INCLUDE LABORATORY: CONTRIBUTIONS TO THE SCHOOL EDUCATION OF STUDENTS FROM THE MUNICIPAL EDUCATION NETWORK OF LINHARES-ES

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ABSTRACT

The motivation for this investigation is due to the implementation of a social inclusion project for public school students, through digital technologies, on the premises of Faceli (the researchers' place of academic activities). This study aims to analyze the contributions of the "Include Laboratory" project to the school education of students from the municipal school network of Linhares-ES enrolled in this project. The methodology adopted involves a qualitative approach, with interviews with the former president of the Faceli Foundation, the facilitator and the monitor who develop the activities in the Include Laboratory, and a focus group with students who attended the project. The results indicate that this laboratory contributes to the school education of students regarding the appropriation of essential skills in the use of technologies, connection with school content and realization of projects in a collective way. Thus, the experiences lived in the course promote the digital and social inclusion of the participating students.

Keywords: Digital inclusion. Education. Technologies. Faceli. Linhares-ES.

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INTRODUCTION

The concept of inclusion is a central theme in education because it promotes the participation and involvement of all students, regardless of their individual abilities, needs, or characteristics. In this way, an inclusive laboratory is a space designed to offer equitable and accessible learning opportunities, considering the diversities of each student.

The Include Laboratory, implemented on the premises of the Faculty of Higher Education of Linhares (Faceli), emerges as a practical example of this approach, aiming to ensure that all students have access to fair and equal learning, while promoting inclusion, diversity and mutual respect.

According to these premises, this study seeks to answer the central question: how does the Include Laboratory work on Faceli's premises and what are its contributions to the school education of enrolled students? To address this issue, the general objective of this research is to analyze the contributions of the Include Laboratory to the school education of students enrolled in the program and has the following specific objectives: to identify the methodology used in the Include Laboratory program; describe how the Include Laboratory works on the premises of the Faculty of Higher Education of Linhares (Faceli) and investigate the students' perception of the contributions of the Include Project to their school life.

To this end, the methodology of this study presents a bibliographic review on the subject and a field research that included an interview with the former president of the Faceli Foundation, the facilitator and the monitor who develop the activities in the Include Laboratory and a focus group with students who attended the project in the first semester of 2024.

THEORETICAL FRAMEWORK

THE USE OF TECHNOLOGY IN BASIC EDUCATION

The concept of technology is broad and multifaceted, it refers to the set of scientific knowledge and principles used to create products, services, and tools that facilitate problem-solving and the accomplishment of tasks (Kenski, 2012). Thus, the author emphasizes the dynamic character of technology and its presence in different spheres of daily life, whether in the educational, social or professional sphere.

In Brazil, initiatives aimed at the use of information technology in basic education date back to the 80's with government investments, especially by the Ministry of Education (MEC) (Valente; Almeida, 2020). "In the 90s, the *internet* promoted great changes in the social and economic spheres. These changes also altered school dynamics" (Araújo *et al*.,

2017, p.924-925).

Thus, *online* education began to develop, allowing students to have access to a wide range of information and educational resources. Since then, technology has been increasingly integrated into the educational process, transforming it significantly. According to Moran (2013), technologies are increasingly present in the educational sphere. There are a variety of digital materials on any subject and available for the teaching and learning process.

In this way, the use of current technologies enriches the school space by providing students with "[...] to actively learn, to research all the time, to be proactive, to know how to take initiatives and interact" (Moran, 2013, p.31). As protagonists in the educational process, students seek new knowledge, expanding their experiences and meaningful learning.

The COVID-19 pandemic has contributed to the advancement of the use of digital technologies in the teaching and learning process. An abrupt transformation in education led to the emergency adoption of remote teaching as a strategy to not stop school activities. This period forced both educators and students to quickly adapt to new technologies and the virtual environment, which, despite the challenges, accelerated the process of digitalization in teaching (Ribeiro, 2021).

As a result, remote teaching, which was initially seen as a temporary solution, has proved to be a catalyst for the reassessment of educational practices and the resignification of the role of technologies in education.

