

# Pedagogical Robotics – A way to Experiment and Innovate in Educational Teaching in Morocco

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**Abstract:** - Over the last decades, robotics in education has emerged as an interdisciplinary, project-based learning activity offering major new benefits to education at all levels. They have become an urgent and essential need for the development of students' mind. In this work, we highlight the role of practical pedagogy and consequent educational methodologies while using robotics in school education in Morocco. In this framework, the necessity of shifting from the traditional learning methodology to an approach that gives a great importance on the curricula by integrating robotics in Moroccan school and in training professional teacher are suggested.

**Key-Words:** - Robotics, Traditional, Curricula, Pedagogical, Innovation, Methodology.

## 1 Introduction

In thinking of a traditional learning approach, we picture a teacher who dictates everything he/she knows to a group of students who registers the information, which is eventually remembered and dedicated to a memory for a short amount of time until after the test. Even when students are asked to apply the information to a so-called real life situation, they use the information in a systematic way to solve an arbitrary problem that probably has no significance to them. Hence, if the teacher approaches the classroom experience with subject matter uppermost in his/her mind, he/she might as well talk to the wall. He/she will wander aimlessly through a thicket of student's needs and questions. Students are not just so many empty jugs to be filled. We cannot pound knowledge into them. All we can do is make the student want to learn and then facilitate the learning process by providing an atmosphere in which learning can take place. We are the facilitator of the learning experience.

In Morocco, as in many other countries in the world, these traditional learning environments have rigorous requirements as to subject matter that is to be covered and the method by which to cover it. This doesn't leave much time for integrating other modes by which children learn into a classroom, whether it is for the purpose of learning the prescribed material or other materials. For instance,

technological tools, which are becoming more and more prevalent in our society, are not used to a great extent in schools. Even if some schools have computers, they are most frequently used as tools to help students practice, in a drill format, that which they're learning in the classroom curriculum. They are not there to allow for discovery in students' areas of interest.

There is a general belief that in learning, robots can be an effective means to facilitate more engagement, higher motivation, and the development of practical skill sets, beyond the focus of robotics itself. For instance, the effectiveness of robotics as a subject to convey a larger skill sets to students has been analysed and found to be promising [5].

Robotics is an exciting multi-disciplinary area that is going to dominate the 21st century. The robotics industry is entering a new period of rapid growth [8].

Robots can be seen as computer tools with both computational and mechanical services to perform physical movement-oriented tasks. Robots allow demonstrating the capabilities of electronics technology and providing students with opportunities for project-based learning.

In the context of e-learning, robots are increasingly seen as a means for enforcing engagement, excitement and fun in learning [9],

## 2 Background Literature

Hardly a day goes by when we do not hear, nowadays, about a new introduction that contributes in serving humanity in various fields such as space, military, industry, medicine, commerce, entertainment and even education. Robots have become essential in many areas because of their ability to raise the productivity and to reduce the cost of effort and human resources. Because of its essential role in keeping up the progress in the global technology and communications, the interest of robots becomes immense and is increasingly spread in the media circulation.

There are many areas in which robots can perform tasks, and education is one that has a big potential to apply and promote them. Unfortunately, there are not many studies covering the integration of robots in the educational environment.

Studies show that the robots can be built to perform specific tasks to improve learning motivation, making teaching more practical and tangible. They can be used as learning peers or assistants through developing human-robot interaction [7].

The well-known “paradigmatic shift” that occurred in robotics at the end of the 1980s and that brought robots from factories to other working and everyday-life human environments [2, 3] raised the important problem of designing and developing human-robot interaction modalities and tools. One further important paradigmatic shift has occurred from the concept of “robots as tools” to “social robots and pedagogical robots”.

Dimitris Alimisis [10] highlighted the role of constructivist pedagogy and consequent educational methodologies either while using robotics in school education (Robotics in Education) or while training teachers to use robotics for teaching purposes (Education in Robotics). In this framework, he suggested constructivist methodologies for integrating robotics in physics and informatics and in professional teacher training.

