ADVANTAGES AND DISADVANTAGES OF IMPLEMENTING ARTIFICIAL INTELLIGENCE IN THE EDUCATIONAL PROCESS

Summary. The article discusses the main aspects of the use of artificial intelligence in education, focusing on its advantages and challenges. The author defines AI as a system of functional computer technologies that model human thinking and skills, such as analysis of complex systems, judgment, and dialogue support. AI allows collecting and analyzing large amounts of data, developing individualized teaching methods, automating control, and providing feedback. Innovative technologies in education have proven to be effective even in times of crisis, such as quarantine and war. The main benefits of AI include personalization of learning, creation of individualized plans, immersive learning, and intelligent progress tracking, which reduces the workload of teachers and allows them to focus on students. At the same time, AI adoption is facing resistance to innovation, financial challenges, and skepticism about its effectiveness. Most AI programs focus on content presentation and testing, which does not promote critical thinking and creativity. Research prospects include developing methodologies for evaluating AI’s effectiveness, integrating learning theories with practical developments, and addressing ethical issues.

Keywords: artificial intelligence, education, personalization of learning, innovative technologies, digitalization.

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Problem statement. Artificial intelligence is a system of functional computer technologies that model human thinking and skills, such as analysis of complex systems, sound judgment, dialog support, etc. AI can be defined as a scientific field that sets and solves problems of hardware or software modeling of those types of human activities that are usually considered intellectual.
to develop and implement teaching methods for specific disciplines in an individual trajectory based on the collection and analysis of large amounts of data and software modeling. It simulates human speech activity to solve educational, communicative and professional tasks, automates control of learning material, provides feedback, and performs analytical work [2, p. 171].

Domestic scientists note that: "innovative technologies in education have demonstrated their promise and potential both during the quarantine of 2020-2023 and during the full-scale war against Ukraine. The destruction of the ability to conduct the educational process directly on the basis of educational institutions did not lead to the collapse of the educational process. Some educational institutions – schools, colleges, universities – resumed teaching in a full synchronous format within a few weeks from 02/24/2022" [3, p. 389].

Different authors' definitions of AI include its ability to perform tasks in a human manner, implement machine intelligence for tasks such as playing chess, proving mathematical theorems, writing poetry, and diagnosing diseases, and using algorithmic constructs that copy human intelligence.

It can be argued that the ability to replenish primary knowledge is one of the key features of intelligent systems, which is called intelligence. Thus, an intelligent system is an autonomous cybernetic system capable of analyzing the current situation, making decisions, and learning.

Today, AI is widely used in educational practice, in particular, in intelligent learning systems, educational robots, information dashboards, adaptive learning systems, etc. Since its emergence several decades ago, AI has been viewed as a powerful tool and a condition for the formation of new paradigms of education and technological development. AI has created new opportunities for educational innovation: the transition to personalized learning, which has changed the role of the teacher. The use of AI-based technologies, such as natural language processing, artificial neural networks, machine learning, deep learning, and genetic algorithms, has made it possible to create an intelligent learning environment.

However, despite numerous successes and the introduction of AI in the educational process, there are significant problems and challenges. The mere use of advanced AI-based computing technologies does not guarantee quality educational outcomes. In addition, the use of innovative technologies should be closely linked to learning theory. The analysis of research in this area has revealed a significant gap between AI methods and theoretical foundations of learning, which critically affects the results of AI implementation in education.

Research shows that AI faces serious challenges in education, such as meeting individual learner needs, providing relevant content at the right time, and encouraging learners to actively participate in their own learning. Despite advanced computing and information processing methods, AI alone does not ensure high-quality learning and good educational outcomes. Innovative technologies must be integrated with relevant learning theories to be effective. Studies have shown that most cases of AI application in higher education do not take into account critical theoretical, pedagogical, and ethical aspects [4; 5].

Thus, the purpose of this article is to highlight the main models of artificial intelligence application in education with a description of the relevant theoretical foundations and practical implementations. There is a need to explore in more detail how AI can be effectively integrated into the educational process, meeting the needs of students and improving the quality of learning. This includes studying the theoretical, pedagogical, and ethical implications of AI, as well as developing recommendations for its effective use in educational practice.

Analysis of recent research and publications. Recent research and publications on the introduction of AI in the educational process demonstrate a significant interest in this topic and reveal various aspects and challenges faced by modern educational systems. In particular, researchers analyze the effectiveness of AI in individualizing learning and improving the quality of educational outcomes. For example, S. Yahodzinsky examines anthropomorphic information networks and convergent technologies, focusing on their challenges and opportunities for the educational process, while N. Bobro emphasizes the positive impact of AI on educational outcomes.

