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EDUCATIONAL POTENTIAL OF ROBOTICS IN HIGHER EDUCATION: A PAPERTIAN APPROACH

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This pedagogical proposal presents the use of robotics for a ludic learning, since the late 1980s, when robotics was first introduced into the classroom, mobile robotics are used in education at all levels and various subjects. These courses are usually divided into lecture and laboratory sessions. At the lecture sessions students learn and at the laboratory sessions, students experiment on real or simulated robots. Experiments are done on robotics concepts and most times students are required to use concepts they learned in other courses, such as control and programming. Previous research has demonstrated that professors' and learners' view towards an educational potenial of robotics and the strong influences of their learning outcomes and learning process.

On the other hand, the new technologies into science education classrooms has been an important aspect of preparing teachers for a changing educational environment.

This project explores the use of lego mindstorms ev3 mobile robots to develop instructional strategies to guide the learning process, increase students' understanding of concepts and their practical application in mathematics subjects, with a ludical learning, supported in a constructionist model.

keywords: education, technology, robotics, constructionism.

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Abstract

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1 INTRODUCTION

The technology has a position of advantage in the development of Universities, a good training in mathematics and programming in computer sciences carriers is considered a significant aspect in every educational system.

In present days different robotic platforms has been a popular technology used by universities for educational purposes [1, 2].

The use of technology is present in every activity performed by humans; education is no exemption, although so far there hasn't been a great advance since the use of technologies has to have a pedagogic foundation so it can get the most potential by defining goals.

One of the most internationally renowned thinkers for his studies in this area is Seymour Papert, because besides creating digital tools to aid learning, he proposed the constructionism as an educational theory which underlies the use of technologies in education [3].

With the low academic performance presented by the students and the lack of motivation as reference which prove the same regarding the subject matter of Math VI in the major of Computing. It is considered essential the search of tools which allows reinforcing logical-mathematical skills. With this, it is intended for students to assimilate knowledge and not just repeat processes not understood or doing the same things without reasoning.

There are many tools which can be used for teaching. One of these are robots; which besides being used mainly in the industry, they have also created interest in the knowledge area in order to used them as an aid in the different methodologies of teaching and learning [4].

Educational robotics is propitious to help productive, creative, digital and communication skills; and it becomes an engine for innovation when it produces chances in people, in ideas and attitudes, in relationships, in ways of acting and thinking of the students and educator [5].

1.2 Educating with technology a papertian approach

Seymour Papert (1999), developed a theory based in the constructivism of Piaget, this approach helps to comprehend how the ideas are understood and transformed when expressed through different ways. This author credits that the best learning is derived of offering optimal opportunities so the learner constructs its own knowledge. Papert's theory says that the students when they learn are involved in two types of construction: the inner world (in their minds) and the external world (the environment), this way more knowledge is generated. In his essay from LCSI's book, Philosophy and Implementation of Logo, declares that "…I have adapted the word constructionism to refer to everything that has to do with making things and especially to do with learning by *making*, an idea that includes but goes far beyond the idea of learning by *doing*" [6].

This theory focuses mainly in the art of learning or of learning to learn, using technology and in the importance of doing thing to learn. To Papert the projection of intuition and ideas is an important part for learning.

Papert (1999), considers that knowledge is constructed and the educational system must level the road and provide the opportunities for the children to develop creative activities which privilege their constructionist process. This is why he asserts that if we want to improve the quality of education, the learner must be offered better opportunities to construct, for him the pairing of constructivism + technology = constructionism is fundamental for learning with technologies [9].

For Vicario (2009), it hasn't been a work more brilliant than Papert's in the area of educational technology and I agree with her that he must be proclaimed as the "Father of Educational Informatics"[7].

Is in this sense that the constructionist theory considers that a significant learning is achieve when the children are involved in the construction of a product such as a little essay, a poem, a questionnaire, a story, a drawing, a technological substrate, a learning robot, etcetera, [8].

