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RESEARCH ARTICLE OPEN ACCESS

AN INTERDISCIPLINARY PROPOSAL OF UNPLUGGED EDUCATIONAL ROBOTICS APPLIED TO THE EARLY YEARS OF FUNDAMENTAL EDUCATION

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ABSTRACT

This work is the result of a proposal for activities involving Unplugged Robotics, applied to the educational context, for a class of the 4th year of elementary school. The objective was to analyze how this resource can encourage and guide the stages of learning in an interdisciplinary perspective, reusing everyday materials, which would possibly be discarded. The practice developed was based on competencies and skills from the National Common Curricular Base, based on the theme of socio-environmental awareness, more specifically the environmental impacts caused by human action. The qualitative approach, using action research characteristics, indicates that Unplugged Robotics is a significant alternative for schools that aim to work on the basic foundations of Educational Robotics, without the use of digital technology and expensive materials.

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INTRODUÇÃO

Understanding and contributing to the internal school movement requires considering objectives, contents, methodologies, organizational and curricular actions, assessment of learning, without discarding the particular social contexts and the most comprehensive ones: social, cultural, economic, legal, political-educational elements, among others (Libâneo, 2006). Likewise, there is a particular procedurality, inherent to each individual, so that there is a meaningful learning, including as essential elements to this construction, previous knowledge that is predominantly relevant to the learner and potentially significant materials (Moreira, 2012). But, how many teachers reflect on what, for what and how to teach certain content? They often reproduce in the same way they were taught. This is a permanent debate: to overcome reductionist practices, which do not serve contemporary society, to cover all forms of learning that exist in a classroom, and to involve students so that they feel encouraged to participate in activities. As Almeida and Valente (2011) point out, Digital Information and Communication Technologies (DICT) can be a reinforcement of the dilemma in question or an instrument that enables pedagogical actions aimed at transforming the teaching-learning process: incorporated into the Common National Curricular Base (BNCC), DICT are cited as some basic elements for the development of competences and skills. Attention is drawn to the document's fifth general competence, which presupposes understanding, making use of and developing DICT in a critical, relevant, ethical and reflective manner in social dynamics, with a view to communication, the dissemination of information, the production of knowledge and problem solving (BRASIL, 2018). On the other hand, most of the education system, especially public schools, present as barriers, insufficiency, scrap or lack of digital equipment, in addition to an excessive number of students per class, of a precarious basic structure, such as the lack of fans and expedient material, etc. In this case, it is necessary to list what is available to teachers to transform students' passivity into creativity, criticality, autonomy and logical reasoning. Observing this scenario, Unplugged Educational Robotics is seen as a possibility to overcome limitations and develop active methodologies. According to González and Souza (2017), Educational Robotics consists of creating collaborative learning environments for

the use of technology applied to robotics. When elucidating a curriculum proposal for children to understand such techniques, Patiño-Escarcina *et al*. (2019) uses five fundamentals of robotics applied to the educational context:

a) "Robotics and society", highlighting the usefulness of a robot for society;
b) "Mechanics", observing the positions and movements of the object in the environment;
c) "Electronics", such as the study of the behavior of electrons immersed in different media and influenced by the action of electric and magnetic fields;
d) "Programming", as the sequence of instructions for the execution of activities;
e) "Control",as the area responsible for associating programming with the electromechanical field.

The Unplugged Robotics seeks to apply the five fundamentals of robotics in the school environment, in accordance with simple resources, without the need for kits, sensors, motors, or any electronic devices, being an alternative for institutions without access to expensive equipment and for teachers who do not have training in the technological area, but seek to approach the fundamentals of Educational Robotics. There is no production in the literature that conceptualizes Unplugged Robotics, however, this presents itself as a practice to introduce the concepts of robotics, through the use of scraps and materials that are easily accessible at home: disposables, plastic bottles, bottle caps, rubber, straws etc. An analogy that cannot be dismissed is its relationship with Cultura Maker, that is, the advent of "do it yourself". This movement defends the premises of creating, learning and building collaboratively, denoting freedom of expression and experienced interaction. Making project development with products easily accessible is its goal, which is why it is gaining evidence in the educational scenario (Brito; Gama; Brasileiro, 2018). As mentioned, there were no publications eminently described as Educational Robotics Unplugged or Robotics Unplugged applied to the educational context. However, there are works related to robotics in the school environment that, at a certain point, come close to experiments with low-cost materials and interdisciplinary practices.

