Artificial intelligence in education

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ABSTRACT
With the great advancement of technologies in recent years, Artificial Intelligence has been assuming a relevant role in several areas of knowledge. The use of this technology has been developing for more than two thousand years with the aim of providing the computer with the ability to think and act like a human being. In this context, this work aims to deepen the studies of Artificial Intelligence, with a focus on education, showing ways of how it is possible to introduce this technology in the classroom, providing student interest and better teaching and learning. The main aspect that will be presented in this theme is the use of educational robotics as a learning tool, helping to improve logical reasoning and the student's cognitive capacity. The methodology addressed in this paper was the exploratory research and the bibliographic review carried out from the theoretical framework found in articles, books and scientific journals. In conclusion, this work intends to present concepts and applications in the use of Artificial Intelligence (AI) in education, presenting some lines of research and promoting new trends in studies.

Keywords: Artificial Intelligence, Education, Robotics, Educational Robotics.

1 INTRODUCTION

Artificial intelligence, or AI, began after World War II and currently covers several areas of activity, from general use, such as learning and perception, to specific tasks such as proving mathematical theorems, chess games, and diagnosing diseases. Artificial intelligence systematizes and

automates intellectual tasks and is therefore potentially relevant to any sphere of human intellectual activity. In this sense, it is a universal field (Russell; Norvig, 2004).

Artificial intelligence is an area of computer science research that involves technology and is constantly evolving, and that has been transforming today's society through the way people perform their daily tasks, such as banking transactions, automation of services, smartphones, use of social networks and location systems. Briefly, the meaning of AI relates to the ability of machines to learn to think and act like humans.

According to Pereira (2018), some of the areas of application of Artificial Intelligence are, for example:

– electronic games and toys;

– robotics and industrial automation;

– automatic software verification;

– process optimization and control;

– natural language processing;

– deductive databases and data mining;

– learning, planning and scheduling tasks;

– recognition of faces, voices, smells and tastes.

Despite this great technological advance in society, in the field of education, in the use of new technologies, especially artificial intelligence, has been growing slowly, but its use as an ally in the process of interaction and mediator of learning is already perceived, and robotics has been implemented in schools as an interdisciplinary and transdisciplinary learning tool. where it uses the teaching of programming to develop solutions to real-world problems and assist in the improvement of students' cognitive and logical ability (Polini *et al.*, 2018).

In view of this information, this work aims to carry out an exploratory and bibliographic review on the theme Artificial Intelligence in Education and the use of educational robotics in schools, as one of the aspects of AI, seeking to gather studies on the subject and awaken to the need to use new technologies in the education of young learners. to meet the challenges posed by today's information society.

2 ARTIFICIAL INTELLIGENCE IN EDUCATION

Research on artificial intelligence (AI) is expanding and being applied in several areas every day and claims to be the great technological advance of humanity, such as autonomous control, smart cities, medical diagnostic *software*, games, robotics, etc.

The first systems in the field of education, where the computer was used as a teaching tool, were computer-based training (*CBT) and computer-based instruction* (Computer Assisted Instructional - *CAI) (McArthur* et al.*,* 1993) and were used in the teaching of arithmetic, for example.

The purpose of these systems was to present a problem to the student, record their answer, and evaluate their performance. It did not provide the individualized attention of a human tutor, since according to Beck *et al.* (1998), the systems did not consider the individual abilities of the students, because the sequence of questions and answers was directed by the students' successes and mistakes.

According to McArthur *et al.* (1993), this evolution of systems, in the search for personalized teaching, could only be achieved through a system that could reason about the domain and about the student. And from there, the Intelligent *Tutoring Systems (ITS) emerged*.

> An STI is a computer system that provides personalized instruction or feedback to students without much intervention from human teachers" (Cooper *et al*. 2012, p. 138).

According to Vaz and Raposo (2002), Intelligent Tutoring Systems offer flexibility in the presentation of the material and have greater ability to respond to the user's needs. They provide individualized learning to the student, learning relevant information about them. He also says that these systems are considered "intelligent" because they present pedagogical decisions on how to teach the material, allowing greater interactivity of the student with the system. These systems have proven to be efficient in improving student learning and motivation.

In modern times, there have been more and more actions involving the use of ITS systems to modify and improve the teaching model considered traditional, always based on the use of new technologies, such as intelligent teaching/learning systems.

> An ITS can have several benefits with the goal of enabling effective instruction: (1) presenting individualized instruction that allows all students to access the same curriculum with different entry points and learning tasks that are tailored to the needs of the students; (2) enable students to achieve similar proficiency levels more efficiently; and (3) From an appropriate design, ITS can empower teachers to focus on a small subset of students who need extra help and thus provide more effective instruction (COOPER, NAM, and SI, 2012).

In addition to STIs, there are other educational systems that make use of artificial intelligence, such as learning management systems (*Learning Management Systems* - LMSs), analysis learning (*Learning Analytics* - LA) and intelligent educational robotics. All of these only become possible to be used in the school environment with the use of technologies underlying the WOULD, such as the Internet, via wireless or wired networks, computers and/or mobile technologies, such as *Tablet* and *Smartphone*, and cloud storage. It is these technologies that are most commonly found in schools today and that directly influence AI, in addition to being responsible for the emergence of new technologies, such as *Big Data*, *Machine Learning*, Virtual Reality, etc.

