



## Artificial Intelligence and Education: An Overview

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### Abstract

The main purpose of this research is to present a comparative perspective to everyone who is interested in education in terms of the advantages and disadvantages of the use of artificial intelligence in education. When the literature on this issue is examined, it is clearly seen that there are both positive and negative opinions about the use of artificial intelligence in education. This situation leads to instability in the education systems of the world countries. As a result of this instability, on the one hand, while education systems look at the use of artificial intelligence positively in order to keep up with technology and benefit from the advantages that it can provide, on the other hand, they hesitate when they consider the disadvantages that this situation may cause. For this reason, in this study, comparative information was given in order to conclude this indecision and hesitation experienced by education systems, and the idea of using artificial intelligence as an assistant teacher in education and seeing it as an opportunity rather than a danger was advocated.

**Keywords:** Artificial Intelligence; Education; Technology; Advantages; Disadvantages; Assistant Teacher

### Introduction

Human beings have been described as the most intelligent of all living things due to the cognitive features they possess. The intelligence that human beings have makes them capable of many cognitive processes such as thinking, learning, reasoning, comprehending, perceiving, reaching conclusions, making decisions, and so on. With the invention of computers, it has aroused great curiosity about whether these cognitive features, which have long been known to be unique to humans, can also be realized by machines. Based on this issue, in 1950, the English mathematician Alan Turing wrote an article about "Can machines think?" and he sought an answer to the question of "If a person can perform skills such as decision making and problem solving by using the existing knowledge as well as logic, why can't machines do it?" [1]. Thus, the main idea that will enable the emergence

of artificial intelligence was put forward for the first time. However, the concept of "artificial intelligence" entered our lives for the first time in 1956 when it was expressed by John McCarthy at the Dortmund conference [1]. Since this date, artificial intelligence has become the most important building block of today's technology. In particular, thanks to its' superior, facilitating, and advantageous qualities, today, it has become possible to see artificial intelligence in every field such as communication, transportation, business, social media, entertainment, banking, health, finance, digital environment, education, and so on. Now let us take a closer look at the definition of artificial intelligence, which has an indispensable place in our lives. According to McCarthy [2], artificial intelligence can be defined as a computer's use of high-level cognitive skills such as reasoning, problem solving, making sense, and generalizing. Besides, according to Gondal [3], artificial intelligence is an information technology that

can perceive human cognition, reason, comprehend, make sense of, generalize, make inferences, learn, and successfully perform more than one task at the same time. Based on these definitions, we can say that artificial intelligence has the ability to imitate human intelligence and perform the various tasks that the human brain does. Singh and Jain [4] state that the general framework of artificial intelligence consists of perception, problem analysis, abstract knowledge, and experiential learning. Perception refers to artificial intelligence's ability to use a sensory system to get information about the world. The problem analysis refers to AI's ability to analyze the information obtained and suggest a solution to a problematic situation. Abstract knowledge means AI's ability to abstract knowledge and applies it to other areas. Lastly, experiential learning means AI's ability to learn from the real world [4]. When these aspects of the general framework of artificial intelligence are examined, it is clearly seen how similar they are to the abilities that today's education understanding wants to bring to individuals. Due to this similarity, the issue of how to effectively integrate artificial intelligence applications into education has come to the fore and a number of studies have been carried out for this purpose. The first of these studies was carried out by Sidney L. Pressey working at Ohio University. According to Pressey [5], the use of multiple-choice tests has the purpose of reinforcing the learning process as well as evaluating students' achievements. However, according to him, the necessary requirement for achieving the goal of reinforcing learning is immediate feedback on students' test results. In order to meet this requirement, Pressey emphasizes the inventability of a machine that immediately shows test results and informs students about the correct answer. After Pressey's this idea of integrating artificial intelligence with education for the first time, artificial intelligence began to take more place in education. However, when we compare it with other fields, although a long time has passed since the idea of using artificial intelligence in education, its' use is not at the desired level yet. Chopra [6] explains this situation as follows. Despite today's technological developments, it is expected that only 47% of learning tools will be equipped with artificial intelligence capabilities by 2024 [6]. This rate is quite low when compared to the use of artificial intelligence in other fields. Therefore, in order to increase this rate and to benefit from the opportunities of artificial intelligence, the education system in the world makes some plans and develops various applications. Also, in Turkey, in line with the 2023 targets, the Ministry of National Education carries out some studies in order to popularize the use of artificial intelligence in education [7]. The main reason why the use of artificial intelligence in education is at a low level and on the other hand, why some studies are carried out to increase this level is that the use of artificial intelligence in education has both advantages and disadvantages. Due to this ambivalent nature of the use of artificial intelligence in education, the

