

The impact of using artificial intelligence applications in teaching

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Abstract— With the development of Artificial Intelligence (AI), the entire world, and the education field in particular, is facing great opportunities that can enhance and reform traditional education. This paper refers to the concept of artificial intelligence and the systems used in the field of education and many important aspects of applying artificial intelligence technology in this field, as it provides an overview of the history of artificial intelligence, its stages of development, its role in the future of education and its potential impact on learning, teaching and education. AI brings new opportunities for development as well as huge challenges for education. It has also been noted that issues related to ethical implications are rarely discussed in studies, such as critical reflection on educational and ethical implications as well as risks of implementing AI applications.

Keywords—Artificial intelligence, teaching, learning education

I. INTRODUCTION

Current era has witnessed an unnatural development in the field of modern technology until it came to control all activities of our life. This rapid development has been associated with the development of societies in our contemporary era, as it directly contributes to building a society dependent on electronic information services directly related to production and education services. There is no doubt that artificial intelligence is no longer the preserve of a particular segment of society, but rather has become accessible to everyone and effectively penetrates many areas of our daily life, and one of these areas is education. The systematic integration of artificial intelligence into education gives the potential to address some of the biggest challenges in education today. The full implications of AI development cannot yet be predicted, but it seems that the applications of artificial intelligence will be one of the most important educational technology issues during the next twenty years [1]. This rapid change in technology will put pressure on educational policies and it is important to know AI and the potential impact it will bring on education. [2].

This paper will discuss artificial intelligence and its applications in the field of education, as its main objective is to identify the potential impacts of this technology on learning, teaching and education and to achieve potential changes in the educational landscape. And how can Artificial Intelligence in Education "AIED" be presented mainly through computers and basic systems so that it can interact with students in new ways and help teachers to teach more

effectively. With the rapid change of technology, we will witness a widespread spread of artificial intelligence in education. At that time, decision makers will face the challenges of activating this technology in the field of education, including challenges in data security and unlawful use of data that could lead to bias against individuals. [3]

II. DEFINITION OF ARTIFICIAL INTELLIGENCE

The term artificial intelligence was first used in 1956 when John McCarthy organized a two-month workshop at Dartmouth College in the United States of America at the time entitled Artificial Intelligence Workshop. John McCarthy said AI is based on guesswork and simulation as in [1]. Nabif (2010) defines artificial intelligence in [4] as the ability to perform tasks in a manner similar to humans in thinking and performance, while Nelson (2014) defines artificial intelligence in [4] as algorithms that mimic human intelligence in their structure. From here we conclude that artificial intelligence has a basic mission, which is to imitate human intelligence by building a system controlled by a computer. In [5] (Adams, 2017) says that AI is able to learn on its own without human intervention, that is, it is able to carry out complex tasks that go beyond human intelligence. In 2019, artificial intelligence was defined as a machine with the ability to predict and make influential decisions in all areas of life, whether in virtual or real environments, by AI experts at the Economic Cooperation Organization. [3]

Despite the multiplicity of the concept of artificial intelligence and its differences, most scientists and experts in this field assert that artificial intelligence has deep and intertwined disciplines that encompass most areas of life (H. Zhao, Li, & Feng, 2018) as in [6].

A) three-level business model to analyze AI

There is a three-level business model for analyzing AI and its impact. These three levels are activity, business, and operations. The activity is accomplished through goal-oriented actions, which are basically methods of solving presented problems that need to be solved in order to accomplish the activity. Work begins with operations using the tools present in the present situation. This triple form is not able to reduce levels to each other. The activity in this model represents cultural and social concepts that are not related to the process level. Most scholars and experts focus on the different levels in this hierarchy as learning behavior depends mainly on the operational level in this hierarchy while social and cultural focus focuses on social and cultural relationships in learning. Fig 1. illustrates a business model for the three

levels, in which human learning is observed in the three levels of activity. When a behavior encounters a problem, the process stops after we realize that the problem has occurred and the action takes its place. After understanding the problem, the search for a suitable solution begins. At this level, learning consists of reformulating problems in creative ways that predict new patterns that, in turn, take on new ways of thinking. In this context, activity-level learning can be understood as the invention of new things and knowledge of an imagined future. [2]

