EDUCATIONAL ROBOTICS IN One Laptop per Student – UCA Project

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Abstract

In one of the schools involved in the project One Laptop per Student-UCA in Campinas, SP, Brazil, the process of the teacher training involves the development of educational robotics activities. This involves conception, design and construction of robotic devices, using classmate laptop and development of methodologies integrated to the curriculum. Teacher training has been constituted as a research activity conducted by researchers at the Nucleus of Informatics Education Applied-NIED at State University of Campinas - UNICAMP. This article briefly presents the UCA program addressing their goals and processes for teacher education, discussions of educational robotics, objectives and methodologies of this research, partial results achieved and conclusions about this work.

Keywords

Educational Robotics, Teacher Education, Public School

Introduction

The project One Laptop per Student (UCA), of the Ministry of Education (MEC), Brazil, was developed by Núcleo de Informática Aplicada à Educação (NIED/UNICAMP) having as partners the Núcleo de Tecnologia Educacional (NTE) from Campinas and a municipal school in this city. In the State of São Paulo the UCA project is responsible for the preparation of local teams of teacher training in the use of low-cost classmate computer, integrated into the curriculum. Since 2010, the Educational Robotics at NIED has developed research in order to use the low-cost computer to control robotic devices whose purpose is educational and this activity is being applied by the Educational Robotics to a public school. The objective of this research is primarily to train the teachers for the use of Educational Robotics, with classmate computers as a tool able to enrich and contribute to the practice of teaching and learning in the classroom. The research discussed in this article only focus on a specific school from the process of training teachers of the project as a whole. So it was exclusively used on training teachers for the use of Educational Robotics at Elza Maria Pellegrini de Aguiar school. The methodology used is a qualitative study focusing on the development activities of teacher training for the use of robotics as a pedagogical resource. In this sense, the research emphasizes on monitoring the performance of these teachers with their students, in order to identify an effective contribution of this resource to enrich the curriculum in elementary school. As UCA Project is on implementation stage, the specific indicators about the improvement results from it to the curriculum are not read yet, though studies

have been developed with this purpose. The article briefly presents this research on the implementation of robotics education in this school.

What is the Project One Computer per Student? – UCA

The UCA project began when the NGO One Laptop Per Child - OLPC was presented to the Brazilian government in the Economic World Forum in Davos - Switzerland, in January 2005. In June of that year, Nicholas Negroponte, Seymour Papert and Mary Lou Jepsen came to Brazil especially to exhibit this idea in detail. Over 2007 five schools were selected in five states. Since then 150,000 educational laptops were distributed to approximately 300 public schools. Each school received laptops for students and teachers, infrastructure for Internet access and training of managers and teachers in technology use. In 2010, the project was at the phase called "pilot". This stage covered approximately 300 public schools, distributed in some units of the Brazilian Federation. In the city of Campinas, SP, training is held at the municipal school Elza Maria Pellegrini de Aguiar, which is the object of this research. In this context training fits the implementation process of educational robotics in that school and research activities involving students and school teachers. The figures 1 and 2 represent the low-cost computers of UCA program in Brazil.

Figure 1: Laptop Classmate

Figure 2: Laptop XO

Educational Robotics Environment

The educational robotics has been used for decades by educational institutions and researched as a tool to enrich teaching and learning environment. In this context it can be understood as a process of interaction with a robotic device (mechanical/electromechanical) and a way of promoting cognitive processes (d'Abreu & Garcia, 2010). Or,

> a *set of resources with the purpose of learning science and technology integrated into other areas of knowledge, using activities such as design, construction and programming of robot.* (Lopes, 2010, p.46).

Therefore, it is an interactive process seeking conciliation between concrete and abstract in solving a problem that involves steps such as: design, implementation, building automation and control mechanism. In all these steps can and should occur the construction of knowledge, coming from different scientific areas. An environment of educational robotics must bring to surface technological ideas and allow children to take ownership of them. In this context technological ideas were understood as the possibility of connecting mechanical parts and electronic components to perform a given task (Papert, 1994). Moreover, brings about the possibility of developing a teaching methodology in a rich and diverse way using low-cost

computers. Studies are being made to enable the use of computers to perform activities of Educational Robotics with classmate computer involving the use of the software program scratch, (http://scratch.mit.edu/) low cost alternative material, and electronic interface with the Arduino (http://www.arduino.cc).

