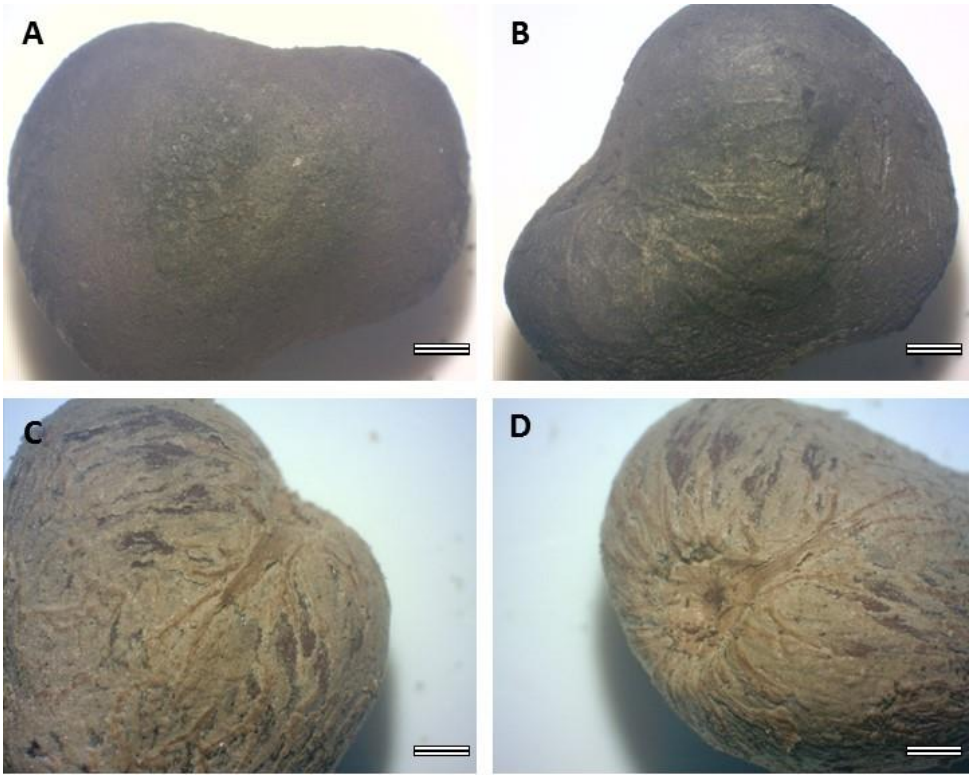


Figure 2 - Taphonomic process of the seeds of *Bactris setosa* from the Atlantic Forest *sensu stricto* in southern Brazil. A and B: carbonized seed; C and D: non-carbonized seed, detail of hilum and raphe. Scale bar = 10 mm.