education systems of the world countries cannot decide exactly what kind of principle they will adopt regarding the use of artificial intelligence. On the one hand, they try to increase the use of artificial intelligence by considering the advantages that it can provide in education; on the other hand, they abstain due to some disadvantages that may be caused by the use of artificial intelligence in education. For this reason, in this study, the benefits of artificial intelligence in education and some negative situations that it may cause will be clearly revealed, thus a comparative perspective on the use of artificial intelligence in education will be presented. Although artificial intelligence has some disadvantages, it is clear that we will encounter it more in education in the near future. Hence, it is thought that this study will be useful and eye-opening for everyone who is interested in education to learn the advantages and disadvantages of the use of artificial intelligence in education comparatively, to be prepared for both situations, and take some precautions for its disadvantages.

## Advantages of Using Artificial Intelligence in Education

### Personalized Instruction

In the conventional education system model, all students are seen as being produced from a machine that produces a single molded product. According to this traditional understanding of education, there is a standard student model and every student is tried to be adapted to this standard pattern. Also, it is assumed that the students who are tried to fit this standard pattern have the same intelligence levels, interests, desires, needs, abilities, learning styles, learning paces, socio-cultural backgrounds, and so on. According to this understanding, a teacher, who has a class of 30 people, explains to each student a subject in the same style and pace, makes each student do the same activity, asks the same question, and gives the same homework. When evaluated from a logical perspective, although it is obvious that all these 30 people cannot have the same learning style, pace, and ability this fact has been ignored for many years and the education system has been continued with this traditional understanding for a long time. However, later on, it was understood that the traditional education model did not contribute to the success of the students due to its standardized perspective, and a personalized education model, which is much more beneficial, was developed instead of this education system. In the personalized education model, teachers who are in the facilitator position instead of an authority position consider each student as an individual with different characteristics. They accept that each student comes from a different socio-cultural environment, has different intelligence levels, learns with different methods and techniques, and has different interests, abilities, and

needs. According to Dockterman [8], personalized education means the adaptation of instruction by changing the content, mode, and rate in accordance with the specific characteristic of a learner. Today, this understanding of education is the most important goal of many education systems in order to increase the students' motivation and provide students with a more efficient education. Taveggia [9] conducted a comparative study to show the effect of the personalized education model on students' academic success and analyzed 14 studies conducted between 1967-1974. According to the results of the research, it was revealed that the academic success of the students who were educated with the personalized education model was superior to the students who were educated with the traditional education model. After the result of this research, the question of how it is possible to offer an education according to the specific characteristics of each student came to mind, and at this point, artificial intelligence came into play. Artificial intelligence collects data about students and analyzes their interests, needs, and abilities. As a result of this analysis process, it determines in which area each student is lacking educationally, what are each student's learning style (is it visual, auditory, or tactile), and learning pace. As a result of the data collected about each student, a personalized education model suitable for the characteristics of the students is presented. Also, activities suitable for students' development levels are determined and homework is given according to this level. Thus, students complete their academic development in accordance with their developmental level and increase their chances of success. The Intelligent Tutoring System (ITS) is one of the systems that plays an important role in collecting data about students and providing students with a personalized education opportunity. According to a study which is conducted by Akyuz [10], ITS ensures many benefits such as keeping students engaged longer, enabling them to learn at their pace, ensuring personalized learning, and increasing their motivation. On the other hand, data collection with voice and face recognition systems, and the creation of education profiles based on lessons, topics, and assessments are other methods of artificial intelligence to offer personalized education [11].