Researchers also note the importance of the digital transformation of education, which has been accelerated by quarantine restrictions and other global events such as military conflicts. For example, A. Tymoshenko, A. Kozynets, and S. Yahodzinsky analyze the evolution of digital technologies in education, emphasizing that even in crisis situations, such as the 2020–2023 quarantine, digital tools have made it possible to ensure the continuity of the educational process. In addition, S. Karpluk explores the specifics of the introduction of digital technologies in higher education in Ukraine, emphasizing the importance of AI and other innovations for the transformation of the educational process.

However, the study also points to numerous challenges and the need for further research to overcome existing problems. The authors emphasize that the mere use of advanced computing technologies does not guarantee quality educational outcomes. It is necessary to ensure a close connection between innovative technologies and learning theories to effectively integrate AI into the educational process and ensure its successful implementation.

Identification of previously unsolved parts of the overall problem. Despite numerous studies and publications covering the introduction of AI into the educational process, there are still aspects that require deeper study and further research. First of all, there is no systematic approach to integrating AI with learning theories. Most studies focus on the technological capabilities of AI, but do not take into account the pedagogical foundations, which is critical for the effective implementation of innovations in education. This leads to the fact that the latest technologies do not always provide.
The expected level of learning and development for students.

Second, there is no clear methodology for evaluating the effectiveness of AI in the educational process. Existing studies are often limited to descriptive results without an in-depth analysis of the impact of AI on various aspects of the educational process. It is necessary to develop standardized criteria and evaluation methods that will allow for objective measurement of the results of AI in education and reveal its real effectiveness.

The third important aspect is the lack of attention to ethical issues related to the use of AI in the educational environment. The introduction of AI technologies may be accompanied by the risks of privacy violations, algorithmic bias, and unequal access to technology. Ethical standards and policies need to be developed to ensure the fair and safe use of AI in education, protecting the rights of all participants in the learning process.

**The purpose of the article.** The main purpose of this article is to identify the main models of artificial intelligence application in education with a detailed description of the relevant theoretical foundations and practical implementations. The article aims to explore in more depth how artificial intelligence can be effectively integrated into the educational process, meeting the needs of students and improving the quality of learning. This includes analyzing the theoretical, pedagogical, and ethical implications of artificial intelligence, as well as developing recommendations for its effective use in educational practice.

**Summary of the main material.** The evolution of AI applications in education can be represented as a sequence of successive models. In this article, we consider three models (Table 1).

Let's take a closer look at the models. Thus, in the Pupil/Student as Recipient model, AI provides knowledge in the subject area and guides learning processes, while the pupil/student acts as a recipient of the AI service. The theoretical basis of this paradigm is behaviorism, which emphasizes the construction of carefully organized content sequences that lead to the correct completion of the task by the student.

The first model sees learning as a process of reinforcing knowledge acquisition through programmed instructions that introduce new concepts in a logical, step-by-step manner, providing immediate feedback in the event of incorrect answers and maximizing positive reinforcement. The pupil/student acts as a recipient, responding to predefined sequential blocks of learning content, and following predefined procedures and learning trajectories. In the first model, AI systems retain the characteristics of learning machines. It can be concluded that within this paradigm, AI systems are the least oriented to the needs of the learner.

A typical example of Model 1 is the early intelligent tutoring software systems, such as ACT Programming Tutor. ACT is an intelligent tutor built on a cognitive model of programming knowledge. As the student works, the tutor evaluates the student's growing knowledge in a process called knowledge tracking. Another example is Stat Lady, a series of computerized experiential learning environments that teach topics in introductory statistics. The program reflects the theoretical principles that learning is a constructive process enhanced by empirical immersion in the subject area.

In Model 2, "Learner/Student as Partner," the AI system relinquishes its controlling role and acts as a supportive tool, while the learner acts as a co-author of the system, focusing on the process of personalized learning. The second model is based on the cognitive and social constructivist view of learning, which presents learning as a process of interaction between learners and people, information, and technology in a socially determined context [1].

Accordingly, in the second model, the AI system and the learner must actively interact to optimize learner-centered, personalized learning. The AI collects individualized information from pupils/students as input to adaptively optimize the learning model, while the learner acts as a co-author interacting with the AI to organize more effective learning. Compared to the first model, the second model makes a significant breakthrough in the direction of personalizing learning through sustained collaboration between the learner and the AI system.

Dialogue-based learning systems or exploratory learning environments have been developed to achieve interaction between the system and learners. On one hand, the AI system collects and analyzes multimodal data from the learner to accurately understand their learning status. For example, some researchers have used a Markov decision process to automatically create rules using learner data and refine the rules as they generate new data. Other researchers have used dynamic Bayesian network models to represent multiple

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Table 1
hierarchies of learner skills and the relationships between different skills, which has increased the accuracy of representing learner knowledge [1].

