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Artificial intelligence as a pioneering step in school institutions

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Abstract **- In this paper, we deal with the potential applications of Artificial Intelligence in educational institutions. One of the main goals of applying the mentioned technology is to make the education system more efficient if possible. Based on research in this area in the world, our impression is that there is a long-term plan for introducing AI in schools, as a new kind of learning standard. The idea is not for artificial intelligence to completely take over the domain of education, but for some processes to be better organized or improved, so that the result of learning would be of better quality. New technologies, in the form of modern learning platforms that incorporate AI as one of the most important components of the system, significantly improve the communication and research work of students. It is evident that new generations are coming whose experience will be significantly different from ours, and that the new technologies from the domain of AI that we consider in this paper will significantly affect the design processes in the future.**

Keywords – ***education, artificial intelligence, machine learning, technology, robots***

Apstrakt – U ovom radu bavimo se potencijalnim primjenama AI u obrazovnim institucijama. Jedan od glavnih ciljeva primjenom pomenute tehnologije jeste da se obrazovni sistem učini efikasnijim ako je to moguće. Na osnovu istraživanja ove oblasti u svijetu, naš utisak je da postoji dugoročni plan za uvođenje AI u škole, kao novog vida standarda za učenje. Ideja nije da vještačka inteligencija u potpunosti preuzme domen obrazovanja, već da se neki procesi bolje organizuju ili unaprijede, kako bi krajnji ishod učenja bio kvalitetniji. Nove tehnologije, u vidu savremenih platformi za učenje koje inkorporiraju AI kao jedan od najvažnijih komponenti sistema u značajnoj mjeri poboljšavaju komunikaciju i istraživački rad učenika. Evidentno je da dolaze nove generacije čije će iskustvo biti značajno drugačije u odnosu na nas, i da će nove tehnologije iz domena AI koje razmatramo u ovom radu značajno uticati na obrazovne procese u budućnosti.

Ključne riječi **– obrazovanje, vještačka inteligencija, mašinsko učenje, tehnologija, roboti**

I. INTRODUCTION

In today's era of the Internet and the Internet of Things, one direction of research is becoming increasingly popular and ubiquitous. It is about artificial intelligence and its branch - machine learning.

Artificial intelligence that can independently write poetry and prose or programming code is no longer just a common occurrence in science fiction literature or movies, nor is it an idea in the minds of scientists around the world but has become an everyday thing. Artificial intelligence has become an integral, unavoidable part of our daily lives: from Siri to auto-journalism, from predicting stock movements to predicting crime, from facial recognition to medical diagnoses, and more. But of particular interest here is artificial intelligence entered the classrooms. It is shown in Figure 1.

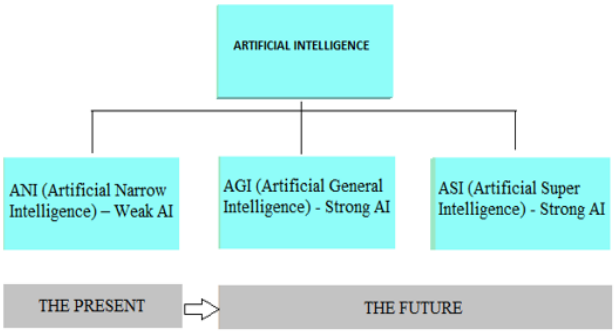

Figure 1. Types of artificial intelligence [1]

Machine learning is a branch of artificial intelligence that involves methods or algorithms that automatically create models from data. News about the successful application of machine learning emerges every day.

Machine learning in education is a form of personalized learning that can be used to provide each student with a personalized educational experience. Due to its properties, we can say that ML increases students' involvement in the educational process and their love for engagement and learning.

One of the parts related to machine learning and its application in education is predictive analytics. It focuses on understanding the needs of students. It helps conclude what might happen in the future.

Some of the main ways in which artificial intelligence and machine learning raise the quality of teaching in educational institutions are more accurate and objective assessment, advanced learning analytics, efficient organization, and access to material, increased knowledge acquisition, personalization of learning, improvement, and updating of courses enables

learning from any place at any time and makes learning less stressful.