Nowadays, Robots have become a prevalent educational tool in some middle and high schools, as well as in many youth summer schools, raising interest in programming, artificial intelligence and robotics among students. Beside software engineering courses, several universities, now,

include programming robots in some first year courses of computer science [4].

## 3 Curriculum and Reasons of its Development

Effective teaching and learning is one of the biggest challenges that face many developing countries, including Morocco. The curricula of education in these countries are usually designed to encourage the traditional methodology of teaching without instructional strategies that facilitate the inclusion of all students [6].

The concept of the curricula was not a commonplace, whether in literature or in educational practices, in the education sector. Until recently, the study programs were reduced to regulations Materials and cognitive content that is taught at various educational levels. They, also, were reduced into the tables and uses of time that determine the weekly distribution of these materials. Therefore, to prove their distinguish from this tradition, early pioneers and education experts, in program planning, start giving a great importance on the contents of the teaching by focusing on the student rather than the subject matter and its implications. From there, the term “curricula” was born and was known in general, as a collection of all what was provided by the school in terms of knowledge, skills and trends ... to help the learner, on balanced and proper growth in all his/her personality aspects.

Many teachers and education experts, however, feel that the curricula in their countries do not, as yet, sufficiently encourage creativity and innovation, mainly because they are not clear how creativity should be defined and how it should be treated in learning and assessment. Furthermore, curricula are often overloaded with content, which reduces the possibilities of creative and innovative learning approaches in practice.

The accelerated pace of technological development around the world calls for the renewal of education systems, particularly those in the South, so that they can improve the quality of teaching and learning for skills development through The effective use of Information and Communication Technologies (ICT). Indeed, the transformation of the world into the information society or the knowledge-based society has profound implications for education systems. In fact, education systems in all countries are called upon to broaden, ease and improve their relevance and quality at all levels.

In this sense, Morocco, like all developing and western countries, understood the importance of the use and integration of ICT in its education system. To this end, since 2005, the Moroccan government has adopted a program called "GENIE" (GENeralization of Ict in Education) [11], with the aim of generalizing these technologies with a view to their integration into the education and training system. In line with the strategic vision of reform and the embodiment of the orientations of the Moroccan ministry in the dissemination of information and communication technology in the educational field. In corporation with the Tawassol Association for Technology Development, the Moroccan Educational Ministry often organizes training workshops for technology and computer science teachers. Figure 1 illustrates one of these workshops that was organised recently at Al Akhawayn University in Ifrane.



Figure 1. Robotics Workshop for technology teachers.

#### 4 What is a Pedagogical Robot?

To distinguish between educational robots and industrial and commercial robots, it must be noted that both kinds encompass the same general characteristics. However, what distinguishes pedagogical robots is that they are safer for use by students and that they are less material cost. In addition to that, they contain instructions that guide students on how to program them and interact with their components such as, their sensors, engines and arms.

These Pedagogical Robots are given orders through a computer provided with a special program, in addition to some applications that enable the student to carry out simulated reality

through fake environment which performs his/her experiments.

These kind of robots can be taken in advantage in the development of classification and installation and the concept of programming skills because it can transfer student from the theoretical to the practical application through the integration of educational materials of Science, Technology, Engineering, and Mathematics (STEM), which is considered more than a school subject, or the periodic table, or the properties of waves. It is an approach to the world, a critical way to understand and explore and engage with the world, and then have the capacity to change that world [1].

The role of pedagogical robot is not limited only to the technological aspect of exchange, but it also contributes to the refinement of the student's personality in line with the requirements of the era and the skills of the twenty-first century.

The essential components of a pedagogical robot excluding the mechanical parts are:

- ✓ Arduino Kits
- ✓ DC/Servo Motors
- ✓ Sensors (Encoders/Ultra-Sonic/Light/Color/Compass)
- ✓ Wheels(Omni/Conventional)
- ✓ Raw Materials for Building the System

Figure 2 illustrates all these components.

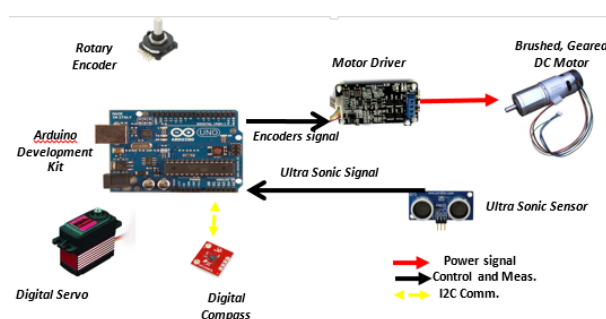


Figure 2. Building Blocks of Pedagogical Robot

#### 5 Importance and Benefits of Using Robotics in Educational Teaching

Skills and competencies, that educational robots seed in youth, revolve around several directions:

- 1) It helps to identify the different functions of mechanical cutting and develop the skill of three-dimensional pieces assemble and link them to different functions.
- 2) It allows the student to delve into the characteristics of the physical and mechanical materials and programming and control as

well as building special algorithms for robots, which helps him to deal with the components of automatic environment (Engines, Sensors, and Controller).

- 3) It plays a major role in the personal social level of the student as it fosters the social spirit of teamwork, responsibility and exchange of roles, in addition to the skills supply and speed decision making and dealing with the presser conditions experienced by the student during the preparation and during and after the parade.
- 4) It gives children an opportunity to think about and assess their own thinking process and their role in the creation of projects.
- 5) It encourages cooperative learning and teamwork.
- 6) It encourages and develops the skills of hand work.
- 7) It encourages project-based learning strategy.
- 8) It develops and enhances the skills of creative thinking as well as problem-solving skills among students.
- 9) It links the learning to the practical life.
- 10) It helps to achieve the concept of fun learning.

## 6 Vision to the Future

Winning global titles is not the most important achievement, the real achievement is to teach the concepts of robotics to a wide section of students who are involved in the local and international competitions in a manner that allows students to build on these achievements in order to expand the base of beneficiaries through the dissemination of teaching the robot in educational institutions.

Science evolves at every moment, while modifying the curriculum sometimes require decades, especially in light of the bureaucracy. Countries that managed to technological advancement in the field has given freedom to its workers in the educational field, so they can achieve the innovation and the invention. That's what is severely missing in most schools in Morocco.

Even though, there are some obstacles and barriers, which are mainly in the financial cost arising from the inclusion of these sciences in the institutions. So the work should be focused on looking for sources of funding. Another obstacle that dominates in Morocco and which is very

essential is the absence of any clear plan of the concerned ministries with the development of curricula in line with the development in the field of science and technology with the required speed. Even if a willing of the development of some individuals is found, this effort remains individually and cannot achieve the desired success because of the lack of a cover that can wrap it and that can secure and keep its continuity path.

Our goal is to encourage student self-learning, where his desire to understand how and why some things work is raised. So it increases his desire to learn more than the student who studies some of materials because the teacher had praised its importance. This desire to understand and compete induces the student to the love of learning.

## 7 Conclusion and Future Work

The Pedagogical robot has become an essential part of the education curriculum in many countries.

In this paper, we introduce the concept of Robots as Learning Objects in Morocco and a framework of methodology for robotics-oriented teaching in Moroccan educational system. Our methodology views robotic technologies not as mere tools, but rather as an interdisciplinary, project-based learning activity offering major new benefits to education at all levels. Our approach also directly addresses a gap in current teaching concerning how to support the learning of practical skills needed in the fast growing market of robotics.

Science and Technology field is a privileged one for the development of robotics either in educational teaching or in informal settings. Acting in close collaboration with both robotics experts and experienced teachers, we plan further experimental activities including teacher training and workshops and classroom involvements which are expected to provide valuable new ideas and data for the successful integration of robotics in Moroccan school curriculum of science and technology.

This future work might, preferably, result in a proposal for a school curriculum that would emphasize the essential role and the great value of robotics in teaching and learning in a wide range of school disciplines that rely on science and technology.

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