In Model 3, Pupil/Student as Leader, the learner has freedom of action, and AI acts as a tool to empower human intelligence. This model reflects the principles of complexity theory, which treats education as a complex adaptive system that includes synergistic cooperation between different elements such as learners, tutors, information, and technology [3]. In this case, AI should be applied with the understanding that its methods are part of a higher-order system.

To achieve synergistic cooperation in a complex system, concepts such as human-computer collaboration, human-centered artificial intelligence and machine learning systems, human-AI collaboration, and human-centered artificial intelligence in education are used. In Model 3, AI helps students and teachers achieve increased intelligence by providing a high level of transparency, accuracy, and efficiency.

The student takes responsibility for being the leader of his or her own learning process and manages its risks. In general, the third model, as a trend in AI development, reflects the main goal of using AI in education, namely, enhancing human intelligence, abilities, and potential. Human-computer interaction based on advanced artificial intelligence methods and human decision-making has high potential.

Having studied the features of AI models in education, we will now analyze their advantages and disadvantages. One of the most important features of AI in education is the promotion of personalized teaching and learning. AI changes the teaching process by enabling individualized learning plans to be created according to students' needs, providing immersive learning and intelligent progress tracking. This helps students improve their learning abilities, reducing learning time and increasing efficiency. Adaptive learning technologies, enhanced by the potential of AI, contribute to an individualized approach to learning. AI can also reduce the workload of teachers, allowing them to focus on working directly with students and helping to develop their abilities. Teachers are moving from the role of knowledge disseminators to the role of facilitators, supporting students' initiative and independence.

Another benefit of AI is the creation of smart campuses that use modern technology to interact in connected and coordinated ecosystems. Technologies such as facial and text recognition, body motion and image analysis improve campus management, security, and the convenience of the learning and teaching environment. AI contributes to educational equity by helping to overcome regional differences and reduce inequalities in access to educational resources. Through distance personalized learning, students in remote areas can interact with outstanding teachers and access high-quality educational resources, and blended online and offline learning methods help to improve the teaching and professional development of teachers.

It is worth noting that there are obvious factors that impede the introduction of AI in education, including traditional resistance to innovation, risk aversion, and problems with financing expensive innovations. Many educators remain skeptical about the ability of AI-based technologies to enrich the learning process and increase its effectiveness, which leads to a conservative attitude in the education sector toward such innovations. Most current AI programs for education focus on content presentation and testing, reflecting a behaviorist model of learning that does not promote critical thinking, problem-solving, creativity, and knowledge management.

To overcome these barriers, it is necessary to strengthen cooperation between AI tool developers and learning experts, as well as to encourage interdisciplinary research involving the social sciences and humanities.

Another significant drawback is the perception of AI as a threat to teachers' employment. Despite assurances from AI advocates that the technology only makes teachers' jobs easier, many educators fear job losses. One of the key reasons for implementing AI is to reduce costs, which may lead to a reduction in the number of teachers. However, the greatest productivity gains are not achieved by replacing people with machines, but by empowering people with machines. AI can perform many routine functions, freeing up teachers to tackle more complex tasks and interact more deeply with students. This reinforces the thesis that the role of the teacher should be transformed from content delivery to skills development, where AI supports teachers but does not replace them. In the future, it will be necessary to pay more attention to the affective and emotional aspects of learning, which will increase the role of teachers in a society that widely uses AI technologies.

Conclusions. Summarizing the results of the study, we can conclude that the introduction of AI in the educational process has significant advantages, in particular, the promotion of personalized teaching and learning. AI allows the creation of individualized learning plans that meet the needs of students, providing immersive learning and intelligent progress tracking. This helps learners improve their learning abilities, reducing learning time and increasing efficiency. Adaptive learning technologies, enhanced by AI, facilitate an individualized approach to learning and allow teachers to focus on working directly with students and developing their abilities. Teachers are moving from the role of knowledge disseminators to the role of facilitators, supporting students' initiative and independence.

However, the introduction of AI in education faces a number of significant challenges. The education sector shows considerable resistance to innovation due to traditional approaches to learning, risk aversion, and problems with financing expensive innovations. Many educators are skeptical of AI's ability to improve the quality of learning, leading to a conservative attitude toward these technologies. Most AI programs for education focus on content presentation and testing, which does not promote critical thinking, problem-solving, creativity, and knowledge management. To overcome these barriers, it is necessary to strengthen cooperation between AI tool developers and learning experts, as well as encourage interdisciplinary research.
Prospects for further research in this area include the development of new methodologies for assessing the effectiveness of AI in the educational process. An important area is the integration of the theoretical foundations of learning with practical AI developments to create more comprehensive and effective learning systems. In addition, it is necessary to pay attention to ethical issues related to the introduction of AI in education by developing standards that will ensure the safe use of these technologies.

References: