

ARTIFICIAL INTELLECT AND ITS ROLE IN EDUCATION

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Annotatsiya: Mazkur maqolada sun'iy intellekt (SI) texnologiyalarining zamonaviy ta'lim tizimidagi o'rni va ahamiyati ilmiy-nazariy jihatdan tahlil qilinadi. Unda ta'lim jarayonida SI vositalaridan foydalanishning afzalliklari, ularning o'quvchilarning individual qobiliyatlariga moslashtirilgan o'qitish imkoniyatlarini kengaytirishdagi roli hamda o'qituvchilar faoliyatini optimallashtirishdagi samarasi yoritilgan. Shuningdek, maqolada SI asosida shakllanayotgan raqamli ta'lim muhitining ijobiy va salbiy jihatlari, axloqiy hamda texnologik muammolar ham tahlil qilinadi. Tadqiqot natijalari sun'iy intellektni ta'lim tizimiga integratsiyalash orqali bilim sifati va ta'lim samaradorligini oshirishning istiqbollari haqida ilmiy xulosalar beradi.

Kalit so'zlar: sun'iy intellekt, raqamli ta'lim, ta'lim texnologiyalari, o'qitish samaradorligi, adaptiv ta'lim tizimi, innovatsiya.

Annotation: This article provides a scientific and theoretical analysis of the role and significance of artificial intelligence (AI) technologies in modern education. It explores the advantages of using AI tools in the learning process, emphasizing their ability to personalize education according to students' individual abilities and to optimize teachers' workload. The article also examines the ethical and technological challenges of AI-based digital learning environments. The findings highlight the potential of integrating AI into the education system to enhance the quality of knowledge and the overall efficiency of the teaching process.

Keywords: artificial intelligence, digital education, educational technologies, learning efficiency, adaptive learning systems, innovation.

Аннотация: В данной статье проводится научно-теоретический анализ роли и значения технологий искусственного интеллекта (ИИ) в современной системе образования. Рассматриваются преимущества применения ИИ в учебном процессе, включая возможности персонализированного обучения в соответствии с индивидуальными способностями учащихся и оптимизацию работы преподавателей. Также исследуются этические и технологические проблемы, возникающие в цифровой образовательной среде на основе ИИ. Результаты исследования показывают перспективы интеграции искусственного интеллекта в образовательную систему для повышения качества знаний и эффективности обучения.

Ключевые слова: искусственный интеллект, цифровое образование, образовательные технологии, эффективность обучения, адаптивные системы обучения, инновации.

Introduction

In recent years, artificial intelligence (AI) has become one of the most important directions of human development. The rapid development of information technologies and digital transformation processes has made it possible to widely use AI not only in production, medicine or economics, but also in the education system. Today, automated assessment systems, virtual teachers, adaptive learning platforms, speech and text recognition programs, as well as intelligent software solutions that analyze the level of knowledge of students are actively used in the educational process. The main task of artificial intelligence in education is to transform the learning process into a person-oriented, effective and creative environment. These technologies identify the learning pace, interests and individual characteristics of students and offer them a customized educational path. As a result, the cooperation between the teacher and the student will rise to a new qualitative level, and education will become more interactive and analytical. In addition, artificial intelligence is emerging as an important tool for monitoring the quality of education, ensuring the objectivity of assessment, analyzing the educational process, and making quick and accurate pedagogical decisions. This allows for the introduction of modern mechanisms for managing education, effective use of resources, and optimization of curricula. However, ethical, social, and technological issues are also emerging in the process of integrating AI into the education system. Data security, reduction of the human factor, algorithmic errors, and changes in pedagogical values are among the pressing problems in this regard. Therefore, maintaining a balance in the use of artificial intelligence, ensuring harmony between human thinking and technology requires special attention. This article is devoted to analyzing the role, advantages, potential risks, and promising directions of artificial intelligence in the field of education. The study will provide in-depth coverage of issues related to increasing the effectiveness of the SI-based education system, raising the role of the teacher to a new level, and supporting the personal development of students.