Valente and Almeida (2022, p.10), highlight that:

> [...] the experiences, productions, and transformations that occurred during the pandemic period will last (Latour, 2021) and will profoundly influence educational processes, causing the resignification of the curriculum and public policies.

Thus, the changes caused by the COVID-19 pandemic in education were not limited to the emergency period, but generated a permanent resignification of the role of technologies in teaching. The experiences lived during the pandemic have highlighted the need to adapt to new educational realities and have shown that digital technologies have become not only auxiliary tools, but central elements in the construction of a modern curriculum and in the formulation of educational policies.

It can be highlighted that, although the pandemic imposed significant difficulties, such as the lack of adequate access to the *internet* and the adaptation to new teaching platforms, it also accelerated digitalization in education (Ribeiro, 2021). Previously seen as a complementary or temporary resource, technology has become central to the teaching-

learning process, which has led to the reevaluation of pedagogical practices and the exploration of new ways of teaching and learning.

In addition, it can be noted that this experience has forced the educational community to recognize the importance of technologies in education, not only as support tools, but also as essential elements for the modernization of teaching. The period of remote teaching catalyzed a deeper reflection on the role of technologies, potentially leading to lasting changes in educational practices, even with the return to face-to-face teaching.

The pandemic has also accelerated innovation and the adoption of digital technologies in education, promoting greater use of online learning platforms, video conferencing tools, and digital educational resources. The experience with remote teaching during the pandemic brought to light the need to rethink pedagogical models and educational policies to better integrate technology into the educational process, in an equitable and inclusive way, even in normal times (Ribeiro, 2021).

According to Moran (1999, p.1),

> Many ways of teaching today are no longer justified. We waste too much time, learn too little, and continually become demotivated. Both teachers and students have the clear feeling that many conventional classes are outdated. But where to change? How to teach and learn in a more interconnected society?

We know that today's generation finds it easy to handle instruments such as *tablets*, *notebooks*, cell phones, etc. In this context, it is up to education professionals to renew their teaching methods and school managers to renew the resources of educational institutions, seeking public policies for this purpose.

Brito and Purficação (2007, p.41) emphasize that:

> In order for technologies not to be just a novelty and not to lend themselves to the disguise of the real existing problems, we believe it is convenient for teachers to understand and accept that, currently, changes provide us with the necessary instruments to respond to the quantitative and qualitative demand for education that it causes. What we need to know is how to recognize these technologies and adapt them to our educational purposes.

Therefore, technologies should be seen as instruments to improve the quality and accessibility of education, but this is only possible if teachers know how to integrate them effectively and with a clear purpose. The pandemic served as an example for this reflection, showing that technological innovation in education does not lie only in the adoption of new tools, but in the ability to use them to transform pedagogical practices in a meaningful and inclusive way.

The National Common Curriculum Base (BNCC) recognizes the importance of

technologies in education as an essential tool for the development of students' skills and abilities, by emphasizing the integration of digital information and communication technologies in all areas of knowledge, promoting digital culture, citizenship and student protagonism (Brasil, 2017).

The general competencies of the BNCC reflect a comprehensive and integrated vision of education, where digital culture and technologies play a fundamental role in the training of students. The intersection between education and technology, as outlined in the BNCC competencies, highlights the importance of a curriculum that responds to contemporary demands and prepares students for an ever-changing future (Brasil, 2017).

CHARACTERIZATION OF THE INCLUDE LABORATORY AND ITS EXTENSION AT THE FACULTY OF HIGHER EDUCATION OF LINHARES-ES (FACELI)

Faceli is a municipal public institution of higher education, created by Municipal Law No. 2,561 of 12/15/2005. It is located in the Novo Horizonte neighborhood and offers undergraduate courses in Administration, Law and Pedagogy. Faceli's mission is to train professionals participating in the social environment with technical competence, ethical attitude, critical spirit and competence for professional practice. In this institution, several extension projects are developed, such as the "Free Training Course in Community Mediation of Conflicts" (Faceli, n.d.).