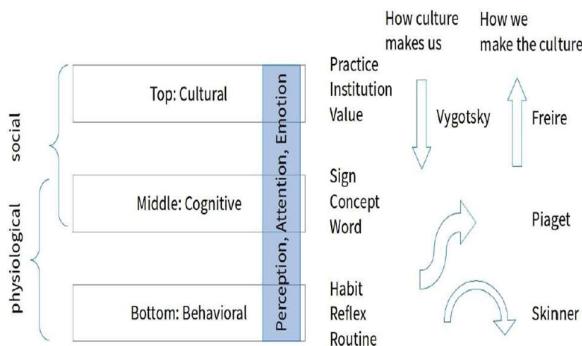


Fig. 1. Three levels of human and machine learning [2]

B) Artificial intelligence development stages

According to the research related to artificial intelligence, there are several stages of the development of artificial intelligence, in [7] both Kandbal and Mehta say that a neural model was proposed in 1943, which led to the establishment of the research technique in the artificial nervous society. In 1956, John McCarthy as in [7] coined the concept of artificial intelligence at the Dart Mouth conference in the United States, which witnessed the birth of artificial intelligence. And in the 1970s, artificial intelligence began to slowly develop and make breakthroughs. In the 1980s, Hinton and Slakhutdinov as in [7] said there had been remarkable advances in algorithms that rely entirely on artificial neural networks. In the first decade of the twenty-first century, the rapid development of artificial intelligence began, which was represented by the provision of the Internet on mobile phones and the emergence of more applications that rely on artificial intelligence. In 2012, Zhou et al as in [7] indicated that deep learning algorithms have achieved breakthrough capabilities in voice and visual recognition. And in 2016, Brunner says AI sparked controversy over its superiority over human intelligence when it defeated World Go champion Alpha Go.

III. ARTIFICIAL INTELLIGENCE IN EDUCATION

Experts believe that the future of education development lies in the presence of artificial intelligence, as academic education must change to knowledge education. [4]

Education and artificial intelligence are two factors in common. Education helps students learn and expand perceptions of knowledge, and AI provides techniques to better understand the mechanisms underlying thought, knowledge, and intelligent behavior. [8]

Since artificial intelligence depends on knowledge, its work depends on software, by programming it with human intelligence in order to interact with the world. This knowledge is represented in what are called "models". There

are three main models in AIED: the pedagogical model, the field model, and the learner model.

Fig 2. shows a simplified image of a model-based adaptive teacher model. There are three basic models that an adaptive teacher relies on: the learner model (knowing who the student is), the teaching model (knowing effective methods of teaching), and the field model (the subject being learned). AIED algorithms process the knowledge represented in the models according to the needs and capabilities of each individual and deliver it to the learner. Adaptive content takes educational content (in the form of text, video or activity) to the learner. Adapted to the needs and capabilities of the individual learner; Consistently collect data and analyze learner interactions such as emotion, speech, and achievements and provide feedback to help them progress through the content they learn. Deep analysis is also used in student interactions and is more accurate to support their learning. Some systems include so-called open learner models. Results of the analysis are presented to learners and teachers and include learner achievement, emotional state, or misconceptions. This helps the teacher understand the student's approach to learning, and this system will assist, motivate, and enable learners to track their learning. In addition to previous paradigms, AIED researchers have developed models in the emotional and metacognitive aspects of learning. These AIED models may be the biggest contribution to learning. [8]

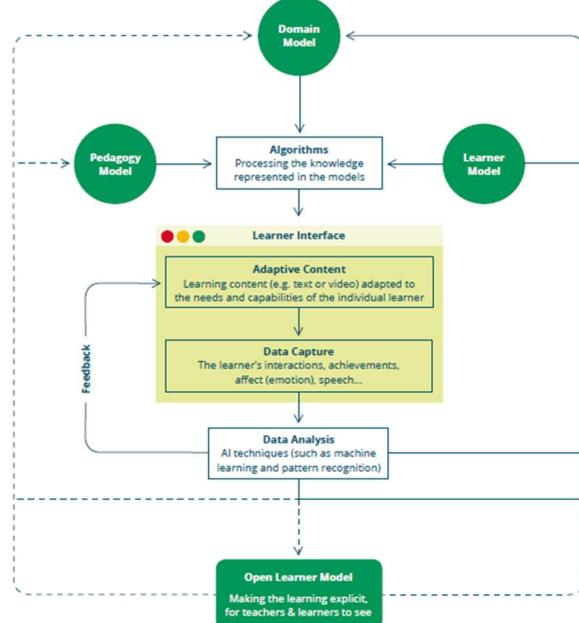


Fig. 2. AIED system showing a simplified picture of a typical model-based adaptive tutor [8]