Contextualizing the research in the school

The research covers only part of the process of teacher training, in the UCA project, therefore, focuses exclusively on training teachers to use educational robotics at Elza Maria Pellegrini de Aguiar school. The study was developed in a public school which has approximately 500 students from 1st to 9th grade in elementary school. In 2011 two teachers and fifteen student monitors participated in these research. The group of 15 student monitors of different ages have learned to operate the computer classmate and begun to assist teachers in the task of appropriation and use of computers in the classroom for the educational robotics activities. The research was developed in a class of forty students. Despite the fact that each student has his/her computer, the educational robotic activities were developed in group. There were five groups of eight students each. There was not enough material for each student to develop his/her own project. For this and because working in a collaborative way emphasizes cooperation, the students were encouraged to work in groups. In addition, this team work also encourage exchanging and negotiation skills that are inherent aspects of the real situation of the society. By this classroom organization a rich learning situation provides Educational Robotics. The issue of the study was to understand "**what should be considered relevant in teacher training for implantation Educational Robotics in schools in terms of the UCA project?**"

Methodology of research

From the methodological point of view, the research began with the realization of pilot workshops conducted by researchers from NIED 2 teachers and 15 students in elementary school, students working as monitors. The workshops took place during two months in August and September 2011, at weekly meetings of two hours and 30 minutes, a total of 7 meetings, culminating with the participation of teachers and students monitors in the event "Arena Digital", figure 3a and 3b, promoted by the prefecture of the city of Campinas. During the second semester of 2011, in the development of the training process, teachers and students were extremely receptive, engaged and interested in working with Educational Robotics. The methodology involved the analysis of video recordings collected during the workshops. As interaction, meetings and conversations with teachers and with students were taking place, the importance of definitive establishment of educational robotics at school was becoming increasingly clear and welcome. Thus in the beginning of the year 2012, the final implementation phase of the Educational Robotics in school was established. In this phase the teachers were in the final stage of training and working with their students under the guidance of the researchers at NIED.

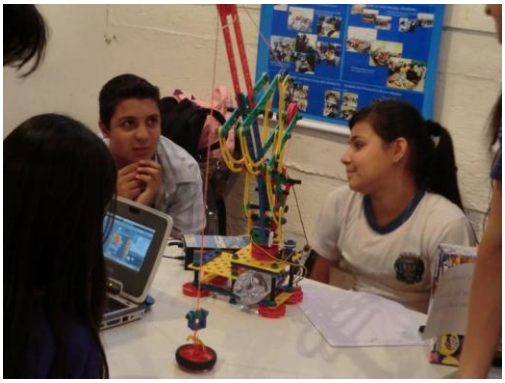

Figure 3a: Students operating a crane.

Figure 3b: Nightclub equipped with sensors that beep when the car enters

Considerations about the work

During the development of the training process, both, teachers and student monitors, were extremely receptive, interested and involved in the development of educational robotics in the school. Both have produced in the very first pilot workshops a blog (http://emefelza2010.blogspot.com/) on educational robotics. A teacher who worked with the student monitors, said:

> *"It was my first experience with robotics teaching and in fact, very positive, because I slowly got to realize that it must be used in an interdisciplinary way. In the workshops I could work the skills and abilities all the time ... Using laptop for performing the work is pretty easy, because it allows mobility, making it possible to develop collaborative projects ... It is something we were present to and is to be made part of our teaching process from now on ... "*

The following excerpt from the opinion of two student monitors who participated in the pilot workshops.

> *"Robotics taught many things I could not do through the computer. Robotics taught to program the robots using the computer. It also taught to work as a team. "Scratch" is a simple program that everyone could use. The time was very short, though. If there were more time, we could have learned much more "... "I loved the lessons I learned in robotics, mainly that the robots are moved by sensors ... We learn many interesting things in the robotics class."*

Partial results of the research

Developing activities in a context that integrates building robots, computer programming and electronics has enabled teachers and students from public schools to use ICT integrated to the curriculum in a context in which learning of scientific concepts happens differently. This proposal of teacher training its different from the others basically because of mobility it offers. Teachers and students can work with a laptop to develop activities inside or outside classroom, including at their houses. The role of student monitors to help teachers in the use of laptops in the classroom also constitutes a differentiated approach in which the teacher is no longer the absolute master of knowledge. He needs and so starts to accept the contribution of the student. An important fact to mention is that as a result of the workshops, the school board got to mobilize financial resources to purchase materials to build a room for Educational Robotics, what will enable the school to continue the project, incorporating it in its curriculum. This is denoted as a partial result which may become the improvement of teaching practice in school. It is worth mentioning as a partial result that from 2012 on students and teachers of public schools will be

able to do science with the same standard of private schools with higher purchasing power. Making Educational Robotics in the context of the UCA project meant working in an environment which fed students to acquire skills like: design, construction, automation and control of robotic devices. This process allowed the practical use of math and physics concepts as force, velocity, acceleration, weight and so on. The students had a contextualized learning that allowed them to experiment, test and validate scientific hypotheses.

Conclusion

It can be affirmed in conclusion that the research basic issue was answered as he work was able to provide: studies on the possibilities of utilization of the classmate computer to perform activities of Pedagogical Robotics involving the use of the "scratch" and also alternative, low cost material; awareness of teachers and school board about the importance of working with Pedagogical Robotics in the formation process of didactic practice; ongoing development by the school board of actions aiming to final implementation of Pedagogical Robotics as curricular activity. The research is still going on, having the end due to the end of 2012, with the consolidation of teacher education. Records of video and audio of the research activities in 2012 will be analyzed and published later in other articles. It is hoped that from now to come a permanent and constant interaction of school teachers with the team of NIED is kept.

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