The institution is maintained by the Faceli Foundation and funded with resources from the Municipality of Linhares. Since its creation, Faceli has stood out for its contribution to the social and economic development of the region. The institution promotes research and extension in all branches of knowledge, encouraging scientific, technical, and cultural dissemination (Faceli Foundation, 2023).

The Faceli Foundation, in partnership with the Campus Party Institute, started the activities of the first Include Laboratory in the State of Espírito Santo on October 19, 2023, aiming at the social inclusion and technological development of young people in the community (Include by Campus Party, 2024).

The Include Laboratory is a social program of the Campus Party Institute that promotes the digital and social inclusion of young people from 8 to 18 years old, from low-income communities. This program includes the implementation of technological laboratories with free technology courses, such as robotics, programming, *design,* and other equivalent technologies (Campus Party, 2021).

In this sense, the central objectives of this social program are:

- Promote digital and social inclusion, using technology as a tool to transform the

lives of young people and prepare them for the challenges of the future.
- Provide communities with a leading role in the use of technology to solve problems.
- Support formal education, promoting the integral development of learners through active methodologies (Campus Party Institute, 2024).

Currently, there are 80 laboratories implemented throughout the national territory, 63 active in 11 states and 59 cities (Instituto Campus Party, 2024). Include Laboratories have equipment such as: furniture, *notebooks*, 3D printers, drones, robotics *kits*, among others. The courses offered are taught by scholarship holders, who live in the community where the laboratory operates, trained by the Campus Party Institute (Campus Party, 2021).

METHODOLOGY

In order to meet the expectation of the problem, the research was conducted as a qualitative case study of exploratory and descriptive nature. According to Flick (2009, p.37), "Qualitative research is aimed at the analysis of concrete cases in their local and temporal peculiarities, starting from the expressions and activities of people in their local contexts".

To carry out the research, prior authorization was requested from the sector responsible for the Include Laboratory, of the Campus Party Institute, which returned the appropriate authorization by *e-mail*. Next, the instruments used in this research were scheduled and carried out.

In this stage, a semi-structured interview was used with the former president of the Faceli Foundation, articulator of the partnership between the Faceli Foundation and the Campus Party Institute (responsible for the project, at the national level), with the facilitator and the monitor who develop the activities in the Include Laboratory. The research also included a focus group with five students in order to investigate their perception of the contributions of the Include Project to their school life.

The focus group allows interaction between participants, enabling different perspectives and opinions on the subject studied. Group discussions not only reveal the opinions of the participants, but also how these opinions evolve through dialogue and the exchange of ideas, enriching the qualitative analysis of the process of social construction of knowledge and its beliefs (Flick, 2009).

The collected data are presented and analyzed, in a contextualized way, in the light of the theoretical foundation presented with the objective of elucidating the practical implications of the experience lived by its implementers and target audience.

RESULTS AND DISCUSSIONS

The research was carried out in two different moments. At first, interviews were conducted with the monitor and facilitator and the focus group was held with five students enrolled in the program on Faceli's premises. In the second moment, an interview was made with the former president of the Faceli Foundation at his residence. All interviews and the students' perceptions were recorded and transcribed below.

THE PROCESS OF IMPLEMENTING THE INCLUDE LAB AT FACELI

To better understand how the process of implementing the Include Laboratory at Faceli took place, an interview was conducted with the former president of the Faceli Foundation (maintainer of the Faceli college) who was responsible for articulating the partnership with the Campus Paty Institute. The former president of the Faceli Foundation has a degree in Chemical Engineering and Economic Sciences and a master's degree in Education with 24 years of experience in Higher Education.

Asked about the implementation process of the Include Laboratory at Faceli, the former president of the Faceli Foundation replied:

> Initially, it was assumed that the Faceli Foundation should be open to partnerships that would add value and innovation to the institution, allowing greater institutional visibility, better use of its physical structure, at no significant cost and, mainly, a new way of providing educational services to the society of Linhares, within the requirements of social inclusion in which the Foundation and its maintenance are inserted. Faceli. Having established this assumption, an opportunity in this sense was sought in the national scenario, which culminated in the Foundation's candidacy in the selection process of educational institutions interested in implementing a laboratory of social inclusion through digital technologies (Include Laboratory), maintained by the Campus Party Institute, which has a network of major supporters from the private sector and the Renova Foundation.