AIED's future ability to meet challenges in education depends on how we deal with these three dimensions as shown in Fig 3. - that is:

- 1) The need for smart technologies that can embody what we know about great teaching and learning.
- 2) The lure of consumer products, which
- 3) It can then be used effectively in aspects that combine what distinguishes human and machine in real life. [9]

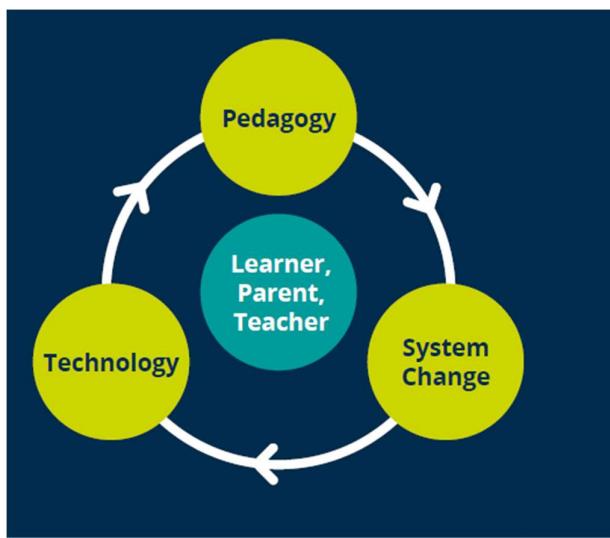


Fig. 3. Three dimensions [9]

IV. THE ROLES OF ARTIFICIAL INTELLIGENCE IN EDUCATION

1) *Artificial intelligence can automate basic activities in education, like grading:* Most teachers find grading is a daunting and time-consuming work that can be used to develop teaching skills or interact with students. Now with the development of artificial intelligence, the teacher is able to automate grades for all types of tests, whether it is for multiple choice tests or objective tests, it may allow teachers to focus more on activities in the classroom and student interaction rather than grades.

2) *Educational software can be adapted to student need:* One of the main ways in which AI will affect education is through the application of higher levels of individualized learning. With the help of machine, this type of teaching can be a solution to help students at different levels work together in one classroom, as the teachers will facilitate their work and their work will be assistance and support when needed.

3) *it can point out places where courses need to improve:* This system helps students get instant solutions that help them understand the topic as it uses smart methods that make students more capable to remember what they have learned so that they can do it correctly in the next times.

4) *Students could get additional support from AI tutors:* This type of system may help the student to teach the basic concepts, but it is unable to teach the student's thinking and creativity skills, so teaching these skills is still the role of teachers in reality.

5) *It could change the role of teachers:* With the presence of this technology and smart computing systems in education, the teacher's role in education will change from the role of the teacher to the role of the facilitator. But teachers are indispensable in reality, as they will complete the artificial intelligence lessons and they will interact with students and help them accomplish the tasks.

6) *AI may change where students learn, who teaches them, and how they acquire basic skills:* With the presence of

artificial intelligence, education will become available for students, so that they can learn from anywhere, anytime. This type of AI system can replace certain types of teaching and in some cases, these systems can replace teachers. [10]

V. THE APPLICATIONS OF ARTIFICIAL INTELLIGENCE IN EDUCATION

1) *Automatic grading system:*

It is a system that relies on artificial intelligence for its performance. Simulates teacher behavior in a learning environment, assigns grades to students' assignments, provides feedback, and evaluates and analyzes student responses. [7] It is also used to improve teaching, competitive programming, and facilitate data extraction. [11] Ma & Slater as in [1] says this system will encourage and motivate students to keep reviewing. Nehm and others as in [1] also said that these systems are not only about measuring students' abilities through tests but also encouraging them to continue progressing.

Automatic grades have two purposes: first, for assessment to be broad in a smart educational system, and second for being accurate in grading all students and in line with the assessment rules. [12] There are many programs that work on grading classification and can be accessed for free, but there is a variation in the work of these systems in terms of programming languages, some of them work on one programming language and some of them work on several languages. Fig 4. shows how to automatic grading works [11]. There are many examples of the grading system in education including gradscope and Wolfie.

