

In addition, AI is able to perform routine tasks such as checking homework, automatic test analysis, which significantly saves teachers time and allows them to focus on developing students' creative and analytical abilities.

The use of AI tools in computer science lessons is possible in several forms. First, it is the use of virtual assistants and chatbots that are able to answer students' questions, explain the material and guide them in the process of completing assignments. Secondly, these are learning platforms with AI elements, such as Khan Academy, Coursera, which adapt to the student's level of training.

In addition, code analysis tools such as repl.it or Scratch with the automatic project evaluation function, which allows students to instantly receive feedback and improve their programming skills.

In practice, AI can be used to create adaptive exercises. For example, the CodeCombat platform offers students programming tasks that gradually become more complicated depending on the student's success. Another example is the use of voice assistants in the classroom, which can conduct mini-surveys, remind students of assignments, or comment on student responses.

It is also possible to mention projects in which students train their own AI models using Python and machine learning libraries, which develops research skills and immerses them in the real challenges of the digital age.

Despite the broad prospects, the introduction of AI into school education is accompanied by a number of difficulties. Among them are insufficient training of teachers to work with AI tools, limited technical equipment of schools, as well as important issues of ethics, data privacy and digital security. It is important to prevent the misuse of technology and maintain a balance between live communication and automation.

Computer science teachers are encouraged to start small, using AI to test knowledge, create visual materials, and analyze learning outcomes. It is important to train teachers, share experiences, and integrate AI into school projects. It is also advisable to discuss the opportunities and threats of technology with students, forming a responsible attitude towards AI [2].

Artificial intelligence can significantly enrich the teaching of computer science, make learning more effective, interesting and individualized. With a competent approach, AI becomes not a substitute for the teacher, but his assistant and ally in developing the intellectual potential of schoolchildren.

References

- [1] Semakin I.G., Henner E.K. Computer Science: a textbook for grades 10-11. Moscow: BINOM, 2023.
- [2] Yudin S.V. Artificial intelligence in education. Moscow: Prosveshchenie, 2022.

THE USE OF ARTIFICIAL INTELLIGENCE IN ADAPTIVE LEARNING: ANALYSIS OF PERCEPTION AND READINESS OF UNIVERSITY TEACHERS AND STUDENTS IN KAZAKHSTAN

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Currently, there is a global trend toward the transformation of education systems. At the core of this transformation lies the emergence of personalized learning experiences, where artificial intelligence (AI) aims to adapt educational content and interactions to meet the unique needs, preferences, and learning pace of individual students [1].

Adaptive learning is a teaching and training approach in which the content, methods, and pace of instruction are adjusted based on learners' individual needs, abilities, and learning styles [2]. The theory of adaptive learning is grounded in the principles of personalized learning theory [3]. A number of studies have shown that the use of adaptive learning and AI enhances students' motivation, engagement, and academic performance [4, 5].

An analysis of the problem domain and scientific literature on the application of AI in education has shown that the issue of developing an intelligent adaptive system capable of tracking each learner's progress, evaluating performance, and adjusting the content of academic disciplines remains highly relevant.

Despite the potential of AI methods for implementing personalized learning, Kazakhstan currently lacks a sufficient number of specialized platforms for higher education that can be effectively integrated into university-level academic activities. Furthermore, both instructors and students face numerous challenges in integrating AI technologies and tools into the learning process.

Therefore, during the development of the university's adaptive platform, we identified the need for a preliminary in-depth study of the needs of future users—university students and instructors. This approach allows us to better address and incorporate user expectations in the development of an adaptive educational platform for higher education.

As part of the initial stage of problem exploration, surveys and online questionnaires were conducted among instructors and students from six leading universities of the Republic of Kazakhstan: Eurasian National University, Saginov Technical University, Karaganda Buketov University, Zhubanov University, Toraighyrov University, and Ualikhanov University. A total of 111 instructors and 657 students participated in the study.

To investigate the issue, general qualitative research methods were applied, including interviews, surveys, data collection, analysis, and interpretation. In addition, statistical methods and generalization were used as a basis for drawing conclusions.

Stage 1: Analysis of University Instructors' Readiness in Kazakhstan to Use AI in Adaptive Personalized Learning. The first stage of the study focused on analyzing the readiness of university instructors in Kazakhstan to incorporate artificial intelligence into adaptive personalized learning. The questionnaire for instructors included questions aimed at identifying their interest in and attitudes toward AI, as well as their familiarity with technologies and tools intended for integration into the educational process. It also assessed their willingness to implement adaptive learning within higher education institutions.

In the open-ended questions, the objective was to determine which AI-based software tools instructors currently use in their teaching practice, to what extent they understand the potential of AI technologies, and whether they possess sufficient knowledge or experience for their systematic application.

The survey results showed that the majority of university instructors in Kazakhstan support

the use of AI-based adaptive technologies for personalized learning in the educational process — 79.1% expressed full support, 15.5% expressed partial support, and 5.4% did not support the idea.