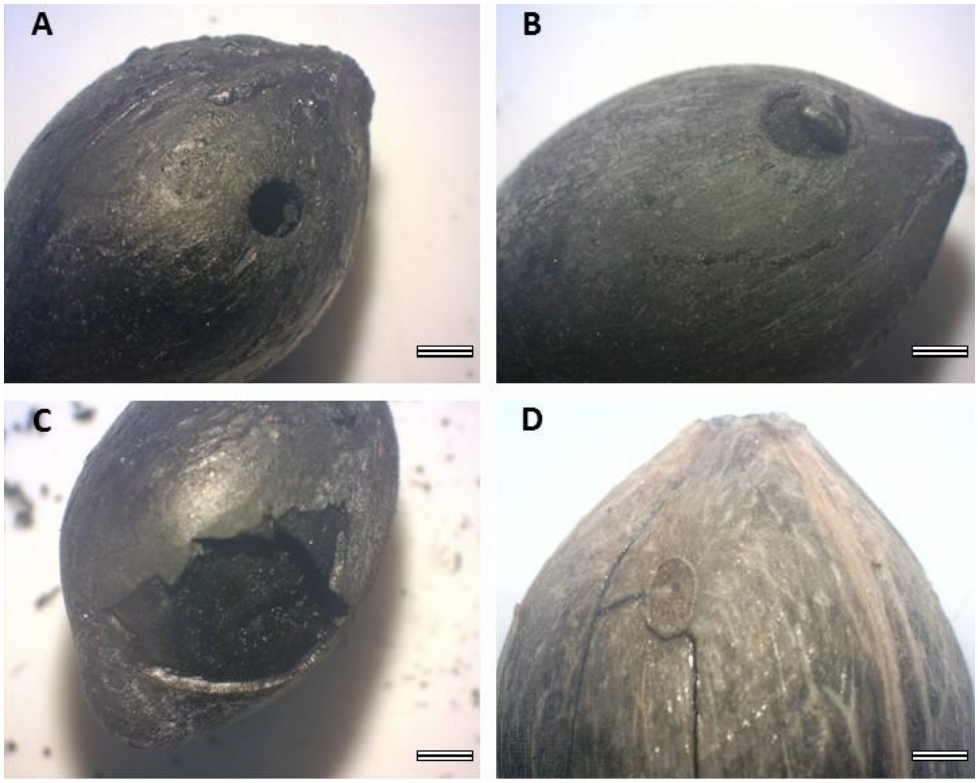


Figure 3 - Taphonomic process of the seeds of *Butia catarinenses* from the Atlantic Forest *sensu stricto* in southern Brazil. A – C: carbonized seed, detail of hilum. D: non-carbonized seed and detail of germination pore. Scale bar = 10 mm.

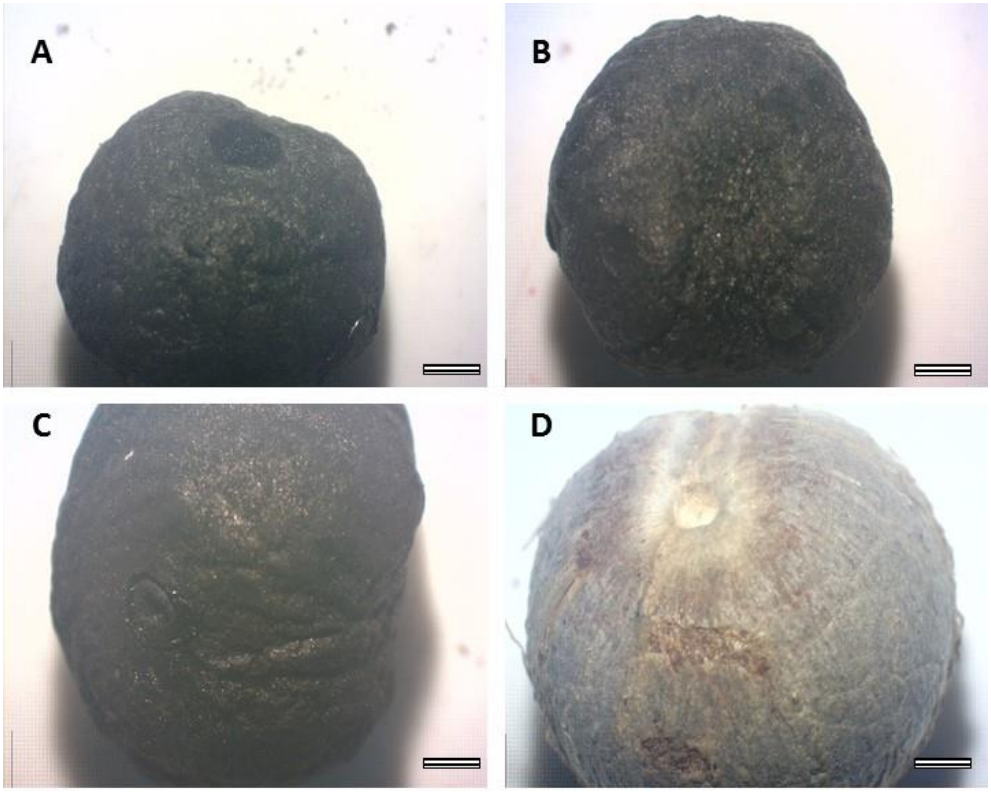


Figure 4 - Taphonomic process of the seeds of *Euterpe edulis* from the Atlantic Forest *sensu stricto* in southern Brazil. A – C: carbonized seeds, details of hilum, raphe and micropyle; D: non-carbonized seed, details of the hilum and raphe. Scale bar = 10mm.

