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The continuous advance of digital technologies reinforces the need to provide more attractive teaching environments. Compatible environments, not antagonistic, with the way children and adolescents learn. This work presents an experience of integrating technology in the science discipline in elementary school. 44 students from the 5th year of a public school participated in the research. Methodologically, the inverted classroom technique was chosen. To support the activities and make the contents available, a didactic sequence based on Inquiry-Based Learning, made available in a VLE. Two questionnaires were applied: one with 12 items, which aimed to obtain registration data and identify the students' profile; and another, which sought to identify the students' perception of the new didactic experience. This second had 18 items, arranged on a 5-point Likert scale, divided into 4 domains (Usability, Perception of Learning, Satisfaction and Utility). The average obtained from the items was 4.28 points on the Likert scale. This revealed that the experience was well evaluated and approved by the participants, and that the presented model of learning was pleasant, in addition to arousing the students' interest in research.

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1. Introduction

The Digital Technologies of Information and Communication (TDIC) designate a set of technological innovations and tools that allow a redefinition of the functioning of society. These technologies are an integral part of the society in which we live and have impacted on people's way of life. Smartphones, notebooks and a multitude of computing devices and devices surround our activities, inevitably reaching the educational level. Teaching and learning processes are no longer limited to classroom time and space. The concept of ubiquity (COPE and KALANTIZS, 2009) has been installed in a society that learns and absorbs data and information all the time and everywhere, and this also has a direct effect on the way in which teaching should be viewed in this context. This context, which, pressed by the advancement of new technologies, proposes new and continuous challenges for teachers, students, institution managers and the institutions themselves.

Recently, the National Education Council, through Resolution No. 1, of February 2, 2016, defined the national operational guidelines for institutional accreditation and the offer of distance education courses, within the scope of Basic Education (Brazil, 2016). In line with the provisions of art. 80 of Law nº 9.394 / 96 and with Decree nº 5.622 / 2005, the resolution understands the Distance Education modality as a way of developing the teaching and learning process mediated by technologies, which allow the direct action of the teacher and the student in different physical environments [4]. The technological resources that mediate this type of teaching and learning consider a multiplicity of platforms, media and media such as the Virtual Learning Environment (AVEA), transmission of classes via satellite, internet, video lessons, MOOCS, cell phones, social networks, applications mobile learning, digital TV, radio, print and others that make up the possibilities of ICT. These possibilities may be appropriate and appropriate to different models and formats of pedagogical mediation, in order to ensure that it fully meets the new location in which it intends to operate, being able to enable transmission and mediation [3].

The integration of DICT into the educational system is not a new phenomenon, however, it is a complex theme and its success does not only involve equipping schools with technological tools, as technology, although a valuable tool, is not a solution in itself. If it is accompanied by an effective didactic strategy and which seeks to integrate content, pedagogical and technological knowledge, it can become an innovative and effective proposal [16].

The Flipped Classroom is an active methodology that aims to change the way the teaching and learning process takes place in the classroom. The main idea is that the student has a prior study of the content outside the classroom environment, so that later, in the classroom, he can perform other more dynamic activities, clarify doubts, group work, field trips, projects, among other activities that previously could not be carried out, because they were copying material from the board or doing readings and studies in the classroom [1].

It is important to note that a Didactic Sequence (SD), can be defined as a set of activities that are ordered, structured and articulated to fulfill a given educational objective. However, with determined beginning and end, for the teacher and the student. SD is a didactic resource that makes it possible for the teacher to question scientific knowledge and for students to study and discuss a certain theme in more depth [18]. The use of DS favors the use of real situations, similar to those that students live in their daily lives, since, part of the problematization, and leads the student to observe and confront his previous knowledge as the new information presented to him [13]. Thus, it can be said that an SD can be an alternative to overcome some barriers of traditional teaching, where classes are taught practically or totally oral, full of concepts, phenomena, nomenclatures, formulas and theories, charged in the form of tests and tests [8].

In addition, Research-Based Learning (ABI) is a model that emerged in the late 1990s, out of criticism by the American educator Ernest Boyer, about the lack of student participation in research activities and the consequent lack of skills related to it. According to León et al. [7], scientific literacy or the development of research capacity is indispensable given the challenges that are currently present both globally and locally. Many authors refer to ABI as a didactic approach that allows the use of active learning strategies to develop in students, skills that allow them to carry out creative research. Besides favoring in particular the autonomy of students to build their own knowledge [17]; [15].

Pedaste [11] presented a systematic review of the literature, where he selected 32 articles for in-depth analysis. In these, it sought to identify the various steps pointed out by the authors to develop ABI, making comparisons and establishing relationships between them. Based on this study, he concluded that Research-Based Teaching (inquiry) can be structured “into five general phases: orientation, conceptualization, investigation, conclusion and discussion” [11]. This model was the guide for the didactic sequence implemented in this research.

This article reports the experience of integrating technology in education with students from two classes of 5th grade, from elementary school, from a municipal public school, in Imbé/RS - Brazil. For the development of this study, an “Investigative Didactic Sequence” was created, inspired by a “Research-Based Learning” model, made available on Moodle and its application was based on the “Inverted Classroom” approach in science teaching. In the following sections of this document, the research methodology, the results obtained, as well as their discussion, and the section dealing with the conclusion will be presented.