2.1 ROBOTICS AS AN APPLICATION OF AI IN EDUCATION

Robotics can be defined as "the science of systems that interact with the real world with little or no human intervention" (Ars Consult, 1995, p.21). It is a multidisciplinary area, which involves themes in the areas of Mechanical and Electrical Engineering, Computing, Artificial Intelligence, among others. All with the goal of developing robots.

Among the various definitions of the robot, there are:

a) A robot is any machine, or mechanical equipment, that works automatically, simulating human abilities (Random House Dictionary *apud* Zilli, 2002, p. 4).

b) A machine that in appearance or behavior imitates a person or a specific action of that person, such as a movement of his body (Marsh *apud* Zilli, 2002, p. 4).

Ullrich (1987, p. 5) presents another definition for the term robot:

> (...) a multifunctional and reprogrammable piece of equipment, designed to move materials, parts, tools or specialized devices through variable and programmed movements, for the execution of a multitude of tasks (Ullrich, 1987, p. 5)

From these concepts, it can be seen that robotics is a technology that can act and solve problems in the most diverse areas that involve human activity, as they can perform various tasks as long as they are designed to do so. This growth in the various sectors, especially in industry and in the medical area, has enabled the insertion of this technology in the school environment, as a way to enable students to learn new ways through experimentation and collaboration, explaining technical issues in a more fun and attractive way, where the student can intervene in the social environment in which he lives creating solutions based on science and technology.

In this way, the term educational robotics emerges, which According to the Interactive Dictionary of Brazilian Education (2004):

> (...) It is a term used to characterize learning environments that bring together scrap materials or assembly kits composed of various parts, motors and sensors controllable by computer and software, allowing to program, in some way, the operation of models.

Maisonnette (2002) defines educational robotics as being

> (...) the control of electro-electronic mechanisms through a computer, transforming it into a machine capable of interacting with the environment and performing actions defined by a program created by the programmer from these interactions.

It is a new educational proposal, which enables the teacher to apply in a practical way, the theoretical concepts worked on in the disciplines, which were often not understood by the students, and which can be stimulated and motivated to learn through observation, abstraction and invention

from the use of this technology. Multidisciplinarity is used to build models, allowing the student to have different learning experiences (Besafe, 2003).

Among the various types of application of robotics with the use of artificial intelligence, the *chatterbot stands out,* which according to Wikipedia (2012), derives from the junction of the word chatter (the person who talks) and the word bot (abbreviation of robot), that is, a robot, in the form of a program, that interacts and simulates the conversation with other people. Its purpose is to make the person who asks a question to the system not be able to realize that the answer comes from a computer program.

Chatterbots, intelligent conversational robots, are commonly used in computing as a form of introduction to the teaching of programming, and it is a good option to use as a robotics teacher, as they are already used by young people in online games, supporting the player or simulating a virtual partner, which characterizes the presence of an artificial intelligence.

Zilli (2002) presents some skills that the use of educational robotics can develop, such as: logical reasoning; interpersonal and intrapersonal relationships; research and understanding; research work; problem solving through mistakes and successes; use of creativity in different situations; critical capacity.

3 FINAL THOUGHTS

This exploratory and bibliographic research on the integration of Artificial Intelligence (AI) and robotics in education reveals the significant influence of these technologies on the teaching/learning process. AI, since its post-World War II origin, has evolved in a comprehensive manner, playing crucial roles in diverse spheres of contemporary society. However, the insertion of these technologies in education, although growing, still lacks a more effective and broad implementation.

In the educational landscape, AI especially stands out through Intelligent Tutoring Systems (STIs), which offer personalized instruction and adaptive feedback to students. The ability of these systems to consider students' individual abilities represents a significant step towards more personalized teaching. As an example, Chatterbot was presented as an educational robotics application, standing out as a motivating agent in the introduction to programming teaching.

Educational robotics, in turn, is conceptualized as the science of systems that interact with the real world, providing students with practical and multidisciplinary experiences. The use of computer-controllable assembly kits, motors and sensors contributes to the development of skills such as logical reasoning, interpersonal relationships, research, creativity and critical skills. This innovative approach allows for model building and problem-solving in a more attractive way, promoting a more dynamic learning environment.

However, the effective implementation of these technologies in education requires a well-planned pedagogical proposal, with an emphasis on teaching support. There are still challenges to be overcome, such as the slow assimilation of these innovations in the educational context. It is imperative that educational institutions and educators are prepared to incorporate new technologies in an integrated way, providing students not only with access to the tools, but also with an understanding of their transformative potential.

In this context, it is evident that AI and robotics have the potential to revolutionize education, making it more dynamic, personalized, and aligned with the demands of the information society. The search for innovative paths, exploring the various possibilities of these technologies, promises to positively impact the way knowledge is acquired and assimilated. It is believed that, in the near future, the presence of these technologies will be even more common in classrooms, providing significant benefits to learners and preparing them more effectively for the challenges of the 21st century. Therefore, it is essential to continue investing in research and development in this area, aiming to constantly improve educational practices and maximize the benefits offered by AI and robotics in education.

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