Regarding the partnerships that were established to make the Include Laboratory viable, the former president of the Faceli Foundation reported that the Include Laboratory is the result of several institutional partnerships. According to the interviewee, "[...] it was up to the Faceli Foundation to seek to meet the requirements required in the selection process, such as a minimum space of 50m2, exclusivity for use, power and *internet points*, in addition to guaranteed accessibility to the place".

According to the report of the former president of the Faceli Foundation, based on the guarantee given by the institution, the process of documentary analysis and on-site visit for photographic registration of the space (room 28 on the first floor) began, culminating in the signing of the partnership. The partnership between the Faceli Foundation and the Include

Laboratory is marked by a low cost ratio for the Foundation, which only guarantees the use and conservation of a physical space for the operation of the project.

Regarding the resources (human, technological, financial) available for the operation of the Include Laboratory at Faceli, the former president of the Faceli Foundation stated that they are minimal, such as the expenditure on energy on site (directed to the use of computers, lighting and environmental comfort), in addition to the permission to use access to the *wifi* signal institutional. "The Faceli Foundation also includes weekly cleaning of the space and, eventually, provides some support from its Information and Communication Technology sector when there is an intermittency of the *wifi signal*", points out the interviewee.

According to the report of the former president of the Faceli Foundation, the Include Laboratory is located in room 28 on the first floor of the faculty with an area of 63 m2 and a 60,000 BTU air conditioning unit. It has energy structure and *internet* for all equipment installed by the laboratory.

Asked if there were difficulties during the process of implementing the laboratory, the interviewee stated that there were no difficulties, but the need for small adjustments, such as repositioning a *modem* inside the room (to better receive the *wifi* signal), installing more power points and access to the *internet* network. Some measures related to the access of the project's students to Faceli were also necessary, which has a specific protocol for this.

Also according to the interviewee, the implementation process of the Include Laboratory, at Faceli, was conducted in a planned and efficient manner, ensuring that the space offered all the necessary conditions for the development of the proposed activities. The partnership between the Faceli Foundation and the Campus Party Institute proved to be fundamental for the implementation of the project, which is in line with the institution's social and digital inclusion objectives.

OPERATIONAL ASPECTS OF THE INCLUDE NA FACELI LABORATORY

The facilitator of the Include Laboratory is pursuing a bachelor's degree in Control and Automation Engineering from the Federal Institute of Espírito Santo (Ifes/Campus Linhares) with 10 months of experience working in technologies with Basic Education students. Her weekly workload is 20 hours, 8 hours of which are teaching classes for students enrolled in the program and the other hours for planning and organizing the activities developed.

The monitor of this program is a recent graduate in Pedagogy from Faceli, has one year of experience working in technologies with Basic Education students and has a weekly workload of 20 hours of work.

Regarding the objectives of the Include Laboratory in the municipality of Linhares-ES, the facilitator replied that they are on the Include website (see secondary section 2.2). These data underline Include Lab's commitment to providing quality technology education, using modern and inclusive methods that not only teach but also inspire students to explore new possibilities and develop essential skills for the future. These objectives are in accordance with what the BNCC recommends on the development of competencies and skills related to the use of digital technologies, throughout basic education, as highlighted in general competence 5:

> Understand, use and create digital information and communication technologies in a critical, meaningful, reflective and ethical way in the various social practices (including school ones) to communicate, access and disseminate information, produce knowledge, solve problems and exercise protagonism and authorship in personal and collective life (Brasil, 2017, p.9).

The BNCC contemplates that the use of digital technologies must be used in various social practices in a critical and responsible way. The development of these skills promotes access to and dissemination of information, the production of new knowledge and problem solving, allowing students to be protagonists in their social and collective life.

The facilitator also reported that the contents worked on in the Include Laboratory are: automatons[4], basic electricity, algorithms, *online programming*, programming with arduino[5], arduino with sensors and actuators. The use of these technologies demonstrates an alignment with modern educational trends and the search for innovative solutions for teaching.