### Continuous Assessment and Feedback

Feedback is one of the most important factors in the learning process of students. When a teacher gives the feedback, students have the opportunity to obtain an objective comment about whether their performance is sufficient or not. Thus, while students with low performance have the chance to improve themselves by working harder, students with sufficient or superior performance increase their motivation and become more willing for their studies. Moreover, thanks to effective, constructive, and timely feedback, students learn about their strengths

and weaknesses, evaluate their performance, and show improvement. According to Rowe and Wood [12], students learn faster and more effectively if they have a clear knowledge of what they need to do to improve their performance and how they can do it better. Also, in a study conducted by Karaca [13] with 278 secondary school students studying in Eskişehir and Kütahya in the 2009-2010 academic year, it was revealed that the students found feedback important and necessary in terms of increasing the quality of education, but that the teachers lacked the ability to provide effective feedback. Although feedback has a very important role in the learning process of students, teachers cannot always fulfill this important task due to the large student population and the limited time frame. For this reason, either the feedback cannot be given in a timely manner or is limited to only a few students. However, with artificial intelligence, it is possible to give timely and immediate feedback to each student. Thanks to artificial intelligence, students can get immediate feedback after an activity or exam they have completed and see their right and wrong answers. For example, when teachers prepare the exams through the Canvas application, students can immediately access the correct answers and instantly see the score they got from the exam. Thus, they have the opportunity to see their shortcomings in a topic and to improve themselves. In addition, thanks to the feedback and continuous assessment feature of AI, teachers save time and lighten their burden.

### Virtual Classroom Environment

Another opportunity offered to students with the use of artificial intelligence in education is the chance to learn with live experiences in a virtual classroom environment. In particular, with the inclusion of 3D, hologram learning environments, smart laboratories, and VR technologies in education, students have the opportunity to experience many events and situations live while learning about a subject [14]. For example, thanks to the AI applications, students are able to examine many landforms in 3D in the geography course, they can see the human anatomy live in the biology course, and they can examine the artistic features of various historical buildings virtually in the history class. Also, it provides authentic immersive experiences (the subjective impression involved in a realistic experience) that simulate some aspects of the real world (such as dangerous environments or a geographically or historically inaccessible place) that students would not otherwise be able to access [7]. Thus, through learning in a virtual environment like in the examples above, students' learning becomes easier, faster, more permanent, and interactive. Apart from these benefits of the virtual classroom environment, Hiltz [15] revealed in a study that the virtual classroom environment is also beneficial in terms of developing collaborative learning among students.

### Collecting Data about the Student

Thanks to the ability of artificial intelligence to collect data about students, students are recognized from a holistic perspective. Thus, students are known in many developmental aspects. Also, artificial intelligence, which collects data in areas such as socioeconomic status, familial issues, psychological and emotional processes, as well as students' academic processes, can easily determine if there is a problem in any of these areas. For example, it can identify a student who has to drop out of school due to financial inadequacies and take the necessary steps to prevent this situation. Besides, a student who has experienced domestic violence or been abused can also be identified by Image Analysis or Sensitive Analysis of the Individual techniques, and this individual can be provided with the necessary psychological support [16].

### Providing Equal Education

Today, with the effect of some situations such as globalization and migration, classroom environments have students with different characteristics in terms of religion, language, culture, and race. Unfortunately, some teachers who teach in such classes may show some prejudiced or discriminative behaviors against students of a different race, gender, religion, or language. Especially, in some cases, they can be more indifferent and harsher towards these students and because of their discriminative behaviors, students' academic and emotional development can be affected negatively. To avoid this negative situation from happening, the use of artificial intelligence is a very significant alternative, because artificial intelligence ensures that all students are treated equally in terms of being fair and consistent and that there is no discrimination or prejudice against students for reasons such as gender, race, language, religion or being hardworking [17].