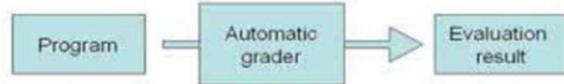


Fig. 4. Automatic grading process. [11]

2) *Virtual Teacher:*

Amidst this rapid development of artificial intelligence technology, AI experts have begun to invent an online virtual teacher to help students learn. At Georgia Tech, students were impressed with the help of teacher Jill Watson, and the students did not know that the true identity of Mrs. Watson supplied by IBM was in fact an artificial intelligence computer. Whiz Education is also known for its online educational program, Maths Whiz. The virtual tutor can also support and assist students in teaching. [7].

3) *Personalized Learning:*

Bailey says that this system of artificial intelligence contains a set of programs that can help the teacher improve teaching according to the needs of each teacher. This program can adapt to the level of the individual that is, it commensurate with the abilities of all students, whether they are fast or slow, they are able to continue Education at the speed that suits them. Holotescu as in [7] also designed and developed the Massive Open Online Course to provide teachers with specialized educational resources, while the smart assistant Botty was developed by Bayne to help teachers improve teaching and make the classroom more efficient. So, these programs will have a role in helping teachers and improving teaching to make them more efficient. [7]

On the other hand, Torres-Díazet et al., as in [1] assert that these adaptive programs have their utility in MOOCs to suggest actions, new items and users, according to students' personal preferences.

4) *Adaptive Learning:*

We defined adaptive learning as a system that relies on artificial intelligence to collect student data, then analyze this data and identify different learning methods for each student, so that the teaching is automatically adjusted to suit the needs of each student. Smart Sparrow company was created in the United States and Australia in 2011 with the goal of developing adaptive educational tools for teachers and schools. This system builds on curriculum integration and study design in real-time adaptive learning in addition to data analysis, smart training and online collaborative learning. Through this system, teachers will be able to use these tools to design curricula and interact with students by adding elements. Also, this system can collect student data and track their progress in education so that it can identify weaknesses and difficulties and thus provide timely feedback. [7]

Adaptive learning systems aim to adapt learning approaches to suit individual students' abilities. Although these systems are successful and effective in improving education, there is no real impact like adopting adaptive learning in schools. [13]

5) *Augmented Reality (AR) / Virtual Reality (VR):*

Augmented Reality and Virtual Reality systems allow students to dive into the imagination, making education more fun by learning about the universe not limited to classroom walls and whiteboards. Alchemy VR has chosen to collaborate with some institutions such as Samsung, Google, Sony, BBC, the National Museum of Nature and the Sydney Museum of Australia to produce Virtual reality for educational content in order to make virtual reality more realistic. The British Broadcasting Corporation formed a documentary team that produced the documentary The Journey of the Great Barrier Reef through which students from all over the world could visit these blue waters and learn about coral reefs in Australia through virtual reality. [7]

Augmented reality and virtual reality are used in education to enhance the exploratory behavior of the student in addition to the perceived benefit and the development of a positive attitude. Virtual simulation concepts are also used to facilitate learning. [14]

6) *Distance Learning:*

Kose as in [5] said that the application of artificial intelligence in remote learning through the computer will bridge the gaps between the student and the teacher in education when he released his book "Application of Artificial Intelligence in Distance Education" in 2014. He also pointed out that there are different systems and smart applications based on artificial intelligence capable of improving distance education.

Online teaching using artificial intelligence could be a feasible alternative in disadvantaged countries to provide education in core neighborhoods. Also traditional learning needs to adopt new technologies and methods of effective learning.

There are several programs that support distance learning systems, including:

iTalk2Learn is an open-source European educational program powered by artificial intelligence. The program provides a balance between practical work and structured activities and helps children learn from the system in a "natural" way. Third Space Learning is a program that allows students to learn at their own pace, and thus, each program is personalized to the student by using AI and Machine learning "ML" automatically. These programs help teachers identify concepts that a student has difficulty understanding before the problem worsens. Sunali Classes is an Indian program that provides 24-hour real-time doubts solution to school students where doubts are resolved in 5 minutes or less. Thinkster is a program that helps visualize a student's thinking process while solving mathematical problems using artificial intelligence. [15]

VI. THE IMPACT OF ARTIFICIAL INTELLIGENCE ON EDUCATION

A. Tuomi as in [16] says the role of education will change with modern education systems, which means that it will be participatory in production, creating efficiencies and allowing people to participate in economic growth. This means that education will have a fundamental role in economic competitiveness and productivity.

B. According to Lufeng (2018) as in [16], AI and education have a mutual relationship; it is primarily revealed in the following aspects:

1) First, the future of education development is contained in artificial intelligence and its development. According to Lufeng (2018) as in [16] "the development of education from academic education to knowledge education is an inevitable trend".