Instructors who partially supported the use of AI-based adaptive technologies (15.5%) explained their stance with the following comments: «AI should not hinder the development of students' critical thinking», «AI is not suitable for gifted students», «AI should be applied primarily to core and specialized disciplines», «Not all AI technologies are advanced enough or suitable for use in the educational process», «GPT models often make mistakes», «Frequent use of ChatGPT makes students overly reliant and less engaged».

It was found that there is a lack of AI applications specifically designed for instructors that could simplify lesson preparation, automate assessment processes, and improve the efficiency of routine academic tasks. The main barriers limiting the use of AI technologies and tools by university instructors include:

- Lack of trust in the capabilities of AI technologies within the academic teaching community;
- Insufficient competencies among instructors in the field of artificial intelligence;
- Lack of accessible AI tools for implementing adaptive personalized learning in higher education institutions.

It should be noted that the main risks associated with the use of AI, as identified by instructors, include the lack of human perception and understanding of information, the formalization of knowledge, the absence of direct “student–instructor” interaction, and the potential for erroneous decision-making.

Stage 2: Analysis of Student Perceptions and Readiness for the Use of AI in Adaptive Learning. The second stage of the study involved a survey aimed at identifying students' perceptions and readiness to use artificial intelligence in adaptive learning. The student questionnaire addressed general issues related to the use of AI technologies, student awareness, and their prior experience with adaptive educational platforms.

The results confirm that university students are interested in using AI tools and demonstrate readiness to adopt adaptive platforms in the learning process for personalized instruction in core disciplines. According to the survey results, 93% of the respondents expressed a desire to study AI as part of the academic curriculum.

The most in-demand AI service turned out to be ChatGPT, a generative AI-based chatbot, used by 40.6% of respondents. 22.3% of students are aware of and occasionally use various neural networks for processing text, images, and audio. 17.5% use chatbot assistants in their studies. The main purpose for which students use neural networks is writing and editing texts.

56.2% of the respondents believe that AI could assist them in creating an individual learning plan and improving academic performance, while 41.4% are somewhat uncertain, and 2.4% do not believe it would help. At the same time, 35% of students think that AI cannot replace a teacher but can serve as a useful assistant. Students envision a future where teachers act as mentors and consultants, delegating routine tasks to technology.

The survey results show that approximately 60% of the students surveyed have a positive attitude toward AI technologies. They believe that the integration of AI into the learning process will help them improve academic performance and are confident in the usefulness of an AI-powered adaptive platform for education. The majority of respondents believe that the use of AI in education can enhance personalization and improve learning outcomes.

The opinions and suggestions expressed by students will be taken into account in the further development of the “Student” subsystem of the adaptive platform “Intellectual Tutor” for both

instructors and students. In particular, the platform will ensure that educational content is delivered in a format that is most convenient and accessible for student perception.

References

- [1] Maher, J. (2023). Personalized learning through AI. *Advances in Engineering Innovation*. 5(1). DOI:10.54254/2977-3903/5/2023039
- [2] Brusilovsky P, Peylo C. Adaptive and intelligent web-based educational systems. *Int J Artif Intell Educ*. 2003; 13(2-4):159-72.
- [3] Bloom BS. The 2 sigma problem: The search for methods of group instruction as effective as one-to-one tutoring. *Educ Res*. 1984; 13(6):4-16.
- [4] Oxman S, Wong W. White paper: Adaptive learning systems. *Integrated Education Solutions*; 2014.
- [5] Walkington CA. Using adaptive learning technologies to personalize instruction to student interests: The impact of relevant contexts on performance and learning outcomes. *J Educ Psychol*. 2013; 105(4):932-45.

USING BLOCKCHAIN TO ENHANCE THE SECURITY OF DISTRIBUTED SYSTEMS

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Abstract

This paper explores the application of blockchain technologies to enhance the security of distributed systems. The paper reviews various approaches including public and private blockchains, smart contracts, consensus mechanisms (such as Proof of Work, Proof of Stake, and Byzantine Fault Tolerance), and decentralized identity (DID) frameworks. Their advantages, limitations, and practical implementation challenges are discussed in the context of securing data transmission, access control, and fault tolerance in distributed environments. A series of experiments were conducted using platforms such as Ethereum, Hyperledger Fabric, and IPFS to evaluate their effectiveness in ensuring data integrity and preventing unauthorized access. The findings showed that the integration of blockchain-based solutions increased system resilience to tampering and reduced attack surfaces, especially when combined with traditional security mechanisms. Using smart contracts for automated access control improved response time to security incidents by 23.7% on average. The results suggest that blockchain technologies can play a crucial role in building robust, secure distributed systems. These insights can benefit system architects, cybersecurity professionals, and researchers involved in the development of secure decentralized infrastructures.

Keywords— blockchain, distributed systems, cybersecurity, smart contracts, consensus algorithms, decentralized identity, Hyperledger, Ethereum, fault tolerance

INTRODUCTION