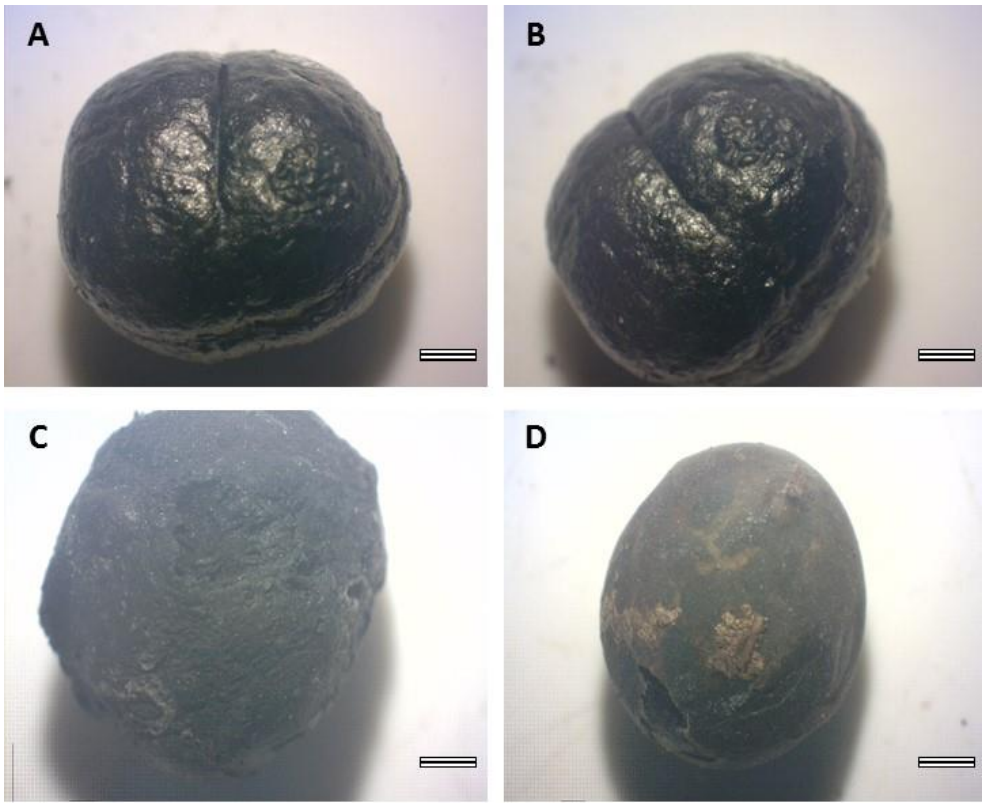


Figure 5 - Taphonomic process of the seeds of *Geonoma schottiana* from the Atlantic Forest *sensu stricto* in southern Brazil. A – C: carbonized seeds; D: non-carbonized fruit. Scale bar = 10mm.