According to the facilitator, the teaching methodology adopted to work on the aforementioned contents is based on 4 topics: context, concepts, hands-on and connections. This methodology, developed by the social institution responsible for the program, combines theory (context and concepts) with practice (hands-on) and promotes the connection between different areas of knowledge. The emphasis on *maker*[6] culture and creative learning is also a differential (Cemim *et al*., 2022).

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[4] According to Cemim *et al* (2022, p.13), "The first robots were called automata, machines built to imitate the actions of humans and animals. In Greek, the word 'automaton' means 'that which moves by itself.'"

[5] "[...] Arduino is a small accessible computer, designed to interact with the environment around it" (Cemim *et al*, 2022, p.140).

[6] Paula, Martins, and Oliveira (2021, p.2) state that "The maker culture is the action of getting your hands dirty, associated with the use of technological resources or other woodworking tools where the student has the autonomy to create, modify, or transform objects, being the main protagonist of their learning".

The facilitator stated that students are well engaged in the proposed activities and that the criteria used to select the technologies and tools are made available by Include itself. Among the strategies used to keep students motivated and engaged in activities, she uses dynamics, circle classes and practical activities. Asked if she needs, at some point, to adapt the activities to meet the different levels of knowledge of the students, the facilitator said that it is not necessary.

Regarding how the evaluation process on the performance of students in the program is carried out, if any type of record is made, the facilitator replied: "Students are not evaluated during the course. There is an obligation to deliver a final project that is done in a group".

About his role at the Include Laboratory in Linhares-ES, the monitor said that he helps with issues such as welcoming students, organizing the room, distributing materials and also acts as a right arm of the facilitator. According to the monitor, the facilitator is the one who teaches the class, working as the teacher in charge of the room.

Asked about how the Include Laboratory works on Faceli's premises, the monitor replied: "The laboratory works on the first floor of the college, in room 28 that was made available for the program. The activities began to be implemented in October 2023".

The monitor also stated that the target audience is children and adolescents aged 8 to 18 from the community, with a main focus on low-income black girls. If the vacancies are not filled by this group, the opportunity is given to low-income black boys. If there are still remaining vacancies, they are intended for low-income girls, regardless of race. Finally, if necessary, they are also considered low-income boys.

According to the monitor, the dissemination of the program is done through social networks and registration is carried out on the Include website, through a *link* that directs to registration. The process is simple and easy.

Regarding the number of classes and students served by the Include Laboratory program, the monitor said that, in Linhares, the program has already served 80 students and currently serves 80 more. Although there are some dropouts, each semester concludes with 80 students. There are two classes on Tuesday and two on Thursday, each with 20 students.

When asked how he evaluates the implementation of the Include Laboratory in Linhares-ES, the monitor's answer was:

> The implementation of the Include Laboratory is a very nice initiative. It is impressive to see that many children and adolescents have never had contact with a computer. This makes us realize the importance of giving these young people the opportunity to have access to technological tools. This contact can awaken new dreams and

goals, such as attending college or IFES. As the project's *own slogan* says "opportunities change the world", the idea of the project is very well received by the community and has a significant positive impact.

The monitor highlights the relevance of the Include Laboratory by emphasizing how the initiative provides a first contact with digital technologies for many children and adolescents. The community's recognition demonstrates that the activities of the Include Laboratory are relevant, impacting the students' school education.

PERCEPTION OF THE STUDENTS ASSISTED BY THE INCLUDE LABORATORY

Five students who attended the program in the first semester of 2024 participated in the focus group: one 9 years old, another 10 years old, and three 13 years old. Two children (twins) make the journey from their home (which is in a neighboring neighborhood) to Faceli by bicycle, two other children (who are siblings) make this journey on foot because they live close to the college and another child uses a bus or car with his mother to get to the place, as he lives in a more distant neighborhood.

About how they describe their experiences in the Include Laboratory, the children answered that the experience is cool, one child highlighted "we discover new things that we think we already know, so when we really learn it's something else". This demonstrates that the laboratory environment offers a learning experience transforming students' initial understanding through a deeper and more practical understanding of some concepts.