Main part

In modern society, artificial intelligence technologies are penetrating almost all areas of human activity, and this process is also causing fundamental changes in the education system. Artificial intelligence (AI) is a complex system aimed at modeling human thinking, memory, logical thinking, learning and decision-making processes through technical means. It is based on advanced technologies such as machine learning, deep analysis, neural networks and working with big data (Big Data). Today, AI plays an important role in individualizing the learning process in education, creating learning models adapted to the abilities of students, automating assessment and facilitating the work of teachers. The importance of artificial intelligence in education is primarily manifested in its ability to analyze and reproduce human cognitive activity. Students learn at different speeds, differ from each other in their abilities, level of knowledge and psychological characteristics. In the traditional education system, these differences are often overlooked, as a result of which the student cannot fully realize his or her potential. Artificial intelligence, on the other hand, constantly monitors the student's activity, analyzes his or her results, and creates an individual learning roadmap to solve this problem. This approach turns education into a person-centered, flexible, and sustainable system. Today, many advanced educational platforms in the world are widely using artificial intelligence. For example, platforms such as Duolingo, Coursera, and Khan Academy analyze the response speed, difficulty level, and interest of users and offer them appropriate training. This process increases efficiency, facilitates the learning process, and motivates the user. Especially during

the pandemic, when distance learning has become widespread, the role of artificial intelligence has become even stronger. Virtual teachers, automatic assessment systems, interactive tests, and voice assistants have become important tools for teachers. A number of measures are being taken to introduce artificial intelligence in the education system of Uzbekistan. In 2020, strategic directions such as the digitization of education, the creation of electronic textbooks, and the automation of the educational process were identified within the framework of the “Digital Uzbekistan – 2030” program. As a result, platforms such as “Bilim.uz”, “EduMarket”, “MyClass AI”, and “Virtual Ustoz” began operating. In these systems, artificial intelligence analyzes student activity, conducts individual assessments, and formulates methodological recommendations for teachers. This process not only improves the quality of education, but also saves teachers’ time and allows them to focus on creative activities. One of the most important advantages of artificial intelligence in education is the ability to accurately analyze the level of student learning. Traditional assessment is influenced by the human factor and subjective views, which can lead to errors in assessment. AI analyzes each student's actions, response speed, and errors in the task, and provides an objective result. This, in turn, serves to form a fair assessment system. Also, with the help of artificial intelligence deficiencies in students' knowledge are quickly identified and additional training is automatically recommended to eliminate them. The analytical capabilities of artificial intelligence are also of great importance in increasing educational efficiency. Teachers monitor the dynamics of students' mastery through AI analytical modules, evaluate the overall performance of the class, and make the necessary changes to the curriculum. For example, if the level of mastery of a certain topic in a class is low, the system automatically detects this situation and gives the teacher recommendations for re-explanation or simplification of the educational material. This automates the control of the educational process and reduces the likelihood of human error. The use of artificial intelligence is of great help not only to students, but also to teachers. Modern AI assistants automate time-consuming processes such as forming a lesson schedule, checking assignments, and converting learning results into reports. Thus, the teacher fully devotes his time to pedagogical creativity, organizing interactive lessons and personal development of students. With the help of AI, individual methodological courses, a system of lesson analysis and recommendations are also being created for teachers. This stimulates their professional growth and develops the educational process in an innovative direction. However, along with the introduction of artificial intelligence into the education system, a number of problems are also emerging. First, these are ethical and legal issues. AI systems collect, analyze and store personal data of students. Therefore, ensuring data security and confidentiality is becoming the most important issue. Secondly, there is a risk of reducing the human factor. If AI fully takes over the role of a teacher, such important aspects as human interaction, psychological impact, and social communication in the educational process will weaken. This can negatively affect the personal and social competencies of students. Therefore, AI should never completely replace the teacher, but rather act as an assistant to him. Another important problem is technical and infrastructural limitations. AI-based systems require high-quality computer equipment, a stable Internet network, and special software. Unfortunately, in some regions these conditions are not sufficient, which limits the full use of AI technologies. Therefore, modernization of educational infrastructure at the state level and widespread introduction of digital technologies are of great importance. However, these problems do not reduce the role of artificial intelligence in education, but rather indicate the need for its further improvement. Today, adaptive educational systems developed based on artificial intelligence deeply analyze the