### Distance Education

The most important development provided by artificial intelligence in education is that it offers individuals the opportunity of distance education. With artificial intelligence, the perception that education can only be taken in a certain place and time has changed, instead, the perception that education is independent of time and place has been accepted. In this way, individuals have the opportunity to receive education wherever and whenever they are and have the chance to develop themselves throughout their lives. Especially, with the development of mobile technologies, many instructive applications were developed and presented for the use of students. For example, thanks to the Duolingo application, which is a language learning system, students had the chance to learn English whenever and wherever they

want without having to go to school [18]. According to the data from National Center for Education Statistics, in 2019, 7,313,623 students enrolled in distance education courses at all postsecondary institutions. This number is expected to increase in the coming years and distance education is expected to take a much more place in our lives.

### A Teacher Model away from Human Characteristics

Since the teacher model created with artificial intelligence will be different from a teacher model with human characteristics, it will not have the problems that a teacher with human characteristics will experience. For example, the teacher model created with artificial intelligence will not have feelings and thoughts such as anger, impatience, or prejudice, and thus will not be able to reflect these feelings towards students. In this way, he/she will patiently answer every question of the students, repeat a topic until students understand it, and will not get angry at students' misbehavior. Thus, students who have introverted and shy personalities will be able to listen to the teacher without feeling worried and easily ask questions about the subjects they do not understand. In addition, since this teacher model will be away from a humane life, it will not have to deal with things other than education, such as life troubles and diseases and so, it will be available 24/7 hours for students [17].

### Adaptive Learning for Students with Special Needs

Artificial intelligence provides a unique opportunity for students with special needs to receive their education efficiently at the maximum level. Especially, the smart devices that will facilitate the learning of individuals with visual and hearing impairments are one of the most important contributions of artificial intelligence in this field. For instance, electronic magnifiers, Braille note-takers, and Braille typewriters used by students with visual impairment are some of the examples of smart devices that are invented thanks to artificial intelligence.

### Disadvantages of Using Artificial Intelligence in Education

#### Lack of Social and Emotional Aspects

Although artificial intelligence has many advantages, its lack of social and emotional features is the most important feature that creates hesitation in using it. As it is clear, artificial intelligence is lacking in basic human emotions such as love, commitment, empathy, and so on. Because of this deficiency, students cannot communicate or interact

with such a teacher model, they cannot tell their dreams, and they cannot share their happiness or sadness. On the other hand, such a teacher model cannot stimulate motivation and confidence in students and cannot form an emotional bond with them. However, Schiff [19] emphasizes in his research that a successful education process requires interacting with students and establishing an emotional relationship with them. In an emotionless classroom environment, the relationship between teacher and student cannot go beyond a motomot transfer of knowledge and this kind of relationship cannot be called education, it is only teaching. However, education is much more than knowledge transfer. In a study, Zhao and Liu [20] state that while teaching is provided with knowledge transfer, education is a special term and it takes place with character development, encouraging creativity, and inspiring students. When we think from this perspective, we can clearly understand that artificial intelligence cannot improve students' social and emotional development.

### A Non-Human Teacher Model

Another point criticized in the teacher model created with artificial intelligence is that this model does not have human characteristics. First of all, since the physical appearance of this teacher model is more like a robot rather than a human, it is not known exactly what effect this situation will have on students. In the long term, this may cause students to lose their social and emotional aspects and become dehumanized. Also, it is not yet clear whether students can trust, respect, and take seriously a robot as they trust, respect, and take seriously their teachers because it is not normal to attribute human characteristics to a mechanical tool. Besides, the teacher is a very important role model for students with his/her behaviors, attitudes, ideas, and moral characteristics. Thanks to these characteristics, students learn from them what kind of a person they should be in the future. However, when the teacher of the students is a robot, it is not possible for them to take it as a role model and to identify its moral attitudes and behaviors with themselves.