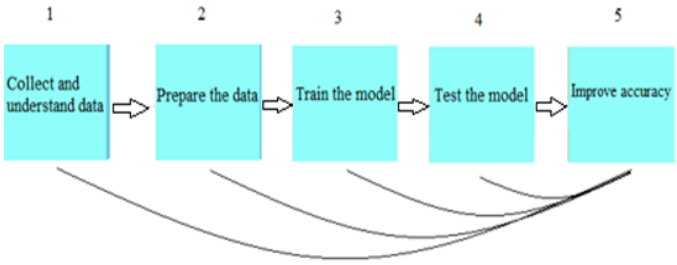

Figure 2. Workflow for machine learning experiments and projects [1]

II. GENERAL ASPECTS OF COMPUTER-ASSISTED EDUCATION

The whole world relies on the possibilities provided by computers and their applications to educate and work. Education is limitless, where the computer helps with the obstacles that come in the way. Computer-assisted education is a success in today's era. [2] The use of computer-assisted learning enhances modern education and provides better learning opportunities that cannot be taught through traditional methods. Most children and adults nowadays spend most of their free time on computers, tablets, and phones, both at home and school, so it is no surprise that computers are increasingly included in schools. [3]

Computer-assisted learning is most often used and is very effective for achieving interaction between students and the computer to improve the already existing learning technology and make the teaching more dynamic and interesting. Computer-assisted learning includes artificial intelligence, multimedia educational software, virtual reality, and computer simulations. [4]

Computer-assisted learning along with information and communication technologies adapted to the individual who wanted to enhance their learning through instructional systems. The main difference in the approach in the past and now is that in the past information and communication technologies relied more on mechanical learning (rote learning) embedded in learning with the help of computers, while today's application of artificial intelligence is a much better solution, and at the same time it has the same the goal of adapting to personalized learning. [5]

III. ARTIFICIAL INTELLIGENCE IN EDUCATION

Artificial intelligence systems are one of the main pillars of the Fourth Industrial Revolution that are happening right now. In the 21st century, education must be as accessible as possible. Access to education and lifelong learning is included in the most important global strategy. [6] AI technologies have been researched in educational contexts for around fifty years. [7]

In the continuation of the paper, some examples of the application of artificial intelligence in education will be presented:

Using computers in class

The gradual introduction of IT methods and devices in education depended on the development of the field of information technology. Computer-Aided Learning is a breakthrough in learning. Some of the advantages of using computers in class are easier access to learning materials (websites of educational institutions, exchange via email) and increased student motivation. The computer education of students includes not only the knowledge of hardware and software, but also an insight into the development processes of information technologies and into the social, legal, economic, and psychological processes that have the context of that development. [8]

Contemporary educational information technologies as didactic media in teaching

Information technology is one of the most important factors affecting the development of today's society. Modern teaching information technology is not the technology of students, but the technology of teachers. Instead of learning about modern information technology, students use its products as a technical teaching tools.

With modern technology, the teacher prepares lessons, organizes the classroom, and monitors students' knowledge. His main task is to introduce the highest degree of computerization of information technologies into the educational process to improve the content of the classroom. The wide use of teaching materials that determine the effectiveness of information technologies and technical means is one of the main characteristics of modern teaching techniques.

The degree of use of information media such as computers, electronic communications, radio, and television is determined by two factors:

- Create instructional materials about learning effective topics.
- Check whether teachers are willing to use the correct technical means and teaching materials in an orderly manner in practical work.

The computerization of the teaching process is one of the main directions and fields of modern teaching technology. [9]

Web-oriented intelligent tutoring systems

Intelligent tutoring systems are used for interactive learning through multimedia. Mentors and tutors are people who provide professional assistance in a specific field and help in acquiring specific skills and knowledge in the learning process. Moving into the context of information technology and artificial intelligence, intelligent tutoring systems (ITS) represent software that simulates the behavior of tutors/teachers, that is, learning assistants.