Albuquerque *et al.* (2007), present Free Pedagogical Robotics as an alternative possibility of introducing the concepts and practices of robotics in the classroom, through the assembly of robots, automata, using scraps such as computer parts, telephone and radio, as well as the Operating System GNU / LINUX Debian and applications like Kommander and KLogo-Turtle. The groups also built a Free Hardware Interface (IHL). Despite the use of electronics and software that distance this proposition, it was observed that the methodology advocated collaborative learning and student leadership, through an Olympics. The fact of being applied in the final years of elementary school and having managed to aggregate 4 teachers and 8 students in the same activity reinforces the idea of deconstructing instructional practices, and decentralizes the teaching figure of the highest level of the classroom. Ribeiro, Coutinho and Costa (2008), present the results of a methodology developed with students belonging to the so-called 1st cycle of Basic Education, in Portugal. Lego Mindstorms robots were assembled and programmed to dramatize the popular story "Carochinha". Each robot was a character, and must be programmed according to the sequence of the story. In this context, skills in Mathematics, Portuguese Language, Science, as well as Dramatic, Musical, Technological and Plastic Expressions were worked on. In addition, students were encouraged to reflect, exercise creativity, act autonomously, solve problem situations and work in an integrated manner with their peers, something that is not always presented in a simple way in the early years of school life. Interdisciplinarity is also present in the experience report by Santos et al. (2016). The authors approach Educational Robotics with the use of scrap metal to study the theme of environmental awareness, covering contents in the area of Natural Sciences, with students from the final years of elementary school. Unlike the others, the work describes a practice of Unplugged Robotics, when selecting the "bladder-powered cart" as the first prototype. PET bottle, barbecue sticks, adhesive tape, bladder, straws and plastic caps are used. The other two experiments used plugged-in devices. The relationship between the ideas presented in this section and the design of this article is based on the constructionist perspective, whose technologies are understood as relevant to the mediation of the subject-knowledge interaction, through their conceptions, expressed in multiple languages (Almeida; Valente, 2011). This means that the use of robotics alone does not guarantee the construction of knowledge in an active way. Digital technologies can reinforce the compartmentalization of teaching, if used in a specific classroom (as is common in computer labs), at a certain time, to learn purely technical knowledge, being yet another subject in the curriculum, bound to remain "boxed", without the apprentices glimpsing its practical usefulness in their daily lives.

Following this constructionist logic, the study carried out now refers to the arguments and themes used so far and to the particular work context itself, focusing on a 4th grade elementary school class, with thirty-six students, in a municipal public school in Parnamirim , Rio Grande do Norte, Brazil, which also suffers from insufficient physical structure, according to most schools. The school in question had technological equipment from the computer lab, such as computers, speakers and datashow subtracted. Therefore, the proposal was idealized to revise the contents referring to the end of the 2019 academic year, using Unplugged Educational Robotics as a guiding and encouraging element of the learning stages, with materials that were within the reach of the community. The following areas of knowledge were covered: Languages, Mathematics, Humanities and Nature Sciences. The students were able to resume information discussed in the classroom, applying it to solve problems, using robotic prototypes built with scrap metal, making it possible to learn the basic concepts of robotics in practice. For a better contextualization of the stages of this research, section 2 deals with the proposal's step-by-step, section 3 analyzes the results and discussions of the practice and, finally, section 4 delimits future prospects and the final considerations of the investigation.