2. Materials and Methods

This research is classified, in terms of its nature as applied research, in view of being a proposal for a practical-theoretical study, with the development and application of a didactic sequence, of a descriptive exploratory nature. And, as a case study, with a qualitative approach, since it aimed to compare theory and practice, as well as, to perceive the satisfaction of the participants regarding the use of digital information and communication technologies in science education [5].

The research was applied, in science classes, in the third quarter of 2018, 44 students from two classes of the 5th year of Elementary School, from a municipal public school in Imbé/RS - Brazil participated in the research. According to the School Census / INEP 2018, the school had 229 students enrolled in the initial years and 158 in the final years. In the period, it also had 41 civil servants, including teachers and technicians. Regarding infrastructure, the school does not have a library, a science laboratory or a computer laboratory. Even having an Internet connection, it has a very limited resource (2Mb) [2]. Thus, for the application to be possible, five notebooks were used (two from the researcher, one from the teacher and two from the school), and when available, the thirty tablets from the Remote Experimentation Laboratory

(RExLab) from Federal University of Santa Catarina (UFSC).

As for the Basic Education Development Index (IDEB), in the period evaluated in the Census, the school obtained 5.1 and 4.7, indicators below the goals for the school, which were 5.9 and 5.3, respectively for the initial and final years. In relation to proficiency, the percentage values in Portuguese and mathematics were 63% and 28% for the 5th year and 51% and 26% for the 9th year [2].

Two questionnaires were applied, which were answered by the students through the project's VLE. It is also worth noting that the two were based on similar ones built by the team of researchers from RExLab, from UFSC, and widely used and validated in other research. RExLab received authorization to use and adapt them through partnerships between the researchers who developed this instrument. The first questionnaire, called "Student Profile" with 12 items, aimed to obtain registration data and identify the students' profile. The second, called "Evaluation of the use of VLE", had 18 items, closed questions, divided into 4 domains (Usability (4), Perception of Learning (6), Satisfaction (6) and Utility (2). The VLE refers to the online environment in which the contents were made available and the objective of the questionnaire was to observe the perception of the students involved in the research regarding the use of the resources offered in science classes. For the calculation of scores, in the second questionnaire, a 5-point Likert scale was used, formed by several elements in the form of statements. In order to carry out the analysis, the following numbers were adopted (Chart 1): Totally Agree (CT), Partially Agree (CP), No Opinion (SO), Partially Disagree (DP) and Totally Disagree (DT), in which the students should express their degree of agreement with the statement, thus, it would be possible to measure the respondent's attitudes and degree of compliance with the statement, thereby showing more specifically how much they agreed or disagreed with an attitude or action, or the how satisfied or dissatisfied with the statement [14].

Table 1. Agreement levels

	Totally agree	Partially agree	Partially disagree	Totally disagree	No opinion
Initials	CT	CP	DP	DT	SO
Value	5	4	3	2	1

Source: authors

For this study, an investigative didactic sequence (SDI) was created for integration in the science classes, of the 5th grade class of elementary school I. Its construction was based on systematization, already validated by the research project Go-Lab: orientation, contextualization , investigation, discussion and conclusion [15]. The research was carried out in four steps (Figure 1).