The purpose of this project is to include the use of the Lego MindStorms® robot as a support tool, which will be handled by the students through the supply of mathematics and programming, based in the theory of constructionism of Seymour Papert in which the vision of learning is seen as a construction more than a knowledge transfer, and wherein the professor goes from being an instructor to an adviser and the student is an active part of his own learning. Achieving with this the decrease of failure in students taking the subject matter of Mathematics VI at the Faculty of Informatics of Culiacán in the Autonomous University of Sinaloa, Mexico.

2   METHODOLOGY

The methodology of this project is described below.

In first place, the programming of mathematics functions will be done in the programming software. For this purpose the Java programming language will be used.

The assembly of the vehicle will be done with the Lego MindStorms® kit based in the basic EV3 model [9] as shown in Figure 1.
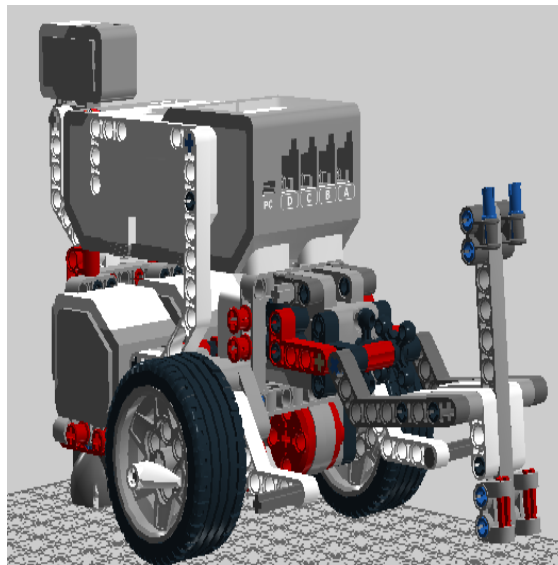

Fig. 1 LEGO MINDSTORMS® MODEL VEHICLE

The remote teleoperation of the vehicle will be programmed so that through a server the vehicle drawing the mathematical function can be manipulated [Figure 2].

The LeIOS programming language will be used, which is a small virtual machine allowing to execute Java code into the Lego MindStorms® controller. Additionally there is an API which implements the nucleus of Java classes, some J2ME and some additional for the communication through Bluetooth, access to the GPS, sensors and actuators.

The assessment will be done in two groups, in each one of them, half of them will take the normal class and the other half will also have the practice with the use of the Lego MindStorms® vehicle.

At the end they will be evaluated with the application of two midterm exams to both groups to analyze if there are learning differences.

Surveys will be carried out for students and professors regarding the use of the Lego MindStorms® vehicles as a tool to reinforce knowledge.
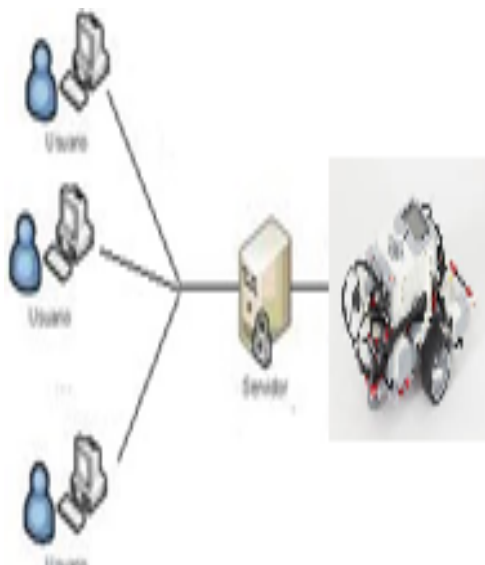

Fig. 2 CLIENT-SERVER SCHEME

The language used is the LeJOS library and is used with Java; the communication with the vehicle is made through Bluetooth [10,11].

Until now the vehicle movement is done by specific instructions to move, rotate and move in angles from LeJOS libraries navigation

3   EXPECTED RESULTS

This project's purpose is to create a tool to serve as an aid in the teaching of mathematics and can be used so the students acquire long term knowledge and, with this, be able to decrease the rate of failure presented in the subject matter of Mathematics VI at the Faculty of Informatics of Culiacán in the Autonomous University of Sinaloa, Mexico

If the goal is achieved, it will be pursued to include this type of tools and similar for technology to increasingly be used as support in classes and the students have greater motivation and ease the learning of different subject matters [12].

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