RESEARCHS ELABORATIONS

This proposal was developed in a class of the 4th year of elementary school, with thirty-six students. The project aimed to resume the contents worked in class, throughout the two months, in an interdisciplinary way, involving all areas of knowledge, incorporating the use of Educational Robotics Unplugged as a motivating and dynamizing instrument of the process. We worked from the perspective of the qualitative approach, whose steps made it possible to subjectively explore the researched reality, according to the nuances of action research, understood in this study as a technique that transcends the understanding of the field for an intervention that aims to improve existing practices, since one of the researchers and students built this process in a collaborative way. It is considered here that the action research procedure operates on two fronts: "[…] performs a diagnosis and analysis of a given situation, […] proposes changes to the set of subjects involved that lead to an improvement in the practices analyzed. "(Severino, 2007, p. 120). The study is still classified as an applied research, for applying theories to intervene in reality.

The insight for this practice was given by realizing the excitement of a good part of the class in relation to a moment in the library, with the reading of the book Journey to the center of the Earth, by Jules Verne. Reading the book was a didactic suggestion, in accordance with what was being studied at the time, about the planet Earth. Therefore, we started from the premise of producing a science fiction text in six teams, whose starting point would be real situations, based on the socio-environmental theme, reported at national, regional and local level, especially during 2019 (year of execution of the pedagogical practice presented here). The problems originated from the environmental impacts caused by human action, and should have a robotic artifact as the main element for its resolution:

a) In August 2019, the Amazon Forest suffered from several fires. The eyes of Brazil and the world have turned to the largest biome on planet Earth, which has 5,500,000 km². You will be tasked with putting out or at least containing fires in a few days or hours;
b) In August 2019, the coast of northeastern Brazil was affected by the oil spill from ships. You will have the mission to collect oil from the marine surface of the states of Rio Grande do Norte and Paraíba in a few days or hours;
c) In January 2019, a dam belonging to the Vale do Rio Doce company broke, transforming the city of Brumadinho into a "sea of mud". Imagine that you were triggered 10 hours before the catastrophe, and could save people's lives;
d) The garbage in manholes and public roads causes the main streets of the municipality of Parnamirim to flood, during the period of heavy rains, as occurred in the months of May and June this year. To avoid this problem, what could you do?
e) The hunting of wild animals is one of the reasons for the threat of extinction of many species of Brazilian fauna. It is necessary to inspect these actions, especially in areas of permanent preservation. The inspection body is the Brazilian Institute for the Environment and Renewable Natural Resources (Ibama). Think that you are Ibama employees and are responsible for monitoring animals in protected areas;
f) On April 8, 2019, there was a strong storm in Rio de Janeiro. As a result, there was a landslide on Morro da Babilônia, causing destruction to the homes and deaths. Imagine that your team was fired before they had victims. What would you use to save people in the community?

a) Then, the robots that could be used were presented. They should choose a model for each group:
b) Jet car: it can reach up to 28,440 km / h, the same speed as a rocket;
c) Jet aircraft: it can reach up to 20,000 km / h. Despite being a little slower than the jet car, it manages to move and reach distances that can be an obstacle for the first artifact;
d) Jet boat: it can reach up to 10,000 km / h. Despite being a little slower than the first two artifacts, it travels to places where it is not possible to reach by car or plane;
e) Robotic hand: with its dimensions larger than a conventional excavator (height 5.10 m; length 11.46 m; width 4.90 m), it is possible to collect large quantities of materials in a short time;
f) Robotic radar: acts similar to radars that detect animals on the roads. It can be very useful to locate animals monitored by chips, at distances up to 1,255.2 km (equivalent to a trip from Rio Grande do Norte to Bahia);
g) Hydraulic lift: designed according to the Pascoal Principle (all pressure applied to a fluid at rest is distributed equally to all its parts), it has a dimension of 15 m in height, supporting up to 3 tons. It can be transported from one place to another, thus being useful for several purposes.