### Systemic Problems

Since the use of artificial intelligence in education is a new situation, the long-term effect of this system on the academic, social, psychological, and emotional development of students is not fully known. For this reason, we cannot say that this system is completely reliable and useful. In addition, since there is a possibility that the system may crash or be hacked, its' use may be dangerous. In such a case, the information collected about the students may be lost or captured by others and this may endanger the safety of students. Also, where the data collected about students is stored and who has access to them are some of the criticisms about the system [14]. If the data collected about the

students fall into the hands of malicious people or countries, undesirable situations may arise.

### Risk of Replacing Teachers

Since artificial intelligence has a very important place in people's lives and can do many things that people can do, a very important question has arisen that occupy people's minds; Can artificial intelligence replace humans? Although this question is asked by people from almost every profession, with the increasing use of artificial intelligence in education, it has become a frequently asked question by teachers. Teachers are concerned about the fear that they will lose their jobs and artificial intelligence will take their place. The anxiety of teachers due to artificial intelligence has become a very common situation all around the world and because of its' negative effects on people, Wang and Wang [21] developed an artificial intelligence anxiety scale (AIAS) to measure the anxiety caused by artificial intelligence. Although teachers are concerned about the possibility that artificial intelligence may replace them, many experts are of the opinion that such a situation is not possible due to some reasons. According to Kolchenko [22], not every student will like the artificial intelligence system equally. Students who are dissatisfied with this system will exhibit some behaviors aimed at deceiving the teacher model created with artificial intelligence, and this will cause the artificial intelligence to present an incorrect personalized education plan for the student. In addition by saying that artificial intelligence cannot cope with students who are afraid and avoid learning and that artificial intelligence will be insufficient in creating student-teacher interaction, Kolchenko [22] emphasizes the fact that artificial intelligence cannot replace the teacher. Besides, according to Tyson [23], although artificial intelligence can provide students with a quality academic life, after a while the main thing that students will need will be social interaction, and artificial intelligence will be lacking in this regard. Lastly, according to Felix [24], because artificial intelligence cannot teach cultural values, historical and social norms and cannot build a positive classroom environment by resolving conflicts, a human teacher is one step ahead with his/her ability, posture, voice, gestures and facial expression and that artificial intelligence cannot replace the teacher [25].

### Conclusion

As a result, in today's technology world, the integration of artificial intelligence with the field of education is an inevitable situation. For this reason, it is very crucial that the education systems of the world countries are knowledgeable about the advantages and disadvantages of the use of artificial intelligence in education. In this study, especially, considering the fact that the use of artificial intelligence in education will

increase in the near future, it is aimed to give comparative information about the positive and negative aspects of the use of artificial intelligence to everyone who is interested in education. For this purpose, firstly, information about what artificial intelligence is, how it emerged, and how it started to be used in education was given and then the advantages and disadvantages of artificial intelligence in education were mentioned. As seen in the study, artificial intelligence provides students with a personalized teaching model and continuous evaluation and feedback, facilitates learning in a virtual classroom environment, collects important information that will help students to be recognized, offers equal education opportunities, provides distance education, and facilitates learning for students with special needs. In addition to all these advantages provided by artificial intelligence, it can be said that it also has some disadvantages due to its lack of social and emotional aspects, being far from human characteristics, the possibility of systemic problems, and most importantly, the possibility of taking the place of teachers. Although these disadvantages cause some hesitations about the use of artificial intelligence in education for the education systems of the world countries, considering the advantages it will ensure, it is clearly seen how important developments artificial intelligence can provide for the education and learning of students. Therefore, in my opinion, in a digitalized world, it will not be a logical attitude to reject the reality of artificial intelligence because of some negative aspects it has and not to keep up with the changing world order because of these negativities. In my opinion, the most important thing to do about this issue is to take advantage of the positive features of artificial intelligence as much as possible and to see artificial intelligence as an opportunity rather than a threat. Although the most important reason for the hesitancy in the use of artificial intelligence in education is the fear that it will replace teachers, it should not be ignored that this situation will not be possible for some reasons as stated in the study, and the idea that artificial intelligence can be used as an assistant teacher should be emphasized. In this way, it will be possible to keep up with the technology and benefit from its advantages sufficiently, and some negative situations that artificial intelligence may cause will be prevented.

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