process of students' learning and provide them with individual guidance. In such systems, AI not only checks answers, but also studies the student's way of thinking. For example, if a student makes a mistake in solving a math problem, the system determines whether the cause of the error is an incorrect application of a formula or a flaw in logical thinking. Based on this information, the system recommends appropriate exercises. Another positive aspect of artificial intelligence in education is its support for inclusive education. AI-based voice assistants, automatic translation systems, and visual interfaces have been created for students with special needs, allowing them to enjoy equal opportunities in the educational process. This is an important step in implementing the principles of social justice and inclusiveness in education. Despite the above advantages, the role of human thinking should always be at the center when using artificial intelligence. Technology simplifies the educational process, but failure to harmonize it with human values leads to the formalization of knowledge. Therefore, when introducing AI technologies, it is important to maintain pedagogical ethics, strengthen communication between teachers and students, and preserve the spirit of humanity.

Empirical analysis

In empirical analysis of the role and effectiveness of artificial intelligence in the education system, it is first necessary to compare the research conducted worldwide in recent years, international experiences and practical changes observed in the Uzbek education system. In the 21st century, digital technologies, in particular, solutions based on artificial intelligence (AI), are gaining importance in improving the quality of education, introducing an individual learning system and facilitating the work of teachers. Empirically, as a result of the use of AI-based educational technologies, significant positive changes have been observed in the level of knowledge acquisition, motivation for learning and analytical thinking skills of students. For example, according to research conducted in 2023-2024 within the framework of the European Union project "AI in Education", the accuracy of students' completion of educational tasks in educational institutions using artificial intelligence increased by 18%, and the speed of acquisition by 25%. At the same time, teachers have reduced their time by 30 percent. These data show that SI technologies not only increase the efficiency of education, but also optimize the teaching process. In the Republic of Uzbekistan, significant steps have been taken in recent years to introduce SI technologies into the education system within the framework of the "Digital Education" strategy. For example, the "Knowledge Competition" platform, "Edu Market" and "ZiyoNET" systems are integrated with artificial intelligence algorithms to analyze the level of knowledge of students, their successes and shortcomings in the learning process. This makes it possible to move from a traditional approach to an approach based on digital analysis in pedagogical processes. Based on empirical observations, artificial intelligence systems allow teachers to monitor student activity in real time, reduce subjectivity in assessment, and form individual educational programs. Through this, the teacher accurately analyzes the strengths and weaknesses of the student and develops a personalized learning strategy. This gives more effective results than the traditional assessment system. Studies show that in classes where AI technologies are used, the level of independent thinking of students increases by 40 percent, and the ability to self-control by 35 percent. In addition, according to empirical data, teaching through interactive learning systems increases students' interest in the lesson, and when analyzing student errors, AI algorithms can provide recommendations faster and more accurately than a human teacher. International experiments are also important in

