ROBOTICS IN MIDDLE SCHOOL: CHILDREN AND ROBOTS

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Abstract

With the objective of describing an investigation involving basic education and activities with Educational Robotics with Tools (Free Pedagogical Robotics) in public schools of Recife, this article focuses on the construction of robotic artifacts, their integration and contextualization with knowledge and school knowledge at the level of initial years of Basic Education. In this experiment, we involved fifty 4th and 5th graders students, aged between 9 and 10 years, trying to identify the level of transposition of the knowledge developed in the curricular subjects to solve the challenges proposed in the educational robotics workshops during the process of context, idealization, design, construction, programming and socialization of robotic artifacts relevant to children's imagination and integrated into the educational Brazilian curriculum.

Keywords: Basic Education, Basic Education, Robotics, Educational Technologies, Free Educational Robotics, Robotics with Tools, Robot.

1 INTRODUCTION

While teachers and researchers, concerned with the learning and cognitive autonomy of our students, we are looking for more diversification of didactic tools to enrich pedagogical practice in the classroom; that for many years has refused to encourage the intellectual growth of children in basic education during middle school in most parts of the world. However, the rescue of psychopedagogy theories [1] and the advent of new technologies of information and communication (ICTs) [2] available and implemented in programs and educational projects in the last forty years [3], and more precisely in the last twenty years in universities and schools in Brazil [4], is promoting the innovation of pedagogical practice in the classroom.

This new phase has been recovering the value of the research and socialization of knowledge and learning, as opposed to mere content-based memorization [5], through the integration of several didactic tools previously only analogical and static, for digital and dynamic instruments with hardware and software integrated with methodologies of promotion of the autonomy cognitive as a pedagogical practice. In this experiment, it’s used as a space of promotion of learning the multireferential universe [6] of Educational Robotics with Tools (Fig. 1), therefore, Educational Robotics dimension that promotes the construction of robotic artifacts contemplating in an integrated way the practical With the cognitive way to do [6] the use of tools such as screwdrivers, pliers, hot glue gun, soldering iron, among others (Fig. 2), constructions with simple electronic elements such as wires, batteries, Sensors and actuators; so, the creation of cognitive robotic artifacts.

Figure 1. Multireferential Robotics Laboratory Space with Tools. Source: own author
2 METHODOLOGY

These artifacts [7] that were not robotic yet, initially identified by students as elements present in disciplinary contents in the classroom contents, are democratically suggested and chosen for construction and transformation during REF activities as a continuation of the pedagogical process in the classroom (Fig 3).

Nobody can deny the contribution of Educational Robotics as a motivating tool and promoter of effective learning in several curricular educational activities [8], majority, before, only related to the areas of the exact sciences [9]. Numerous experiments have now emerged as a proven Effectiveness in learning the arts and humanities. The use of a robot as a pedagogical tool, besides presenting different methodological strategies of use, is based on potential objectives for the development of skills and abilities needed to the new demands of the “knowledge intensive society” [10].

It is integrated with the daily experiences of “digital natives” [10], becoming allied to its integral development, contributing to the recovery of important cognitive processes for the development of learning, such as intrinsic motivation [6], naturally promoting the autonomy of the Process of construction of knowledge and its intensive application in the daily life of the student.

In the Robotics Educational literature it’s common to identify in several experiments the predilection of the boys in the assembly of mobile carts, while the girls in the automation of dolls for artistic activities [11], becoming relative in other levels by different points. In this experiment, happened in two months three robotic artifacts were constructed: a mobile robot structured with electronic scrap guided by a
fully-automatic remote control (Fig. 4); a robotic mascot initially guided by magnets and later with 9g servomotors (Fig. 5); and the model reconstruction of an automated and programmed spinning bridge with the Arduino prototyping platform (Fig. 6).