After thinking about how they would solve the problem situation, they should collectively plan the construction of the text that described from the problem in question to its resolution, taking into account the following criteria:

a) Introduction: present the problem to be solved;
b) Development: highlight the possible reasons that caused the problem, its consequences for nature and for human beings, and what preventive measures and attitudes should have been taken to prevent this from happening;
c) Conclusion: explain the solution found, through the bionic artifact.

After the text was finished, the reasons why robotics had been chosen for classroom work were explained, as well as a basic introduction to its general concept. Then, they started assembling the prototype of the chosen robots (in representative dimensions), using in addition to scissors, ruler, glue, pencil, pen, the following materials for each experiment:

a) Jet car: 4 PET bottle caps, 1 roll of toilet paper (cardboard part), 2 barbecue sticks, 1 milkshake straw, 1 bladder, adhesive tape;
b) Jet aircraft: 1 plastic cup, 2 knives and 1 disposable fork, 4 rubber bands, a piece of wire or clips;
c) Jet boat: 2 popsicle sticks, 2 barbecue sticks, 3 rubber bands, 1 PET bottle, adhesive tape;
d) Robotic hand: cardboard, 8 straws, line;
e) Robotic radar: cardboard box, 1 straw, 2 PET bottle caps, cardboard or Styrofoam tray;
f) Hydraulic lift: Cardboard, popsicle sticks, thumbtacks, colored gouache paint, 2 syringes, 40 cm of transparent hose, compatible with the syringe nozzle thickness.

The ideas and materials described for the production of the robotic artifacts were the result of several researches on the websites of BNCC and Centro EducacionalPioneiro, but mainly on YouTube videos. The proposal was implemented in two stages. At first, it was possible to express the general proposal, as well as to develop the text production, choose the model of the robot to be made and start the creative process. During the second moment, the children finished the creations, and presented the text, the step by step of the robot development to the class and executed each model to test its functionality. During the first phase of execution of the methodology, there were general explanations and the establishment of combinations so that it was possible to manufacture the robots. For the assembly step by step, in addition to verbal guidance, an instructional text was given to each team, thus working on another textual genre. Already with the idea of the prototypes started, the students had the opportunity to attach to the initial model some instrument that would help to solve the situation, in accordance with the creativity of the groups. The systematic evaluation of students' activities and performance took place continuously, at each stage, through observations, dialogues and the productions themselves (texts and prototypes), considering as criteria: arguments based on socio-environmental awareness and responsible consumption; creativity to justify the use of prototypes to solve problems; autonomy in self-directed and collaborative learning; linguistic and grammatical knowledge for textual structuring. As the evaluations took place, difficulties, challenges, limits were observed and the possibilities of using Unplugged Robotics were pointed out in an interdisciplinary perspective, according to the results explained in the next section.

RESULTS AND DISCUSSION

The children's initial reports, when asked about what they understood by robots, were directed to models that performed activities autonomously, from a command. Despite this assertion, the robotic appearance was based on the characteristics of a human being, a dog or another animal. The pleasurable moment of "getting your hands dirty" provided a first contact with Unplugged Educational Robotics, combining theory and practice to understand its fundamentals and demystify the idea that all robots have a humanoid appearance, and that there is a need to acquire high technology to study about it. Furthermore, some conflicts were observed in the activities, due to the difference in suggestions to argue and elaborate the texts or in the range of prototypes. Collaborative work, as a pedagogical strategy that contributes to the promotion of meaningful learning, allowed each student to exercise the appreciation of the diversity of opinions, as well as the leading role in the planning and development of their projects. The initial information of each challenge has aroused curiosity, the desire to research and deepen the understanding of the problems presented, with a wide number of questions. In the production and exhibition stages of the texts, in addition to the science fiction textual genre, it was possible to return to the concept of verbs in Portuguese, mainly in the actions described, such as expressions such as "containing" fires, "spilling" oil, "breaking" the dam, "flooding" the city, among other linguistic and grammatical aspects, in accordance with the skill:

> Use, when producing a text, linguistic and grammatical knowledge, such as spelling, basic rules of nominal and verbal