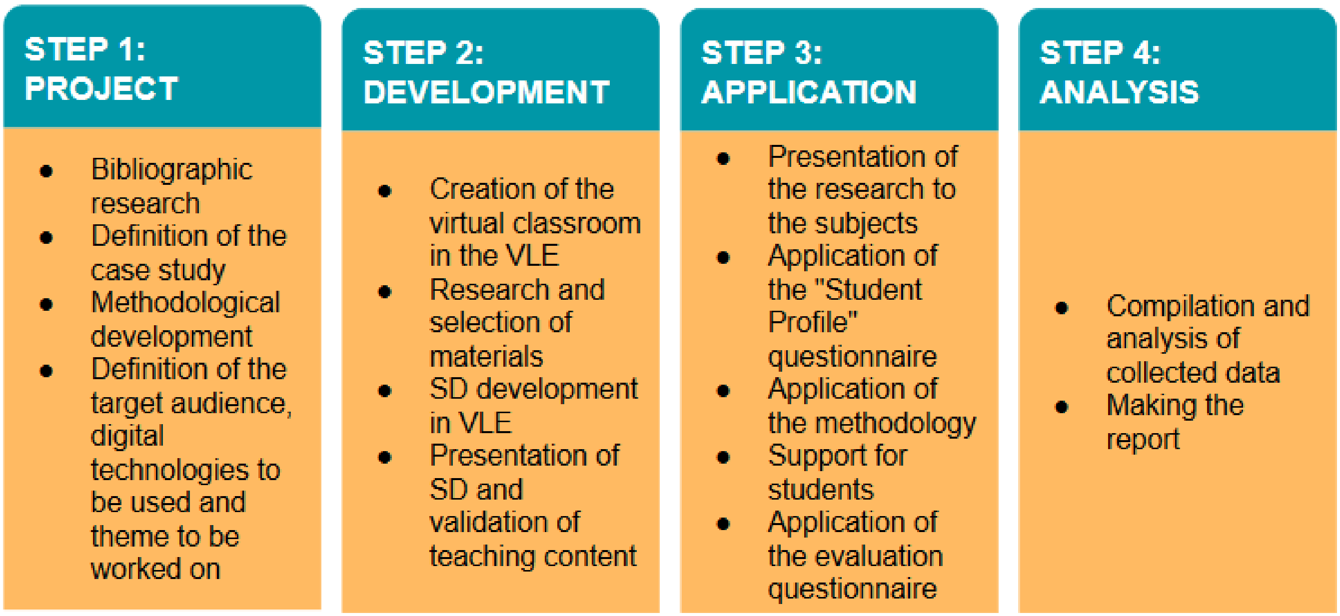

Figure 1. Research Steps
Source: authors

1 - Planning: the main stage of the research, in which the case study was defined and the necessary adjustments were made to the project, the exploratory search for literature on bases and portals was made to deepen the theme; it was also in this stage the definition by Moodle, of the InTecEdu program, to be used as support and repository of SDI. In June 2018, the project was presented to the principal and teacher, in which the application at the school was approved; after that, the content "Water and Soil" was defined with the teacher to be approached in the investigative didactic sequence, considering that this was the content that would work in the third quarter, period in which the application would be carried out.
2 - Development: this stage started with the creation, in Moodle, of the virtual classroom, that is, a space that would be used by the students, for early studies on the content to be discussed and worked on in the classroom. Concomitantly to this, research and selection of teaching materials (digital games, simulators, videos, activities, etc.) were carried out on the theme "Water and Soil, which, after being presented and defined with the teacher, started the sequence development process. investigative didactics, in the VLE.
3 - Application: the application started with the presentation of the study to the students; as the first activity, they were asked to complete the diagnostic assessment instrument "Student profile", in order to get to know the participants and their knowledge about digital technologies. The application also included assistance in the development of the research proposed in SDI for the Science Fair. Finally, the student's satisfaction survey instrument was applied, with the objective of identifying the impact of the application and the participants' perception of digital technological resources.
4 - Analysis: analysis of the diagnostic and final evaluation instruments, and other research materials, in order to verify the results of the research application, which would be used for the finalization and conclusion of this study.

3. Results and Discussion

The active methodology used was Flipped Classroom. In this method, the teaching and learning process was completely reversed to the organization of the traditional classroom. A virtual classroom was opened at VLE - Moodle - InTecEdu (Project for the Integration of Technology in Secondary Education, from RexLab / UFSC, made available to the public network) (Figure 2).

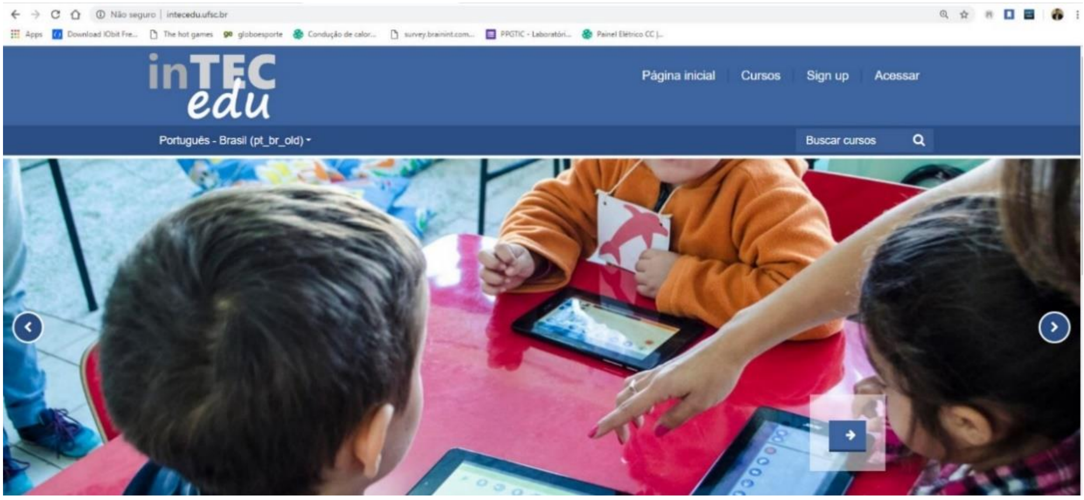

Figure 2. InTecEdu Program Homepage (at http://intecedu.ufsc.br)
Source: authors

The space was designed for students to access the content at home, as the school no longer had a computer lab. In this VLE the student had the SDI available with all the content on the subject being studied, in this case “water and soil”, using different materials and resources, such as: videos, animations, games, simulations, hypertexts, presentations, in addition to individual and group activities to perform (forums, objective and dissertative evaluation activities, activities to be developed and posted later).
The technological environment was organized in a unique layout, in which the SDI was arranged in tabs with the contents and activities that the student should browse and access the materials.
The structure was divided into nine tabs, namely:
1 - Presentation: It is the first page that appeared to the student when he accessed the VLE (Figure 3).

Figure 3. Course presentation

Source: authors

2 - Guidelines: In this tab, students had all the information and guidance on what they needed to do in the virtual classroom (Figure 4)

Figure 4. Course guidelines

Source: authors

3 - Contextualization: Here the proposal was that the student should be sensitized to the theme that would be studied, for that, animation videos, music clips and documentaries on the theme "water" were used (Figure 5).

Figure 5. Course contextualization
Source: authors

4 - Contents: the tab was divided into six sub-tabs (Figure 6) - Water, Soil, Pollution, Recycling, Site Tips and Tutorials, to better organize the materials to be studied. The contents were made available during the application of the research, that is, one tab per week, so that they could access the materials, study, carry out the activities and later, in the classroom, discuss the subject studied. The "Website Tips" and "Tutoriais" tabs were designed to support the development of the activities proposed in the working groups.