3 THE EXPERIMENTS

The symbolic representation of the construct in the process of cognition of these students, was initially presented in a diffuse stage, but in development, requiring only support promoted preferentially by a mediator [12] with a pedagogical conception to encourage the interrogation, And planned action, and that it considered the mistake as a process for reconstruction instead of a determinant of failure in learning, otherwise many artifacts would present functional problems brought about by the impetus of “doing it for obligation”, disrupted, uninterrupted, and unplanned autonomy. Considering students as
multidimensional beings [13] imbued of competences and abilities appropriate for different cognitive processes, it is possible to ensure, through interesting and relevant activities for them, progress in the areas of creativity, logical reasoning, socialization and learning by doing.

In learning processes with educational robotics with tools, students from early years, sometimes, are unable of manipulate certain tools, occasioned by structural expectations involving the security of the student and colleagues. Teachers and pedagogues question the effectiveness of this technology applied to this level of teaching, as well as the danger posed by contact with tools that present risks.

3.1 The controlled mobile robot

During this activity, the girls and the boys presented the same motivation both in the preparation of the materials, phases of disassembly, preparation of adaptation and assembly of the mobile robot, as well as in the experimentation and socialization of the productions. For the majority, they presented skills in dealing with ruler and square measurements, as well as easily developed the important sawing, gluing, and welding skills for mechanical assembly of the robot, following the planning discussed previously in the activity. We noticed at the beginning of the activities that some students requested that the teacher carry out the activity for them, however when encouraged to try one or more times, they demonstrated to have the skills to do so by themselves.

The curricular knowledge was widely applied in the different steps of construction of the artifact, being integrated to the robotic contents mentioned previously, and identified more exactly during the socialization generating comments among the other participants.

3.2 The swivel bridge

The application of the contents of the human sciences was widely approached during the construction of this robotic artifact, allowing to easily integrate artistic skills in the assembly of the bridge, rescuing structures of the historical period of its existence, also identifying socio-cultural characteristics practiced by the population, their clothes, customs And period relations.

To conclude, the students started to identify another programming language for robots, since they already knew the block language of Scratch [14] of other workshops also with robotics. In the contact with the Arduino, prototype platform [15], they were very comfortable, not demonstrating a lack of understanding of the programming procedures presented to move a servo motor coupled to a rotating bridge, discussing the inclusion of movements to either side.

During the socialization, two students represented the whole class demonstrating a single experiment, describing how it was built, the difficulties found and the knowledge built on the programmed control of a robot.
3.3 The robot mascot

This was the experiment carried out in the 4th month of the activities with robotics with Tools, held by a team of trainee monitors of the Rural University of Pernambuco, of the courses of Degree in Computer Science and Computer Science. The attendance to the students was extended, the students provided more accurate observations and identification of skills and competences not yet observed.

It was possible to classify groups with sharper skills and make them interact with those still developing with these skills but who could contribute differently to the others.

Due to the format of the artifact under construction, knowledge of sciences such as the human body were integrated, walking movements, touch sensors, tweaking and other contents related to future humanoid robots.

Figure 8. Final socialization of the spinning bridge.
Source: own author

Figure 9. Preparation of the space and presentation of the prototype.
Source: own author
4 RESULTS

The experiment demonstrates that Educational Robotics with Tools used as a pedagogical tool is able to bring to a space of practice the theoretical knowledge addressed in the classroom by curricular subjects, provoking a natural and involuntary integration of multidisciplinary theory and practice, fomenting motivation Voluntary and uninterrupted, provoking the didactic transposition of knowledge between two or more areas of knowledge.

However, such achievements need teacher interventions, structured mediation in constructivist approaches having the student as an individual possessing innate skills and abilities, thus able to learn and develop new skills and abilities required by the school knowledge, resulting in the construction with quality in the Authorial construction of robotic artifacts relevant to the children’s imagination. The activity with robots not only motivates them for the planned action, but also promotes the development of competences in the social, affective, cognitive, ethical and cultural dimensions.

5 CONCLUSIONS

After all, all the evaluative data collected evidences the transposition of most of the disciplinary knowledge of the school curriculum during the planning of the actions of construction and reconstruction of the robotic artefacts completed by the students, further reinforcing the benefits of Educational Robotics with Tools as an important instrument in the scholar curriculum.

REFERENCES