> agreement, punctuation (period, exclamation point, question mark, commas in enumerations) and direct speech punctuation, when applicable . (BRASIL, 2018, p. 111)

After completing the stages of creating texts and prototypes, the teams exposed their ideas to the class. The first team explained that "The fire in the Amazon Forest destroyed homes for animals and many species of vegetables, and affected the air. [...] We decided to put out the fires with a rescue helicopter, with a hose that will solve the problem once and for all. " On the second day of class, a child from the group brought a miniature helicopter assembled by her and her mother, so that the team could insert the propellers developed in the room. Such made toy had a syringe with water, which would serve as a hose to extinguish the fire points of the forest. The student's initiative drew attention, because in addition to following the proposal to use creativity to increase the artifact, he included his mother in the elaboration of this project. The prototype image is seen in figure 1.

(Source: the authors 2019)

Figure 1. Helicopter model with recyclable material

The second group highlighted: "We created a boat to clean the sea, to remove the oil. [...] May you use your knowledge for good, that this machine can be used for individuals to meet their needs. ". Figure 2 shows the artifact.

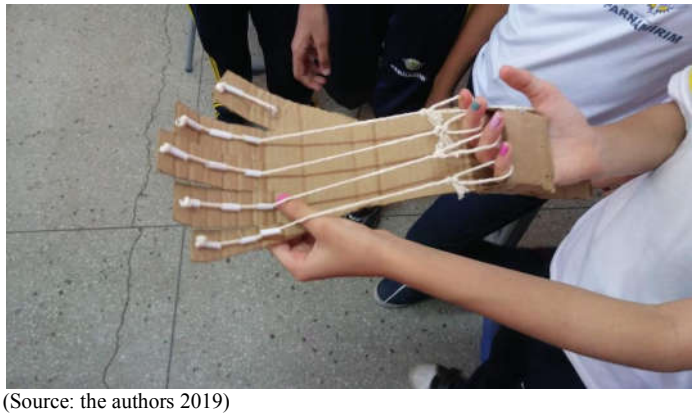
(Source: the authors 2019)

Figure 2. Jet boat

The third team analyzed that it would save people in Brumadinho: "[...] if it were possible, at the moment, we would build a very large car, to fit everyone. If we work with technology a little, maybe we can save several lives. ". Figure 3 shows the moment of making the jet cars. The fourth team imagined the following context: "One day, the mayor decided to create a solution for the flooding of the city. He paid a group of scientists trained in robotics to create something that would help the population. The scientists thought hard and decided to create a robotic hand, which would take the garbage out of the drains and put it in its proper place. " Figure 4 shows the artifact of the robotic hand completed by the group. Regarding the problem of predatory hunting, the group wrote: "We can use robotic radar to track animals in danger or captured. This is really useful for protecting animals. ". The robotic radar is seen in figure 5.

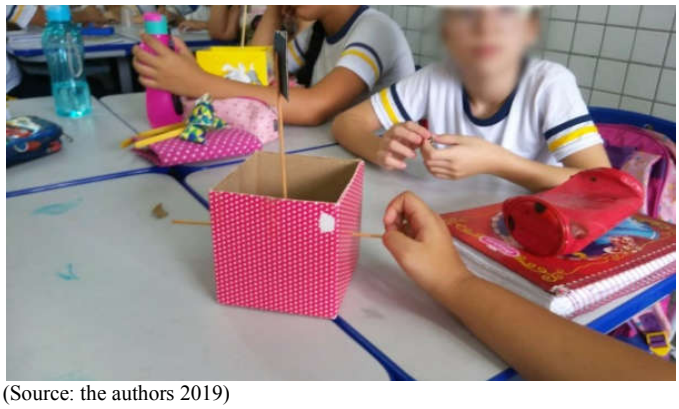
(Source: the authors 2019)

Figure 3. Jet car



(Source: the authors 2019)

Figure 4. Robotic hand



(Source: the authors 2019)

Figure 5. Robotic radar

Finally, the sixth team highlighted: "To solve this problem, we must use the hydraulic lift to save people from the top of the hill, because they can suffer tragic accidents and even deaths." Figure 6 shows the moment when the team was demonstrating the operation of the hydraulic lift for the large group.

(Source: the authors 2019)

Figure 6. Hydraulic lift

The explanation and subsequent reflection on each situation supported the resumption of specific skills in the area of Languages:

> Use different languages to defend points of view that respect the other and promote human rights, socio-environmental awareness and responsible consumption at the local, regional and global level, acting critically in the face of contemporary issues. (BRASIL, 2018, p. 63)
>
> Understand and use digital information and communication technologies in a critical, meaningful, reflective and ethical way in different social practices (including school ones), to communicate through different languages and media, produce knowledge, solve problems and develop author and collective projects. (BRASIL, 2018, p. 63)

The Art teaching area also provides for the gathering of technological resources for registration, research and artistic creation (BRASIL, 2018). In this process, Unplugged Educational Robotics, combined with an interdisciplinary construction, involved different languages and symbols that, in another perspective, may not be integrated because they do not have linear interactions. Such methodology supported the promotion of active learning environments (based on description, execution, reflection and action), based on collaborative learning and shared authorship, thus making the "living curriculum" effective, which at its heart fed the socio-environmental dialogue, as learning needs and predilections, the dialogue of information, areas, knowledge, technologies and points of view. Examples of interactive learning of this magnitude can be developed as thematic projects, which will make it possible to register processes, review paths and narratives, as well as identify the step by step developed and the materialized, constructed and reconstructed knowledge. With regard to mathematics, the specification of the maximum speed of some artifacts, the territorial extent of the Amazon rainforest, the measure of each robot.allowed to review the concepts and use of instruments of measures of length, mass and capacity, and to clarify doubts not presented in previous moments. The students were able to associate the moment with the work with fractions and the recognition, representations, patterns and characteristics of angles, as they measured the pieces, separating them in equal sizes and visualizing open, right and closed angles (BRASIL, 2018). Objects of knowledge of geometry were also worked on, such as location and movement (reference points), direction and direction, parallelism and perpendicularism and symmetry. The curricular components of History, Geography and Sciences were approached in an integrated manner, in discussions about the association of the advent of industries and the country's urbanization process in an unplanned way with some socio-environmental problems. Therefore, specific skills in the areas of Natural Sciences and Human Sciences were contemplated, as mentioned below, respectively:

> Analyze, understand and explain characteristics, phenomena and processes related to the natural, social and technological world (including the digital), as well as the relationships that are established between them, exercising curiosity to ask questions, seek answers and create solutions (including technological) based on the knowledge of the Natural Sciences. (BRASIL, 2018, p. 322)
>
> Identify, compare and explain human intervention in nature and society, exercising curiosity and proposing ideas and actions that contribute to spatial, social and cultural transformation, in order to participate effectively in the dynamics of social life. (BRASIL, 2018, p. 355)

Referring to these competencies, there was a positive discussion about the impacts that human actions cause on nature and, therefore, on society itself. The students discussed, both in teams, and in moments of socialization with the large group about the causes and consequences of the following problems: removal of vegetation, lack of urban planning and awareness of the correct disposal of garbage, sea pollution and consequent damage to coexisting species, billing of companies above the safety of human life, etc. This allowed not only thinking about the causes that led to each problem situation, but also preventive measures, so that there are no similar disasters. The group came to the conclusion that prevention is a better option, less worrying and less complex than the search for solutions to obstacles of any magnitude. At the end of the activities, students were asked to report what it was like to participate in these activities and, unanimously, all expressed the relevance of Robotics to understand a context that, although real, only through an oral presentation would become superficial and inconsistent. "It was fun to understand what robotics is, build experiments and realize that we can think of solutions to problems in the world through it, and even better understand the entire content of the two months", reported a student about her participation in these classes. Another student mentioned: "We managed to use real problems, from our city, our region and the country, which are reported on television and on the internet, in a classroom activity, making robots. That was really cool. ". Resuming the systematic evaluation of students' activities and performance, it appears that students showed more interest and motivation in the learning process. Most of the class demonstrated autonomy and the promotion of self-directed learning, a constructionist assumption. Thus, it is considered that DICT can be an assertion to promote constructionist training, that is, involve students and teachers in learning environments of interaction and active construction, through multiple languages: The constructionist approach is made possible when technologies are integrated in the activity as elements of mediation of the student's interaction with knowledge, with their own ideas expressed on the screen and with the information available in different sources and represented through multiple languages. These activities can incorporate different resources, highlighting the more open software, that is, those that allow inserting new information, expressing thought, establishing relationships, developing social interaction, sharing productions, working in collaboration. (Almeida; Valente, 2011, p. 8-9).