Figure 6. Course content
Source: authors

5 - Science Fair: in this tab, twelve working groups were created (Figure 7), where each group was challenged to answer an investigative question, to present in a future “Science Fair”, which was up to the students to plan and organize the event. In addition, the idea was for them to produce some material (PPT, video, model, etc.) explaining the investigations and the results found.

Figure 7. Science Fair tab

Source: authors

6 - Curiosities: In the "Curiosities" tab, animated videos were made available with curiosities that were related to the theme worked on. Figure 8 shows some of the videos available in the curiosity step.

Figure 8. Curiosities - Examples

Source: authors

7 - Discussion: the purpose of this tab was to establish the debate, through a forum for discussions on the topic, as well as to provide opportunities for the interaction of students and teachers (Figure 9).

Figure 9. Course discussion

Source: authors

8 - Conclusion: to conclude the studies, discursive evaluative activities on what students learned in relation to the topic were proposed in this tab (Figure 10).

Figure 10. Course conclusion

Source: authors

9 - Ending: This tab ended the application of the research, with the students answering the questionnaire about their perception of the use of VLE. (Figure 11).

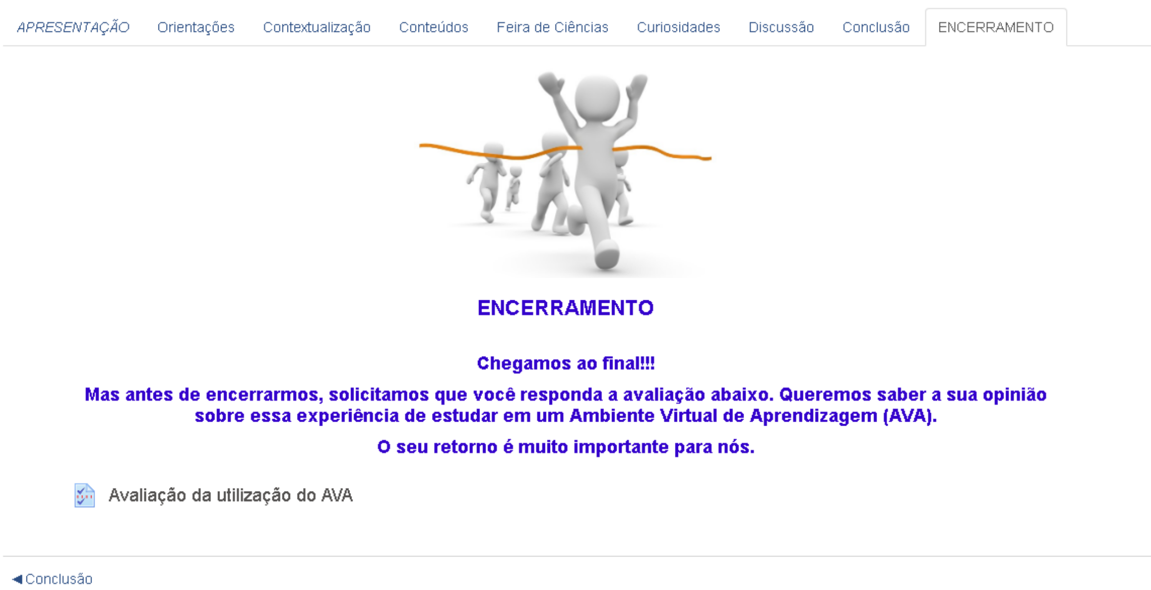

Figure 11. Course ending

Source: authors

3.1 Case Study

The case study was carried out from September 3 to November 5, 2018. During this period, students were constantly urged to access AVEA at home, interact with materials and colleagues, take notes on their doubts, for further discussion in class.In the classroom, it was time to discuss the topic of the week, where students explained what they understood, exchanged ideas and cleared up their doubts. As for technological resources for student use, five notebooks were made available (two from the researcher, one from the teacher and two from the school), and in some meetings, thirty RexLab Tablets were used to carry out activities, evaluations and group research, on your research topic for the Science Fair. Throughout the application of the study, the teachers (researcher and conductor) helped students with their practical and research activities. Regarding the technological resources used, this improvisation was necessary, considering that at the time of the case study, the school did not have a computer laboratory.

3.1 Questionnaire

The research data were collected through questionnaires, applied at the beginning and at the end of the research. On the first day of application, students were asked to answer the “Student Profile” questionnaire in the “Guidelines” tab. In this questionnaire, it was possible to identify the profile of the research's target audience. In total, 44 students participated in the research, half of whom were male and the other half were female. Regarding the age group of students, the percentages were as follows: 55% aged 11 years, 27% aged 10 years or less and 18% aged 12 years or over. According to the Ministry of Education of Brazil (2009), in relation to the 5th of elementary school, the corresponding age at the beginning of the school year, without age/year distortion), must be 10 years. Since, the questionnaire was answered in the second semester, it is possible to argue that 81.52% are close to the correct age/year, however, around 18.18% present distortion in age/grade.

Question 4 asked about “Which subjects do you like best?”. Relating the question to the research objectives, the importance of the activities carried out was evident, since only 27.27% of the respondents expressed “liking more” about the STEM subjects (in English, Science, Technology, Engineering, and Mathematics), being 6, 82% replied that they like science and 20.45% mathematics (Figure 12).