More specifically, the software provides personalized learning support and assistance by asking students questions,

analyzing their language, and providing tailored guidance and feedback to help students learn and understand the content.

What sets this educational software apart is the intelligent tutoring system that interprets student responses and reacts accordingly. So, the purpose of this software is not only to identify the right/wrong answer but to identify in which step the student is making a mistake and provide appropriate feedback to the student accordingly. [10]

The purpose of intelligent tutoring systems is not to replace humans who bring complex social interactions into learning and education environments but to facilitate and improve the process of learning and understanding material.

The main advantage of this tool is that it works with a large number of students, supports each student, adapts to their speed and specific learning needs, and is easily accessible without time constraints.

As such a system, we can take an example: SmartTutor at Hong Kong University (HKU), which uses SmartTutor to support the needs of graduate students. Personalized learning has been identified as a key need in adult education, and SmartTutor aims to meet this need. SmartTutor supports students through a combination of Internet technology, educational research, and artificial intelligence. [11]

Distance learning success

We are facing sudden changes in all spheres of society and the move to an online environment, communication, and life. [12] The appearance of computers and the development of the Internet played the most important role in distance learning because in this way access to the necessary learning materials is enabled, even though the student and the professor are located in distant locations, mutual communication can be achieved.

Distance learning gives students a sense of greater freedom, as they dictate the pace of learning and studying the material themselves. It is not necessary to physically attend the lecture, but they can choose a time when they have no other obligations to acquire additional knowledge. They are not tied to one space but have complete freedom of access from different locations. This form of learning allows students unlimited time and space, better organization in the process of mastering the material, and, of course, easy and quick access to data. [13]

A comparative study of distance learning and traditional schooling has shown that distance teaching and learning can be just as successful as traditional education when appropriate teaching methods and technologies are used and when there is interaction and timely feedback between teachers and students. [14]

IV. AN EXAMPLE OF ARTIFICIAL INTELLIGENCE IN EDUCATION – A ROBOT TEACHER

Changes happen every day, but one of the biggest is the development of technology. Teachers will always have a role in education, but that role may change due to new technologies in the form of intelligent computer systems. The advancement of digital technology also affects education. Teachers and educational institutions should follow technological developments. [15]

For this reason, robotics is increasingly being used in education and that is why robot education is becoming more and more popular. The term robot most often refers to an industrial robot called a robotic manipulator or robotic arm. [16]

The introduction of robotics into general education will ensure easier and simpler use of robots and the acquisition of knowledge about robotic devices. The robot cannot replace the teacher, but it can help him and reinforce the teaching content by repetition. Robots are capable of independent movement, recognition and interaction of the environment, and non-verbal communication such as gestures and facial expressions.

They have a computer screen on their body, which is why they differ from personal computers. [17] Younger generations are more receptive to new technology, and this is why it is necessary to change opinions and use of technology.

Today, "computer literacy" is mandatory because technology is found in every segment of life. Through the use of robotics, informatics, mechanics, and electronics are learned because the robot is the most complete mechatronic object. Robots are of increasing interest to teachers and researchers as a tool for developing cognitive and social skills for students from preschool to higher education. [18]

The introduction of robots into the educational system must have a management system that ensures the safety of robots and people, and the main issue will be the safety of students in the presence of robots. Robots in education include a variety of robots that have different roles. In addition to the role of teacher or tutor, robots can also support learning through peer relationships and can support adaptation and mastery of skills by acting as a beginner.

The robot as a teacher provides direct support to the curriculum through advice, tutorials, and supervision. [19] Figure 3 shows an example of such a robot.

