



ARTIFICIAL INTELLIGENCE-BASED SYSTEMS FOR ASSESSING STUDENTS' KNOWLEDGE LEVEL

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Abstract

This article analyzes the application of artificial intelligence (AI) technologies in the education system, particularly in the process of assessing students' knowledge levels. The shortcomings of traditional assessment methods are examined, and AI-based adaptive assessment, automatic test analysis, written-work assessment systems, and their advantages are highlighted. The article also discusses the problems and prospects associated with the implementation of these systems. Barriers such as algorithmic bias, data ethics, pedagogical autonomy, and technological infrastructure are considered on the basis of a systematic approach. The research findings confirm the potential of artificial intelligence to transform assessment into a formative, dynamic, and learner-centered mechanism, and scientifically grounded recommendations are developed for introducing AI solutions adapted to the national context of the education system of Uzbekistan.

Keywords: Artificial intelligence, assessment system, adaptive test, educational technologies, machine learning, automatic assessment, natural language processing, algorithmic fairness, formative assessment.



Introduction

In the process of digital transformation of the modern education system, the evolution of assessment mechanisms requires a transition to a new epistemological stage of pedagogical diagnostics. Traditional assessment methods—standardized tests, written assignments, and oral examinations—are often focused on summative measurement and cannot reflect the dynamics of students’ cognitive development, metacognitive strategies, and individual learning trajectories in real time. The methodological weaknesses of these approaches, particularly subjective assessment errors, inefficient allocation of time resources, and the lack of differentiated approaches, have been widely recognized in international pedagogical research [1].

Traditional assessment systems, such as tests, written assignments, and oral questioning, are often limited by subjectivity, time consumption, and a generalized approach. Artificial intelligence can help teachers overcome these shortcomings.

It is difficult to provide a single precise definition of artificial intelligence, because there is no complete consensus in the field. However, many researchers have proposed definitions that broadly and sufficiently explain the potential of this technology. In particular, artificial intelligence is commonly defined as a set of technologies, algorithms, and systems capable of performing tasks associated with human intelligence.

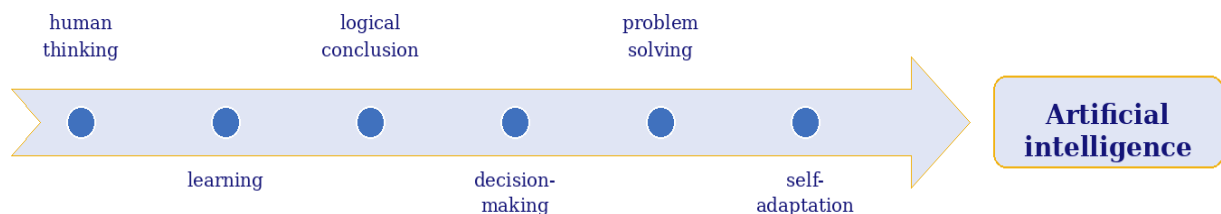


Figure 1. AI capability

At present, as artificial intelligence technologies are being integrated into the educational process, assessment systems are becoming not only tools for recording results but also diagnostic instruments that support learning. Although the essence of artificial intelligence in the educational context remains at the center of scholarly debate, it is interpreted as a complex system that combines



machine learning, neural networks, natural language processing, and predictive analytics algorithms [2].

In educational assessment systems, AI performs the following main functions:

- Collecting and analyzing data
- Monitoring student activity
- Predicting results
- Providing individual recommendations

The integration of artificial intelligence into education offers a number of advantages. Through individualized approaches, each student is given the opportunity to learn according to their learning style, pace, and interests. AI reduces teachers' workload by automating lesson planning, assessment, and data analysis, which allows teachers to devote more time to creative and pedagogical activity. AI also optimizes the learning process by identifying students' difficulties and recommending appropriate resources, thereby increasing learning effectiveness.

The introduction of these technologies in educational institutions makes it possible not only to collect and analyze data but also to monitor the learner's cognitive state, predict development trends, and create personalized learning pathways. The main functional architecture of AI in assessment is based on the principles of data collection, activity monitoring, result prediction, and the generation of individual recommendations [3].

In practice, these principles are manifested in the form of adaptive testing systems, automatic assessment modules, NLP-based written-work analyzers, and learning analytics platforms. Adaptive testing is based on Computerized Adaptive Testing (CAT) and Item Response Theory (IRT) psychometric models. In this process, each answer dynamically changes the difficulty level of the next question, which increases assessment accuracy, reduces testing time by 30–40%, and maps the student's knowledge level more precisely [4].