2) Second, the continuous development of artificial intelligence is promoted through the modern education and knowledge system. With rapid technological advances, Lufeng says as in [16], artificial intelligence will go along with education, complement each other and enhance each other side by side. [16]

C. Artificial intelligence in education provides the potential for more personalized, personalized, flexible, inclusive and engaging learning. [16] says, can provide educators and learners with tools that allow us to respond not only to what is being learned, but also to how it is learned and how the student feels.

D. Artificial intelligence in education can help in cooperative learning, which is a daunting task that one teacher can do alone. [16] states that AI in education will create cooperative learning by ensuring that the right group is formed for the task at hand, or by providing Just-in-time targeted support. [16] While the teacher works in a limited place and in a limited time and individually, learning by means of artificial intelligence systems can be a collaborative interactive learning environment, and the teacher and the student can reach it from anywhere and at any time. [17]

E. Despite the positive impact and innovation opportunities provided by artificial intelligence, it is not without its negative impact. In the era of artificial intelligence, the function of education is no longer "to preach, to receive, to solve", but to reshape the human brain itself.

1) The Impact of Artificial Intelligence on Schools - With this technology in place, education will change. We may dispense with the school environment, but new types of learning centers will be introduced, and students will be allowed to choose courses in different learning centers. This modern system of schools will contribute to adapting to the needs of industrial workers in the industrial era, in line with the requirements of unifying the collective upbringing of the talents required in that era.

2) The impact of artificial intelligence on teachers - With the emergence of the virtual teacher and other systems that rely on artificial intelligence in education, researchers and experts in this field believe that the role of the teacher will change and can be replaced and the machine will help students to learn. Artificial intelligence systems are also more efficient and accurate than humans at teaching and will also be available everywhere, anytime. [18] But there are fears among most researchers in this field that more teachers and education personnel will end up leaving and being replaced by smart machines to carry out sensitive matters.

On the contrary, many of the studies that relied in their study on the use of historical data concluded that the development of technology and the growth of labor productivity will lead to job creation and a reduction in overall unemployment. On the other hand, it is known that the need for industrial products and services is caused by population growth which is one of the important reasons that eliminate unemployment despite the presence of automation. There are many factors that contribute to economic growth, such as education and globalization, as well as increased consumption of natural resources, and advances in science and healthcare. Therefore, it is difficult to know for sure the future of the world using historical patterns. [2]

3) Many scholars in this field as in [19], such as Francisco, et al in 2016, and Tsai, et al in 2017, have sparked controversy in the impact of artificial intelligence on education in light of these tremendous innovations in the twenty-first century. As they all expressed the opinion that artificial intelligence will lead to problems that affect the behavior and emotion of the individual, which in turn will affect the psyche of the learners and will make them lose their internal security. [19].

Artificial intelligence has benefits that will create many changes in education, and in order to achieve the maximum benefit we must better use this tool. But the presence of this tool will pose challenges in how to balance traditional education with its inherited practices that have been created since ages and the capabilities of modern artificial intelligence. [21] As the scientist Joshua Bengio of the University of Montreal as in [19] said, artificial intelligence has risks that would affect society if these machines were left unchecked.

VII. CONCLUSIONS AND FUTURE RESEARCH

In the midst of this great development in technology, some go far in believing that artificial intelligence will control the entire educational process, while others see that artificial intelligence will revolutionize the field of education and will work to improve educational practices and their outcomes. This paper provided an overview of artificial intelligence as a concept and stages of development of this technology and its

role in the future of education, as well as indicating the potential impact on learning, education and education. The results indicated that artificial intelligence brings new opportunities for development in addition to huge challenges for education. If there is an effective application of artificial intelligence methods, it will contribute to the success of today's learners in individual studies. Smart teaching systems also increase productivity inside and outside the classroom and will help in adopting educational content to students' needs.

Educational technology is not only related to technology, but rather with educational, ethical and social dimensions. However, it has been noted that issues related to ethical implications are rarely discussed in studies, such as critical thinking of educational and ethical implications in addition to the risks of implementing AI applications. And because teachers are the cornerstone of education, training them in artificial intelligence will help prevent misuse of this technology.

I propose further research on the use of artificial intelligence techniques and to interact in depth with educational theories and also focus on the ethical implications of this technology. Educational perspectives (educators) on these technological developments are needed to create learning systems and smart teaching.

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