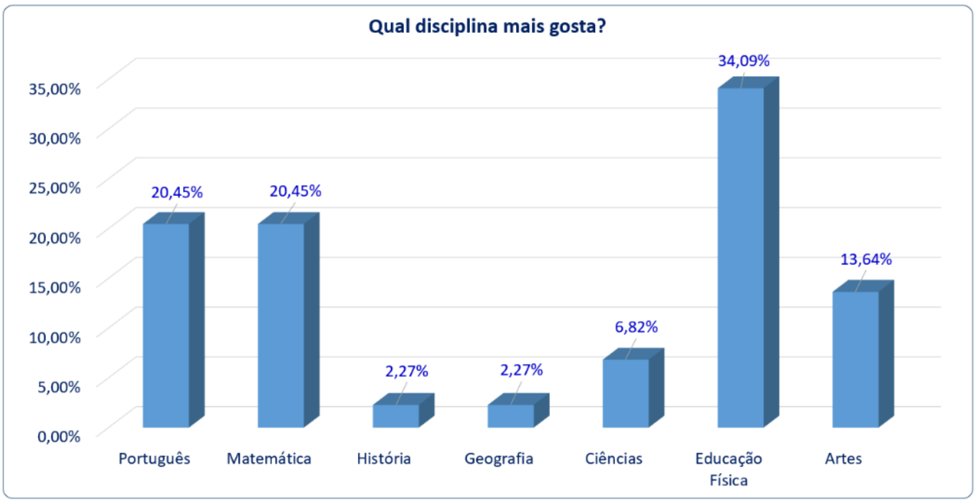

Figure 12. Most liked subjects

Source: authors

The questions in the “Student profile” questionnaire, from 5 to 12, referred to technological issues.
Question 5 was written as follows: “Do you have a computer?”. Of the respondents, 40.91% said yes and 59.09% no. Even though less than half the class, the number of students who have a computer at home, can be considered high, given that the school is located in a low-income community. The next question was written as follows: “Do you have access to the internet?”. In this, 93.18% answered yes, and only 6.82% did not.
However, when asking which "preferentially access the internet", 79.55% answered using mobile devices and only 20.45% answered the computer, contradicting the previous answer, where 40.91% answered that they had a computer. Regarding the “internet access location”, the percentage of 79.55% is repeated, in the response that they access at home, 11.36% at school and 9.09% in other places.
When asked if "do you access the Internet for school activities?", 79.55% answered yes and 20.45% no. And, when answering yes, they should answer the next question, “use the internet for”, 51.52% said “use it to do research”, 30.30% to do work on a topic, 9.09% to do work group and 9.09% for lessons or exercises that the teacher passes.
Question 10, “What activity do you do most when accessing the Internet?” the result showed: 63.64% to watch videos, 18.18% to social networks, 9.09% to search for information on Google or another search engine, 4.55% to post a video that he created, 2.27% to use online text editor and 2.27% read a book online (Figure 13). To finalize the analysis of the items in the “Student Profile” questionnaire, the percentages of question 9 are presented, regarding the “frequency of internet access”. Of the respondents, 77.27% stated that they access more than once a day, 15.91% at least once a day, therefore, 93.18% connect to the internet at least once a day, the other 6, 82% answered that they access at least once a week (Figure 13).

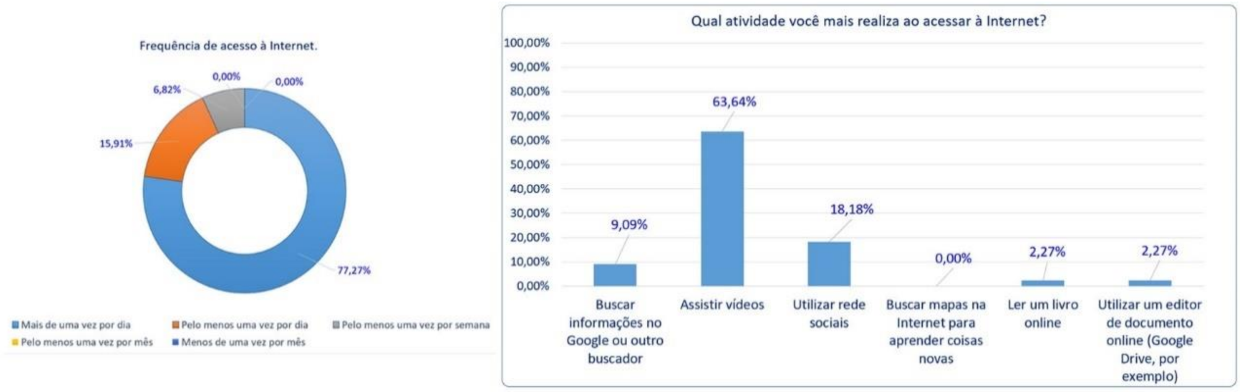

Figure 13. Activities and frequency of Internet access
Source: authors

In view of the result presented in the responses of the student's profile, the possibility of carrying out activities using digital technologies is notorious, considering that the students, despite being of low income, have access to the internet, are familiar with the technology and already used for school activities.
The second questionnaire, called “Assessment of the use of AVEA”, was applied at the end of the research and was answered by 42 students, representing 95.45% of the total enrolled in the science discipline. The questionnaire covered 18 questions built according to the model of an additional 5-point Likert scale, in order to understand what students think about the use of digital resources in classes. The questions that

accompany the items of the answers were evaluated with weights from 1 to 5. The students expressed their degree of agreement or rejection, through a scale that had five numerical values, with defined scores. Possible responses and scores were as follows: Totally Agree (CT) = 5, Partially Agree (CP) = 4, No Opinion (SO) = 3, Partially Disagree (DP) = 2 and Totally Disagree (DT) = 1 (Chart 1).