Asked about what they liked most about the Include Laboratory and what they liked the least, the children said that they liked the projects they did by clearing their doubts. One child said he liked the *LED bulbs*. There were no complaints from any child, which makes it clear that they liked everything.

Regarding what new skills they learned in the Include Lab, the children answered that it was tinkering with technology (something they didn't know much about how it worked) and also with programming in the *scratch*[7] app. Regarding how these skills have helped in school activities, the children said that it helps when they have to do some things on the computer. One child said it doesn't help much because he doesn't have much access to the computer outside the lab.

The students' reports demonstrate that the Include Lab is promoting more inclusive, practical, and relevant education by providing access to modern technologies and stimulating student interest in areas such as robotics and programming. Regarding students

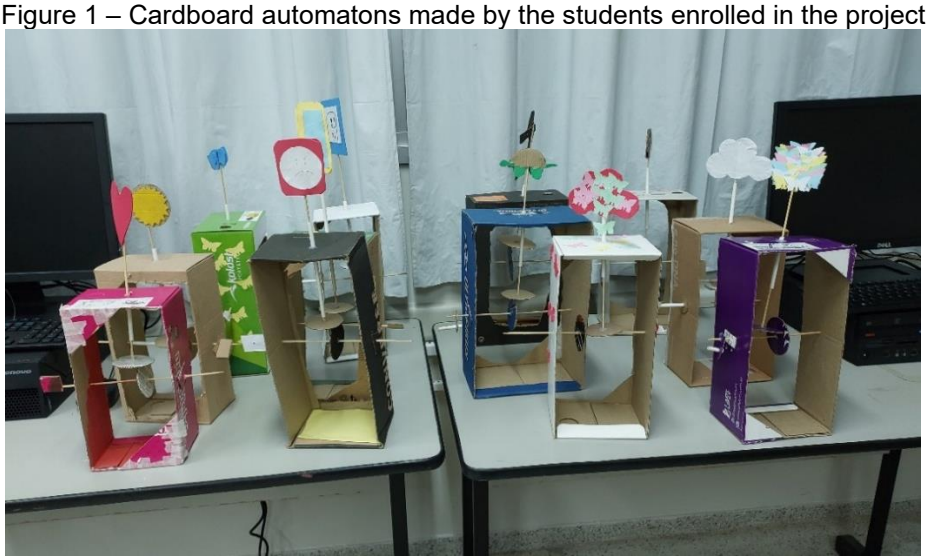
[7] "The Scratch programming language was developed especially for children, as it uses an easy graphical interface with no codes, just lego-like blocks" (Castro, 2017, p.6).

not having access to computers outside the laboratory, Ribeiro (2021) explains that this is one of the challenges for the effective use of digital technologies by the entire student population.

Asked if they have noticed any improvement in school performance since they started participating in the project, the children said yes. One child reported that "It helped me with content in the Science subject about electricity that I didn't know how to answer before", another child emphasized that it helped with the Mathematics content as well. Thus, it is perceived that some content they study in the laboratory is also required at school. So, it is easier for them to understand and get a good grade or even answer the activities proposed by the teachers.

The end of the program's activities, in the first semester of 2024, took place with a display of the work carried out by the students. The event was attended by the students' families who presented nine projects carried out throughout the course.

Figure 1 – Cardboard automatons made by the students enrolled in the project



Source: Survey data, 2024.

Figure 1 presents cardboard automata, a project carried out by the students participating in the Include Laboratory. Building automata, even with simple materials like cardboard, teaches students about the basic principles of mechanics and engineering. This type of activity illustrates how the program fosters creativity and practical understanding of the concepts of robotics and automation from a historical and functional perspective.

Figure 2 – Casa Include made by the students enrolled in the project

Source: Survey data, 2024.