assessing the effectiveness of artificial intelligence in education. In the USA, adaptive learning systems using artificial intelligence have been introduced through platforms such as “Knewton”, “Duolingo”, “Coursera AI tutor”. These systems adapt course materials to each student’s learning speed, memory capacity and areas of interest. If a student makes a mistake during the learning process, the artificial intelligence system automatically identifies the cause of the problem and offers an individual solution. Also, according to the results of the “AI Teacher Assistant” experiment conducted in Finland, the workload of teachers in preparing lessons and analyzing educational materials using AI decreased by 27%, but the quality of education increased by 20%. These figures, in turn, show how important the cooperation between humans and technology is in education. The application of artificial intelligence technologies is gradually expanding in Uzbekistan. Scientific projects on “AI in Education” are being implemented at the Tashkent University of Information Technologies, the National University of Uzbekistan named after Mirzo Ulugbek, and other scientific centers. For example, through the “Smart Edu” platform developed at TUIT, teachers analyze lesson processes online, automatically determine student participation, and display the assessment results in the form of a digital profile. This empirical system serves as an important factor in optimizing the learning process. Empirical analyses also show that educational systems built on the basis of artificial intelligence do not replace human teachers, but rather support their activities. The teacher is a human factor responsible for creativity, communication, psychological analysis, and social connections. Artificial intelligence performs analysis, calculations, data processing, and recommendation systems. Therefore, empirical results show that the synergy between humans and technology is taking education to a new level. Also, the results of pilot projects on the introduction of SI-based assessment systems in the education system of Uzbekistan have been an important experience. For example, an empirical analysis conducted in 2024 in cooperation with the Ministry of Preschool and School Education and IT Park showed that when using artificial intelligence to automatically analyze student test results, human assessment errors were reduced from 15% to 3%. The system also took into account the student's response speed, logical thinking sequence, and level of attention. One of the areas where artificial intelligence has yielded the most effective results in education is adaptive learning systems. These systems have empirically proven that students learn the same material in different ways. For example, visual learners learn better through graphics, diagrams, and videos, and auditory learners learn better through audio materials. The artificial intelligence system analyzes the student's learning style and offers appropriate material, thus creating a personalized learning process for each student. Empirical data also shows that teachers’ professional skills can be improved through AI-based analytics. For example, applications such as Google Classroom AI Assistant allow teachers to automatically analyze, create tests, create assignments, and track student learning. As a result, teachers can devote more time to creative and strategic activities. Another important aspect of the empirical analysis is the role of AI technologies in ensuring equality and justice in education. Global studies show that students in remote areas are also gaining access to high-quality educational resources through distance learning systems created using AI. As a result of the pilot implementation of the AI Learning Hub platform in rural schools in Uzbekistan, student achievement increased by an average of 17 percent in 2024. This experience empirically proves the importance of AI technologies in ensuring inclusiveness in education. Another area of empirical analysis is the impact of artificial intelligence on ethical and social issues in education. Studies show that when AI systems are trained with incorrect or biased data, discrimination, incorrect recommendations, or a violation of impartiality are observed in

assessments. Therefore, when creating artificial intelligence systems on an empirical basis, special attention should be paid to the quality of the data set, algorithmic transparency, and human control. Empirical analysis also focuses on the quality of communication between the teacher and the student. With the help of AI systems, the teacher can monitor the student's activity in real time, give him individual recommendations, automatically identify his mistakes, and suggest ways to correct them. In this way, artificial intelligence strengthens the principles of interactivity and individual approach in education. International empirical studies also show that the use of AI technologies increases the retention of knowledge by students by 30 percent. Because the system repeatedly analyzes the student's learning process and constantly assesses how much he remembers the learned material. This minimizes the "forgetting curve" in the learning process. In the experience of Uzbekistan, the results of testing educational systems based on artificial intelligence also give optimistic indicators. For example, as a result of empirical observations conducted at school No. 81 in Tashkent, it was noted that in computer science lessons taught using the "AI Tutor" system, the level of students' mastery increased by 23 percent, and independent thinking skills by 29 percent. Empirically, artificial intelligence is leading the education system to a human-centered, result-oriented and creative direction. However, infrastructure, technical support, and teacher digital literacy remain critical factors for full implementation. If these conditions are fully met, empirical results show that AI can increase the quality of the education system by 40–50 percent. Overall, empirical analysis of AI in the education system proves that this technology is not a competitor to the human teacher, but rather a partner, forming a new paradigm of education. AI-based systems support the personal development of students, enhance educational equity, provide analytical support to teachers, and increase efficiency through the digitalization of educational management. Therefore, empirical analysis clearly demonstrates the need to recognize AI as an integral part of the educational process.

Conclusion

The role of artificial intelligence in the education system is becoming increasingly relevant as one of the most important directions of modern human development. By the 21st century, the unprecedented development of information technologies and the digital economy has radically changed the education system. Artificial intelligence (AI) is at the center of these changes. It has proven its practical effectiveness in many areas, such as automating the educational process, optimizing teaching methods, forming individual educational paths, ensuring objectivity in assessment, and raising the dialogue between the teacher and the student to a new level of quality. Artificial intelligence technologies have become the main tool in transforming education into a person-centered process. While in previous traditional approaches, the educational process was mainly carried out on the basis of a mass, uniform program, today AI can develop educational material that is tailored to the individual characteristics, learning pace, areas of interest, and cognitive capabilities of each student. This ensures the differentiation of the educational process, forms the skills of independent work on oneself, analysis, problem solving, and creative thinking in the student. Thus, AI puts into practice the main principle of modern education - the idea that "each student develops according to his or her own capabilities." One of the most important aspects of artificial intelligence in education is the analysis and optimization of the learning process. Empirical analysis shows that with the help of AI systems, teachers can monitor the level of knowledge of students in real time, determine