For analysis purposes, the answers to the 18 questions in the questionnaire were divided into the following domains:

1. Usability: referred to the ease of use of digital resources and if there were no problems to perform the desired actions;
2. Perception of Learning: sought to indicate whether the student, through the resources made available, realized if his learning improved and the acquired skills were valuable for learning;
3. Satisfaction: sought to understand the motivation for using resources and for studies;
4. Usefulness: whether it was useful and whether the tools used provided new forms and opportunities for learning.

For the purpose of validating the questionnaire, the total consistency coefficient of Cronbach's alpha was superimposed on all of its questions. The Cronbach's alpha coefficient calculated for the applied questionnaire, in its total (18 items), was 0.8905. The Standard Deviation for the average of the eighteen items was 0.345 and the Coefficient of Variation was 8.08%. The average of the items was 4.28 points on the Likert scale.

Figure 14 shows percentage values by domain. There is a very positive trend in relation to the position of students for the resources used. For “Utility” the percentages were 76.79% for CP/CT and 22.62% for DP/DT. For “Satisfaction”: 86.90% for CP/CT and 11.90% for DP/DT, “Perception of Learning”: 87.70% for CP/CT and 11.51% for DP/DT and “Usability”: 88.10% for CP/CT and 4.46% for DP/DT.

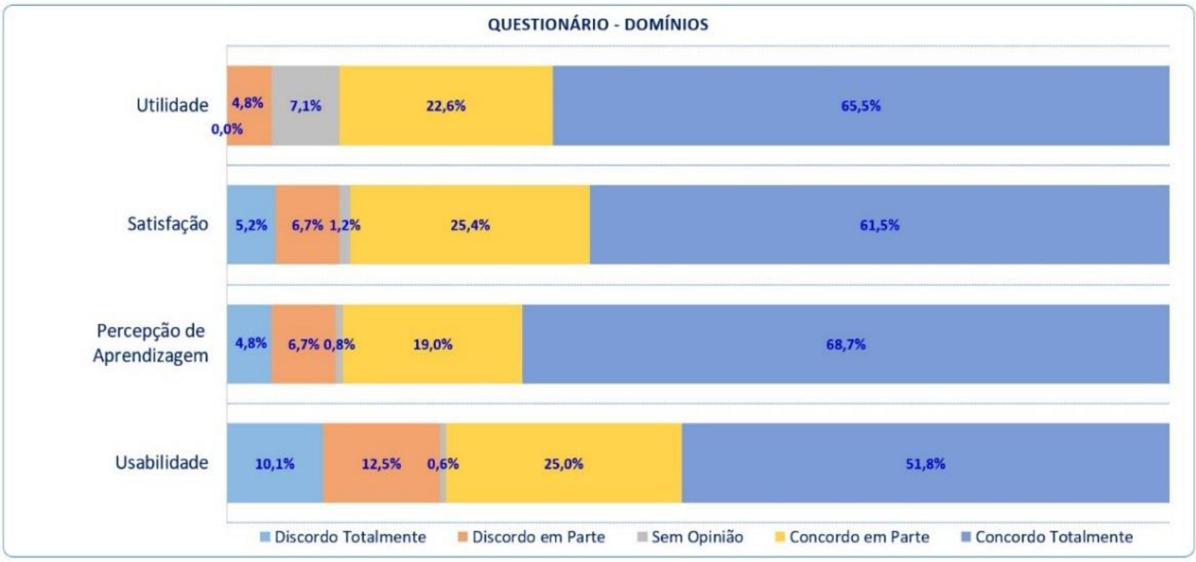

Figure 14. Results for questionnaire about the VLE

Source: authors

The Average Score (EMd) was also calculated for the answers acquired in the questionnaire, using the 5-point Likert scale. To find out, whether attitudes were positive or negative, through the EMd, the following conditions were imposed: values less than 3 presented adverse attitudes and greater than 3, favorable, while value 3 was estimated "without opinion". The average total score, for the 18 items analyzed, was 4.28, on the Likert scale. Figure 15 presents graphically the scores obtained, by domain.