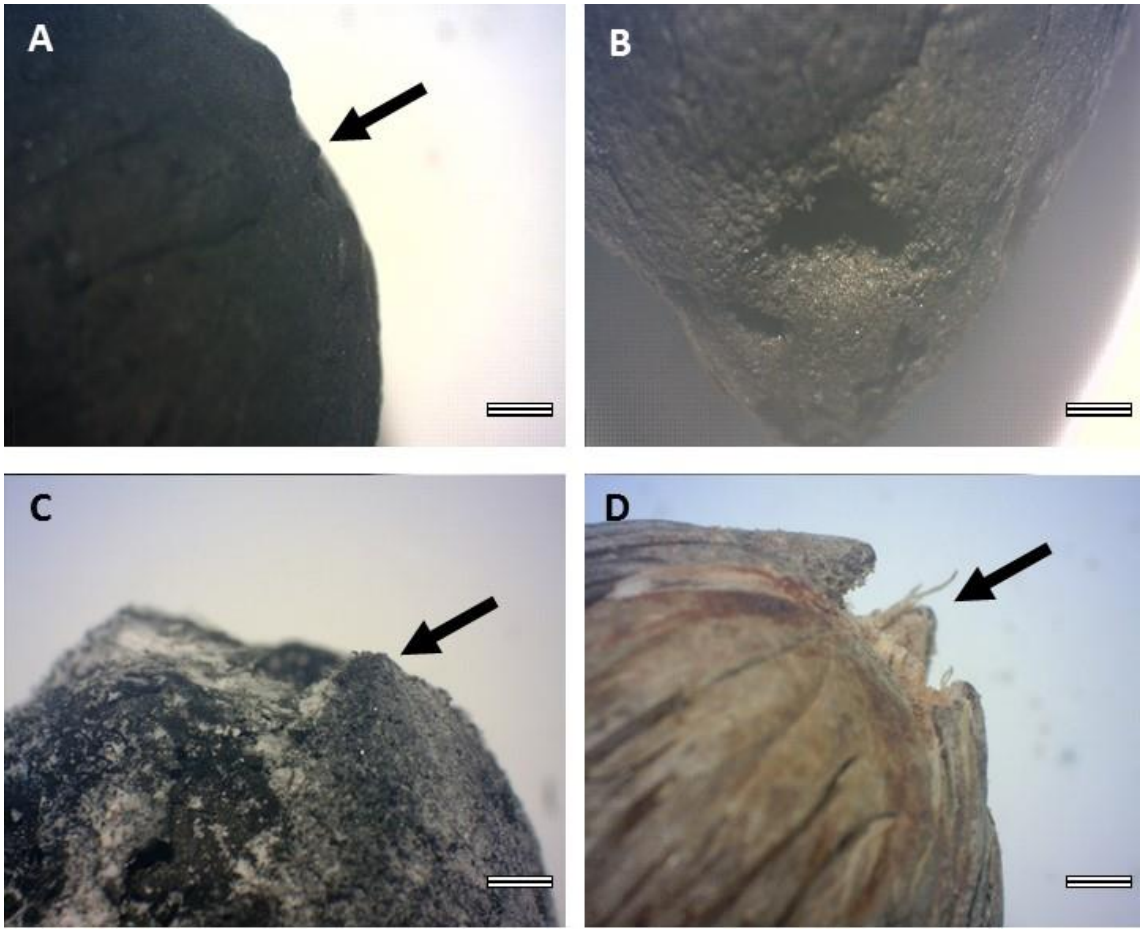


Figure 6 - Taphonomic process of the seeds of *Syagrus romanzoffiana* from the Atlantic Forest *sensu stricto* in southern Brazil. A and C: detail of the structure in the apical portion of a seed after carbonization (arrow); B: detail of the germination pore; D: detail of the structure in the apical portion of a non-carbonized seed (arrow). Scale bar = 10 mm.

In Brazil, archaeobotanical research is mainly focused on understanding the surrounding environment, type of relations established with the natural environment and diet of past societies that existed in the country (Scheel-Ybert, 2016a). Works developed at archeological sites with the sambaqui typology have become promising sources for archaeobotanical investigations (DeBlasis et al., 2007; Gaspar et al., 2013, Melo Júnior et al., 2016) and have led to the discovery of new sites (Bandeira et al., 2018). Although the study of these plant remains generally falls more into the field of archaeobotany than anthracology, the remains are generally preserved by carbonization and found in association with anthracological material (Scheel-Ybert, 2004). Actually, anthracology considers all carbonized macrobotanical remains preserved in the sediment and provides important archeological information (Scheel-Ybert et al., 2010).

Reports of macrobotanical remains of carbonized palm fruits "*coquinhos*" in archeological sites are common in the literature (Lima, 1999-2000; Scheel-Ybert and Solari, 2005). However, works that aim to identify these remains to the lowest taxonomic level and relate them (palm fruits "*coquinhos*") to the diet of past populations are scarce (Nakamura, Melo Jr. and Ceccantini, 2010). One of the oldest studies that reports the presence of palm fruits "*coquinhos*" in archeological sites suggests the exclusive consumption

of *Syagrus romanzoffiana* (*jerivá*) by sambaqui populations on the coast of Santa Catarina, which is based on the presence of carbonized palm fruits "*coquinhos"* at different stratigraphic levels (Beck, 1972).

Dental plaque analyses note the presence of phytoliths of the family Arecaceae at different archeological sites in Brazil (Wesolowski et al., 2007; Boyadjian et al., 2016), reinforcing the presence and consumption of these resources by past populations. However, the suggestion of species, such as *S. romanzoffiana*, is often based on ethnographic literature (Levi-Strauss, 1987) and is not supported by reference collections or specific literature.

Anthracological studies can provide useful archeological results in Brazil, such as helping to describe the surroundings of living and gathering areas of past populations, as well as helping to explain paleoenvironmental and paleoclimatic variations. Specifically, the analysis of fruits and seeds provides paleoethnological and paleoethnobotanical information related to the diet of past populations and complements paleoecological research (Scheel-Ybert, 2004; Schell-Ybert et al., 2006). Thus, amplifying the methodological contribution through reference collections can guarantee more reliable identifications of taxa that represent the natural resources used by these populations.

CONCLUSION

Carbonized samples of palm fruits may facilitate the identification of the species of plant traces found in sambaqui archaeological sites. Reference collections used in plant morphology studies represent the best way to recognize the different species that were used by prehistoric populations, and thus are provide essential support to the research that pervades archeology.

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