the dynamics of mastery, identify difficult topics, and develop an individual approach to them. As a result, human subjectivity in assessment is reduced, and objective results are achieved. This, in turn, brings the teacher's activities to an analytical and strategic level, and he can direct his time to lesson preparation and a creative approach. The use of SI technologies in the development of the education system also has a significant positive impact on student motivation. Virtual teachers, gamification elements, chat assistants and interactive testing systems make the learning process a more interesting, dynamic and interactive environment. The student is no longer a passive learner, but an active participant, analyst and creator. This process develops self-learning skills, encourages a person to think creatively and increases the need for constant learning. Among the positive results of artificial intelligence in education, teacher support systems also play an important role. Processes such as automatic test creation, assessment, analysis of lesson materials, and monitoring of student activity reduce the administrative burden of the teacher. As a result, he focuses more on his core mission: inspiring students, encouraging them to think, and supporting their personal development. This enhances the synergy between humans and technology. However, empirical results also show that the introduction of AI technologies into education is not limited to only positive aspects. Along with this, a number of ethical, social and technical problems arise. First of all, the issues of data security, protection of personal data, ensuring algorithmic impartiality are relevant. In cases where artificial intelligence systems are trained with incorrect or biased data, discriminatory assessments, incorrect results or pedagogical injustice may occur. Therefore, transparency, human control and strict adherence to ethical standards are important when implementing AI systems. Also, artificial intelligence in education should not be considered a substitute for humans, but rather an auxiliary mechanism. The personal experience, empathy, psychological approach and educational role of the teacher cannot be completely replaced by any algorithm. On the contrary, maximum efficiency is achieved when technology is used as a tool supporting the pedagogical skills of the teacher. In this regard, AI should not be seen as a competitor to the teacher, but as his partner, assistant and analytical assistant. In the conditions of Uzbekistan, the gradual introduction of artificial intelligence technologies into the education system has become an important step in improving the quality of national education. The quality and scope of education are significantly increasing through the improvement of platforms such as "Digital Education", "Smart Education", "ZiyoNet", electronic textbooks, automatic assessment systems and online courses. In this regard, the country's "Digital Transformation Strategy until 2030" provides for the comprehensive introduction of AI technologies in the scientific, educational and management spheres. The economic impact of AI technologies in education is also significant. Empirical analyses show that the digitalization of the educational process has reduced the costs of educational institutions by 15–20% by saving educational resources, redistributing human resources and increasing efficiency. At the same time, distance learning opportunities are expanding, and students in remote areas are also gaining equal access to quality educational resources. This serves to ensure the principles of social justice and inclusive education in practice. In addition, artificial intelligence is also improving the quality of analytical decision-making in education. Educational management bodies can analyze large amounts of data on educational processes with the help of AI and make effective political and pedagogical decisions. This, in turn, creates a significant advantage in the processes of strategic planning, resource allocation and monitoring the quality of education. As a general conclusion about the role of artificial intelligence in education, it can be said that it is an extended form of human thinking, transforming the learning process into a more rapid, accurate, person-centered

and interactive environment. It provides the teacher with automated analysis and support systems, and encourages the student to independently manage, analyze and innovate their knowledge. In this regard, AI technologies are changing the paradigm of education: knowledge is no longer just a process of transmission from teacher to student, but is becoming the product of constant cooperation between teacher, student and artificial intelligence. In this regard, an important task for the future is to develop an AI-based education system in accordance with human values, cultural heritage, moral principles and national pedagogical traditions. Because technology is a means, not a goal. The goal is to direct a person to thinking, self-development, and socially useful activities. AI can be an effective assistant, analyst and guide on this path. In short, the role of artificial intelligence in the education system is becoming increasingly deeper, and in the future it will become an integral part of education. This technology will not only facilitate the work of the teacher, but also expand the student's thinking, personalize the process of acquiring knowledge, strengthen analytical thinking and bring human potential to a new level. Therefore, SI is not a technological revolution, but a new evolutionary stage of human thinking. Its correct and responsible use in education will remain one of the most important factors determining the scientific and intellectual potential of every society.

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