In addition, practices that advocate multiple forms of evaluation operate in an inclusive perspective, breaking educational, attitudinal and procedural barriers. In other words, in the same way that the student with more developed writing skills could assist in the production of the text, another student with a skillful orality was predisposed to collaborate in this aspect, as well as others demonstrated greater skill in assembling the robots. Weaving considerations about the particularities of this project, the relationship between reality and playfulness enabled students to build arguments based on the knowledge acquired in each area, uniting them in search of the solution of urgent problems in society, promoting the expansion of socio-environmental awareness. Allied to the central theme, the apprentices could assimilate that when using a material about to be discarded (often improperly), a new utility is obtained, being transformed into a source of learning. However, even so, some remained dependent, awaiting instructions and step-by-step instructions, or waited for the actions of their colleagues in order to proceed. This denotes that the educational model of this generation is still rooted in passive learning. Therefore, in view of what was exposed by Almeida and Valente (2011), it is necessary to increasingly delimit the guiding perspectives of human formation and the guidelines that govern educational dynamics in contemporary times and, therefore, plan and build the existing links between curriculum and Digital Information and Communication Technologies, based on the constructionist conception of students' interaction, as active agents of their learning, as opposed to the instructionist idea, of the computer as a teaching machine, and of many curricula that still bring ingrained the idea that technologies are mere neutral supports for the subjects, such as computer classes.

CONCLUSION

In order to apprehend the complex movement in our educational system, an analysis external to the school is necessary, providing a global view of the social, cultural and economic elements. And, added to that, to learn the internal school movement, considering objectives,

contents, methodologies, organizational and curricular actions, assessment of learning, without forgetting to discard the particular and broader social contexts. To learn about digital technology, without using electronic devices, disposable and reusable materials were used for the initial learning of Educational Robotics, in a school without high-tech resources. It can be considered that this methodology enabled learning that transcends passivity, weaving knowledge, creativity, reflection, reasoning and reasoning. From this strategy, students were able to understand the basic fundamentals of robotics, associated with themes that reverberated during 2019 in the local, regional and national scene, thus allowing the skills and abilities provided by BNCC to be brought closer to problems present in their own community, municipality, region. More important, however, than the role of Unplugged Educational Robotics, is the meaning of who directs it: the teacher. He must be aware that it is necessary to incorporate technologies in his practice, in view of his relationship with the world and, therefore, with the student, who has such an affinity with these means. If Educational Robotics is used in an immediate, reductionist and instructive context of computerization of teaching, it will reinforce the split between teaching and everyday problems. In a diametrically opposite posture, if the direction is in accordance with active participation and the aspects mentioned above throughout this analysis, students will develop different potentials, through education based on scientific, humanistic and technological training, envisioning their autonomy and protagonism. Given the above, it can be considered that this practice was significant for the age group of the public (9 and 10 years old). As future prospects, the aim is to expand the studies on the concepts of Educational Robotics, and how it can enhance learning in an interdisciplinary way. Associated with this study, its applicability is recommended in the unplugged format, in order to become a reference of successful experiences in public schools or, in general, to institutions whose condition does not allow the acquisition of high-cost materials.

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