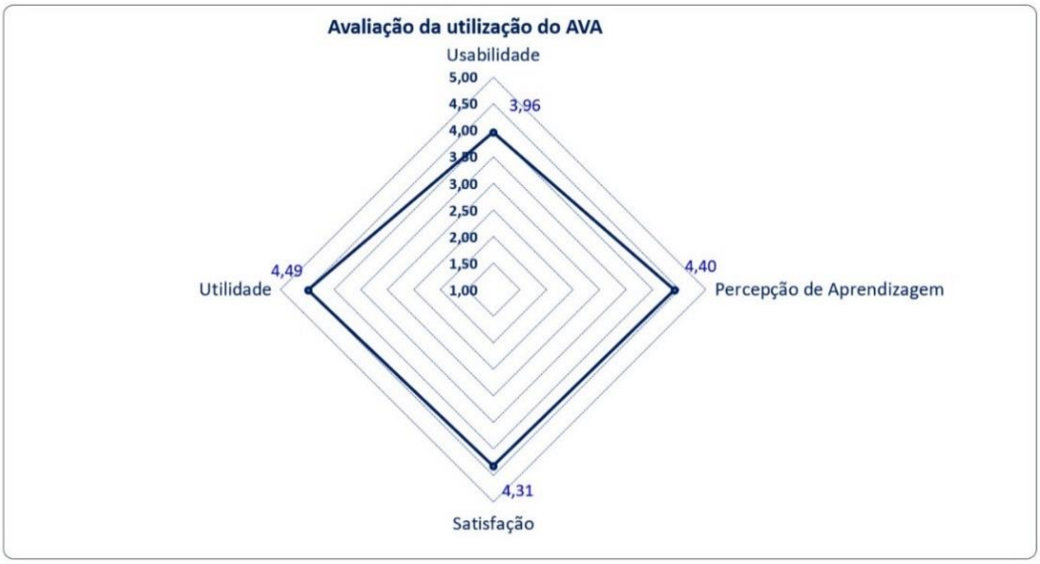

Figure 15. Evaluation of VLE usability

Source: authors

For Perception of Learning, six items were formulated, whose Cronbach's alpha coefficient calculated for this domain was 0.83. The EMd obtained for the six items was 4.40, Standard Deviation of 0.14 and Coefficient of Variation of 3.32%. Regarding the items:

1. The use of VLE improved my understanding of the theoretical concepts that were addressed in practice = 4.48.
2. Accessing the virtual teaching-learning environment (AVEA) helped to relate the concepts studied in the classroom with my daily life = 4.48.
3. The use of resources made available in AVEA contributed to my learning = 4.38.
4. The use of VLE was an effective learning experience = 4.29;
5. The skills acquired were valuable for my learning = 4.60.
6. The way the VLE was used in the classroom contributes to problem solving = 4.19.

The percentage of 87.70% for CP + CT stands out positively. Manifesting a very positive attitude on the part of the students, in relation to the perception of learning.

For Perception of Satisfaction, six items were formulated, whose Cronbach's alpha coefficient calculated for this domain was 0.77. The EMd obtained for the six items was 4.31, Standard Deviation 0.29 and Coefficient of Variation 6.83%. Regarding the items:

1. The skills acquired were valuable for my learning = 4.45.
2. The use of VLE was relevant to my studies = 4.50.
3. The use of VLE increased my motivation to learn = 4.60.
4. I would advise my colleagues to use VLE = 4.40.
5. VLE helped to communicate with my colleagues = 3.81.
6. I would like to use VLE in other disciplines = 4.12.

The percentage of 86.90% for CP + CT stands out positively. Expressing a very positive attitude on the part of the students, regarding the perception of satisfaction. Because, only one item analyzed had a score below 4. Item 5 presented a percentage of 73.81% for PC and CT grouped, indicating the need to implement more actions that encourage communication between students.

For Perception of Utility, two items were formulated, whose Cronbach's alpha coefficient calculated for this domain was 0.19. The EMd obtained for the two items was 4.49, Standard Deviation 0.01 and Coefficient of Variation 0.38%. Regarding the items:

1. The possibility to access the VLE at any time of the day and from anywhere is very useful to better plan the study time = 4.50.
2. VLE can provide new ways of learning = 4.48.

The percentage for grouped CP + CT was 88.10%. Item 1 stands out, which dealt with availability for access to the VLE, with 92.86%, for grouped CP + CT.

Over the weeks (9/3 to 10/22), in addition to the virtual activities, during the face-to-face classes, the students researched the questions proposed in the virtual classroom (VLE), applying the knowledge in the development of the materials for the exhibition at the Science Fair. On the day of the Science Fair (29/10/18), all students, were committed to the organization of the event. The groups were able to explain and present their investigations and the results obtained to the visitors (colleagues, teachers, staff from the education and community department) of the said exhibition (Figure 16).

Figure 16. Students at the Science Fair
Source: authors

5. Conclusion

In view of the results presented in the research, it can be concluded that it is possible to use digital technologies even in communities with few resources, considering that we are living in a time when technologies, as well as the internet, in a way or on the other hand, they are accessible to everyone, including student access.

The interest and motivation of the participants in investigating, researching and solving problems was observed with the application of the research. Therefore, it was found that it is essential to instigate work with investigative didactic sequences, in order to stimulate students to question, to raise hypotheses and to research. With that, we stimulated the interest in the STEM disciplines, which look for the formation of critical citizens and researchers. We clearly realized that the use of the inverted classroom methodology, with the use of a virtual teaching and learning environment, through a planned investigative didactic sequence, it is possible to integrate technologies in any curricular component, including science teaching, as the research results demonstrate.

To emphasize [9] and Prensky [12] reveal to us the importance of considering that digital natives - the Z generation, being necessary an appropriate approach to this generation, using these resources in line with educational interests, as they learn through digital media, after all, were born in the technological world. They also reveal that playful learning, through an interactive world, transforms the instigating and fun teaching and learning process. Thus, the student is more interested in studying and researching, learning to plan and search for information, going from being just a listener and recipient of information, to the protagonist of his teaching and learning process. Based on the statements above, it can be considered that the research reached its objectives, meeting the interests of students, through a more interesting and meaningful teaching and learning process, and with that, they learned the proposed contents in a different way.

Therefore, it is concluded that, although this study faces some difficulties for its realization, considering the problems faced with the lack of technological equipment and the precariousness with respect to the speed of broadband (WI-FI) at the institution, we can consider that the research was successful, reaching its objectives and leaving a technological "seed" of innovation in the school. It is worth mentioning that, based on this experience, the teacher of science education will be able to continue to enjoy the virtual classroom created for this research, which was made available free of charge. Still remaining, the expectation that she will spread her experience to the other professors of the institution, encouraging them to use digital technologies in their classes.