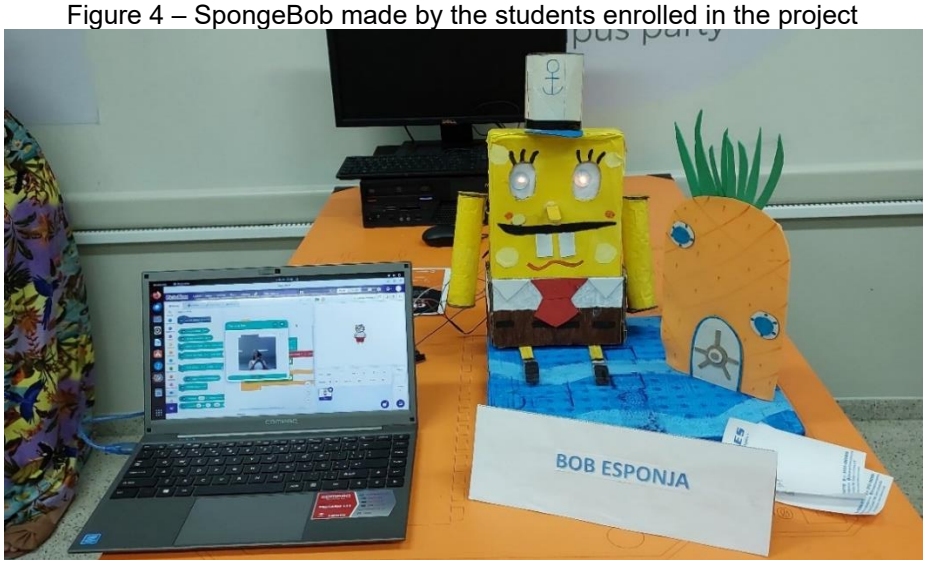
"The Include house, with monitoring, is designed to maintain thermal comfort in the environment, With a temperature sensor installed, it will be possible to measure the temperature and inform it on the LCD display" (Cemim *et al.*, 2022, p. 316). The creation of a house monitored by temperature sensors exemplifies how students learn to deal with electronic components and programming to solve everyday problems.

Figure 3 – Include parking made by the students enrolled in the project

Source: Survey data, 2024.

The Include parking incorporates an automatic gate and a parking sensor with audible warning, technologies common in modern parking systems (Cemim *et al.*, 2022). This project allows students to learn about sensors, actuators, and control systems, providing a practical understanding of how these components work together to create an efficient automated system.

Figure 4 – SpongeBob made by the students enrolled in the project



Source: Survey data, 2024.

According to the Include lab facilitator, SpongeBob's project uses artificial intelligence to detect poses and perform automated movements, transforming the iconic character into a fascinating combination of creativity and technology. Among the components of the project, the *LEDs* installed in the doll's eyes, which offer interactive and eye-catching lighting, and the servo motor, responsible for the precise movement of SpongeBob's arm, stand out. This motor allows the puppet to react in a coordinated manner to the detected poses, providing a more dynamic and realistic experience.

Although this study offers a solid basis for understanding the impact of the Include Laboratory on the education of students in the municipal school system of Linhares-ES, it has some limitations that should be considered. One of the main limitations of the study is the small sample size of the survey, consisting of a limited number of participants, space, and time. Given these limitations, future research may expand the scope of this study.

CONCLUSION

According to the data obtained, it can be stated that the Include Laboratory, by providing access to advanced technologies and active learning methodologies, has played an important role in the school education of students in the municipal network of Linhares-ES. The digital inclusion promoted by the laboratory has allowed students to develop essential skills to face the challenges of the future.

Regarding the methodology used in the Include Laboratory program, it was found that it favors the active participation of students in the proposed activities. The methodology used in the Include Laboratory program combines the theory of teaching robotics and

technology with practical activities. Maker culture and creative learning are important elements in this methodology.

Regarding the operation of the Include Laboratory on the premises of the Faculty of Higher Education of Linhares (Faceli), it was found that the course offered takes place twice a week with four classes of students each. The course is taught by the facilitator who has the support of the monitor.

Regarding the students' perception of the contributions of the Include Project, it can be seen that they really liked the course taken, since they acquired new learning and knowledge for their school education. In addition to learning related to the use of digital technologies, students appropriated content that is part of the school curriculum. It is interesting to note that one student reported that he does not use the skills acquired in the course much because he does not have access to computers outside the project.

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