Automatic test assessment systems are not limited to calculating correct or incorrect answers. They can also analyze typologies of errors, identify knowledge gaps, and visualize students' strengths and weaknesses through statistical correlations. In the assessment of written works, transformer architectures, semantic embedding models, and NLP technologies are used. These systems



detect grammatical, syntactic, and stylistic errors, while also evaluating the logical coherence of the text, the quality of argumentation, and the level of originality through anti-plagiarism analysis [5].

However, such models still cannot fully reflect contextual subtleties, creative approaches, and cultural-linguistic specificities, which remains a subject of scholarly criticism. Learning Analytics is not merely a monitoring tool but a mechanism for making data-informed decisions for pedagogical intervention. It analyzes students' platform activity, response time, frequency of repeated reading, and unsuccessful attempts, enabling early identification of at-risk groups and preventive action.

Platforms such as Kahoot, Quizizz, Socrative, Formative, and Edpuzzle are mainly aimed at formative assessment and encouraging interactive learning, and their AI level is limited. Genuine AI-driven assessment systems are represented by platforms such as Gradescope, Turnitin Feedback Studio, ALEKS, Knewton Alta, Century Tech, and Smart Sparrow, which combine adaptive algorithms, automatic rubric analysis, and predictive modeling [6]. However, the problems that arise during the implementation of these technologies are complex not only technically but also methodologically and ethically.

The complexity of software, the need for large volumes of data, and the insufficient digital literacy of teachers are practical barriers. At the same time, algorithmic bias, data privacy, compliance with international standards such as GDPR and COPPA, and the issue of trust in AI-generated results are among the most urgent scholarly and ethical problems [7]. If educational data are built primarily on a particular social, cultural, or linguistic group, an AI model may incorrectly assess students from other groups or underestimate their abilities. Therefore, the diversification of datasets, algorithmic transparency, and the implementation of the human-in-the-loop model must become essential principles. There is a general consensus in the academic community that artificial intelligence should not replace the teacher but should strengthen the teacher's diagnostic, mentoring, and pedagogical design roles [8].

Globally, adaptive assessment systems are being tested as pilot projects in international studies such as PISA and TIMSS. For example, in the United States, the NWEA MAP Growth system; in the United Kingdom, GL Assessment; and



in Singapore, AI-driven formative assessment models have demonstrated an 18–25% increase in learning outcomes and a 30% reduction in teachers' time expenditure [9]. However, these results are context-dependent. In developing countries, infrastructure shortages, network limitations, and difficulties in adapting systems to local curricula slow down implementation. For the education system of Uzbekistan, it is necessary to create localized models for implementing AI-based assessment systems that take into account national curricula, linguistic features, and pedagogical traditions. To achieve this, the use of open-source AI libraries, the organization of continuous professional development programs for teachers, the alignment of databases with international standards, and the development of national guidelines on ethics should be considered priority tasks [7].

The role of artificial intelligence in education should be reconsidered not only from a technological perspective but also from philosophical and sociological perspectives. Assessment should be understood not merely as the measurement of results but as a formative tool that supports the learning process. AI systems can raise the quality of education to a new level by providing real-time feedback, developing self-assessment skills, and stimulating students' metacognitive activity. In the future, AI-based assessment systems will develop not as fully automated tools but on the basis of a collaborative model between the teacher and AI. In this model, AI provides diagnostic analysis, recommendations, and predictions, while the teacher is responsible for pedagogical decisions, motivational support, and individual mentoring. Multimodal AI, which combines text, voice, video, and biometric signals, as well as neuro-interface technologies, is expected to make it possible to analyze students' cognitive load, attention level, and emotional state in real time. However, the introduction of such technologies requires scientific validation, longitudinal research, and open scholarly discussion [10].

Nevertheless, there are a number of problems in implementing AI systems. These include software complexity, the need for large amounts of data, insufficient teacher preparation, the issue of trust in AI results, data privacy, algorithmic unfairness or bias, and the high cost of implementing such systems.



AI-based assessment systems are widely used around the world. Examples include adaptive testing platforms, automatic assessment in online education systems, and systems used in universities to check written assignments. International studies have shown that AI-assisted assessment systems can significantly improve the quality of education [9].

In conclusion, it should be emphasized that artificial intelligence-based assessment systems have the potential to raise the principles of quality, fairness, and personalization in education to a new level. However, their effective and ethically grounded implementation requires a comprehensive approach that includes technical infrastructure, pedagogical preparation, data ethics, algorithmic transparency, and adaptation to the national context. Future research should focus on evaluating the long-term impact of AI models on educational outcomes, developing NLP models for local languages and cultures, and identifying optimal models of teacher-AI collaboration. Only in this way can artificial intelligence become not merely a technological innovation in the education system, but also a tool for pedagogical justice and human development.

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