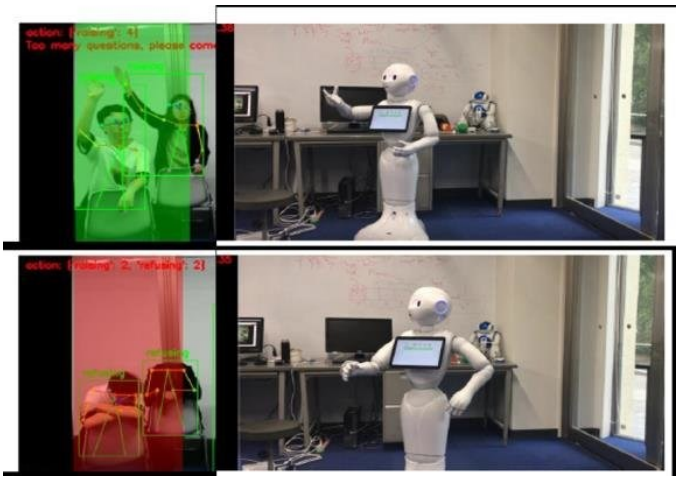

Figure 3. The robot's reactions to the student's behavior [4]

Figure 3 shows the robot's reaction to students' behavior. The first picture is engaged students raising their hands, and the second picture is of students sleeping.

The role of teachers is to provide students with the opportunity for practical work and research and thus ensure that children build their knowledge.

Working with robots creates an environment where students can solve real-world problems, making robots an excellent tool for children to acquire a constructivist learning style. [20] In South Korea, Japan, Taiwan, Canada, and the USA, the first robotic applications were used in education.

Figure 4 shows some examples of robots in learning. Image A shows the iCat robot teaching young children to play chess. [21] Image B shows NAO the robot helping a child improve his handwriting. [22] In image C, the Keepon robot is teaching an adult a puzzle. [23] And image D shows Pepper the robot motivating English classes for Japanese children. [24]

Some of the benefits of teaching robotics in schools are:

- It's fun for kids. Video game design and robotics have been proven to be the most successful for learning information technology.
- A successful way to learn programming languages. By programming robots, students learn to program and learn basic commands.
- Creating better skills for future employment.
- It is also suitable for the development of children with special needs. For example, robots provide clear and calm responses, which suits children with autism (Robot Nao).
- Demystifying complex technologies. Working with robots breaks the fear of unknown technologies.

This way of learning offers practical and fun activities that are increasingly interesting to students. Learning with the help of robots is based on constructivism, where building knowledge is based on one's own experience. [25]

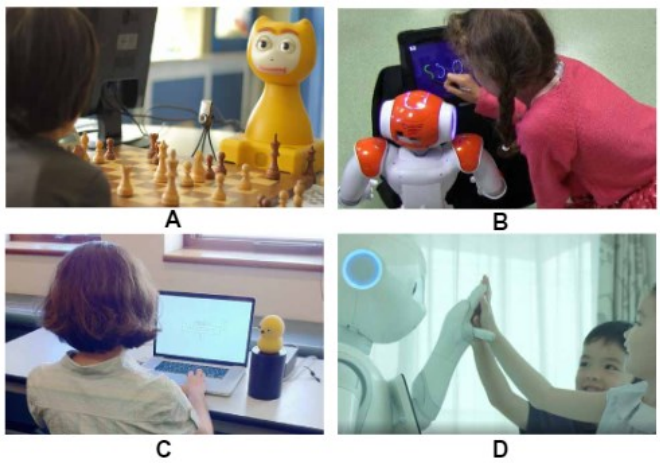

Figure 4. Examples of robots for learning [25]

V. CONCLUSION

Throughout history, man has always tried to create machines that would resemble him. Artificial intelligence can be effectively applied in all branches of education. The use of robots in education is increasingly popular today. The traditional approach to work no longer works and makes no sense in today's lifestyle. People should be aware that technology only makes their lives easier and its development should be seen as a positive aspect of modern times.

Changes in technology entail various changes, as well as changes in the entire system, especially the education system. The introduction of advanced technologies into the education system, in this case, different forms of artificial intelligence, cannot be stopped, nor is there any need to do so. Unfortunately, most schools today do not support the use of technology and thus cannot develop the competencies needed in the 21st century.

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