In time, it is worth mentioning how gratifying to end a study where the results are positive, especially for the school community. Even more, consider a public school where resources are scarce, especially technological ones. Therefore, the aim is to improve this investigative didactic sequence and develop new learning objects, in order to continue providing science teachers with resources to use in their classes. Finally, feeling challenged to encourage other teachers to use TDICs in studies that make up the school curriculum.

With the study, it was certain that researching and applying TDICs in basic education is extremely important, in view of the difficulty in finding studies on the theme, focused on education in the early years. In addition, the reality shows that educational institutions, especially the public network, are still "to whom" in a connected school. As the data obtained in the research demonstrate, students are receptive and "thirsty" for a differentiated teaching and learning process, based on "digital technologies", as it is the language and daily life of this generation. Therefore, we need, in terms of teachers, to appropriate and take advantage of the interest and ease of this generation with digital technologies, to encourage them to a more meaningful learning. The study also demonstrated that despite all the difficulties of the school institution, it is possible to carry out projects and interventions using digital technologies, breaking the paradigms of the traditional school. Therefore, we must continue showing that the use of TDICs in the classroom is possible and that it is efficient, thus, we will be contributing to a change in the teaching-learning process, of the different curricular components.

7. References

[1] BERGMANN, J., SAMS, A. Sala de aula invertida: uma metodologia ativa de aprendizagem. Tradução de Afonso Celso da Cunha Serra. Rio de Janeiro: LTC, 2017.

[2] BRASIL. Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira - INEP. (2018). Censo Escolar 2018. Brasília, DF.

[3] BRASIL. Senado Federal. Resolução nº 1, de 2 de fevereiro de 2016. Brasília, DF. 2016.

[4] BRASIL. Ministério da Educação do Brasil. Ensino fundamental de nove anos: passo a passo do processo de implantação. Brasília, DF, 2009.

COPE, B., KALANTZIS, M. New media, new learning. In: D. R. Cole and D. L. Pullen (eds). Multiliteracies in Motion: Current Theory and Practice. Routledge, London, 2009.

[5] GIL, A. C. Como elaborar projetos de pesquisa. São Paulo: Atlas, 2017.

[6] GIL, A. C. Estudo de caso. São Paulo: Atlas, 2009.

[7] LEÓN, M. P., GARCIA, K. C., E COLÓN, A. M. O. Inclusión del Aprendizaje Basado em Investigación (ABI) como práctica pedagógica en el diseño de programas de postgrados en Ecuador. Elaboración de una propuesta. Journal for Educators, Teachers and Trainers, Vol. 5(2), 2015.

[8] LIMA, G.P.S; TEIXEIRA, P.M.M. Análise de uma sequência didática de Citologia baseada no movimento CTS, VIII ENPEC, Encontro Nacional de Pesquisa em Educação em Ciências. ABRAPEC, Associação Brasileira de Pesquisa em Educação em Ciências, 2012.

[9] MATTAR, J. Games em educação: como os nativos digitais aprendem. São Paulo: Prentice Hall, 2010

[10] MORAN, J. Educação híbrida: um conceito-chave para a educação, hoje. In: Ensino híbrido: personalização e tecnologia na educação. (27-45). [recurso eletrônico] / Organizadores, Lilian Bacich, Adolfo Tanzi Neto, Fernando de Mello Trevisani. Porto Alegre: Penso. e-PUB, 2015.

[11] PEDASTE, M. et al. Phases of inquiry-based learning: Definitions and the inquiry cycle. Educational Research Review. V. 14, 2015.

[12] PRENSKY, M. Aprendizagem baseada em jogos digitais. São Paulo: Editora Senac São Paulo, 2012.

[13] SILVA, E.L.; BEJARANO, N.R.R. As tendências das sequências didáticas de ensino desenvolvidas por professores em formação nas disciplinas de estágio supervisionado das Universidades Federal de Sergipe e Federal da Bahia. IX Congreso Internacional sobre Investigación en Didáctica de las Ciencias, nº extra, p. 942-1948, Girona, 2013.

[14] SILVA JÚNIOR, S. D. DA; COSTA, F. J. Mensuração e Escalas de Verificação: uma Análise Comparativa das Escalas de Likert e Phrase Completion. PMKT - Brasileira de Pesquisas de Marketing, Opinião e Mídia, São Paulo, v. 15, p. 1-16, out, 2014.

[15] STYLIANIDOU, F., TSOURLIDAKI, E. Manual de apoyo para docentes de Go-Lab. Disponível em: http://files.eun.org/scientix/resources/TranslationOnDemand/Go-LabD6.6_USM_ES.pdf. Acesso em: 15 ago, 2019.

[16] VALENTE, J. A. A Comunicação e a educação baseada no uso das tecnologias digitais de informação e comunicação. Revista UNIFESO – Humanas e Sociais. V. 1, n. 1, Rio de Janeiro, 2014.

[17] VALENTE, J. A, BARANAUSKAS, M. C. C., E MARTINS, M. C. ABInt: aprendizagem baseada na investigação. Campinas, SP: UNICAMP/NIED, 2014.

Vieira, F.A.C. Ensino por investigação e aprendizagem significativa crítica: análise fenomenológica do potencial de uma proposta de ensino. Tese (Doutorado) – Universidade Estadual Paulista, Bauru, 2012.
[18] ZABALA, A. A prática educativa. Porto Alegre: Artmed, 1998.