

USE OF ARTIFICIAL INTELLIGENCE TECHNOLOGIES FOR THE QUALIFICATION TRAINING OF MATHEMATICS TEACHERS

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Abstract

This article provides a scientific and practical analysis of integrating artificial intelligence (AI) into Uzbekistan's education system. It considers the theoretical and practical bases of AI use, including a 5-stage model and experience of using platforms such as Eduten. The article also pays attention to curriculum development, methodological projects, and the graphical representation of abstract mathematical concepts using AI tools such as ChatGPT, Eduaide.AI, Wolfram, and GeoGebra AI, among others.

Keywords: Mathematics teachers, professional development, artificial intelligence, ChatGPT, Eduaide.AI, GeoGebra AI, pedagogical technologies, curricula, methodological projects, interactive learning.

Introduction

The national education system currently comprises 4,916 preschools, 10,163 secondary schools and 211 Barkamol Avlod centres, as well as over 400,000 teachers. The Ministry of National Education operates five state teacher training institutes and 14 regional institutes for the further training and retraining of teaching staff. According to Presidential Decision No. PQ-231 of 21 June 2024, teachers in educational institutions are required to undertake further training at least once every five years. In accordance with the Digital Uzbekistan 2030 strategy, a programme for the active introduction of AI and digital technologies was adopted. The Presidential Decree No. PQ-4996 of 17 February 2021 stipulates the measures to be implemented for the establishment of conditions conducive to the advancement of AI within the nation.

Research has demonstrated that the incorporation of virtual reality and game elements in educational settings can enhance engagement and motivation in

students. The automation of routine tasks (e.g. the checking of homework, comments, etc.) enables educators to allocate their time and focus to more creative and communicative activities. However, as indicated by numerous studies, a significant proportion of students who utilise AI on a daily or weekly basis may be at risk of developing deficiencies in critical thinking skills. Research undertaken by UNESCO indicates that the lack of clarity surrounding automatic assessment algorithms can engender a perception among students that grades are not equitable.

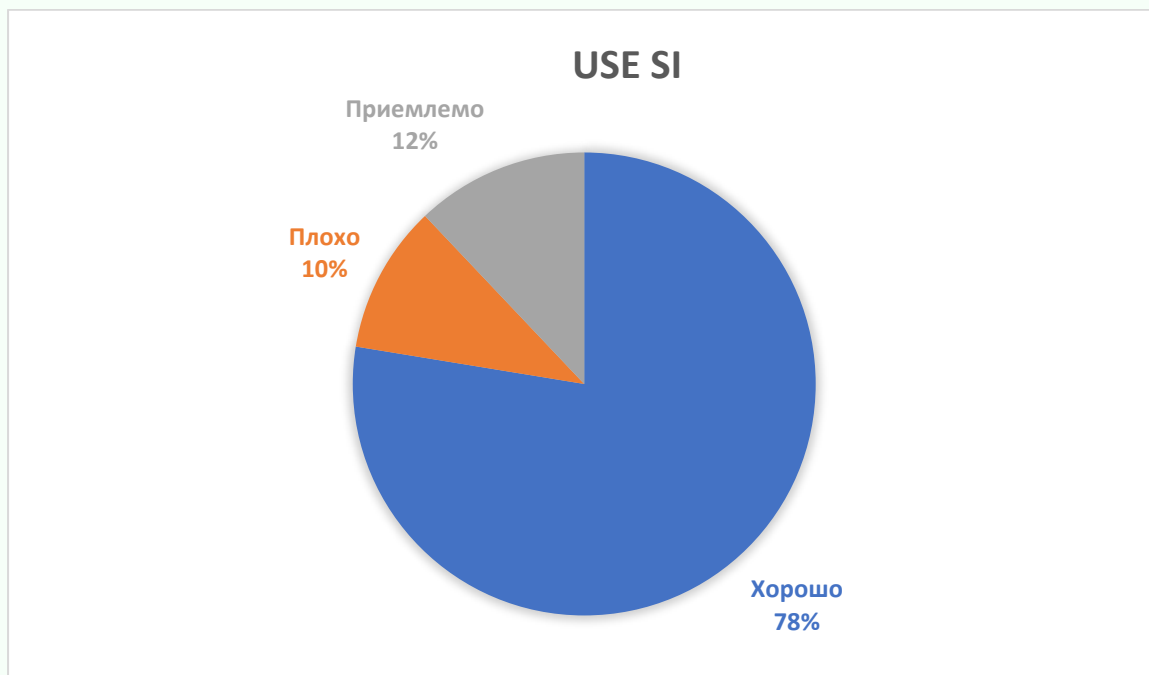
In the context of Uzbekistan's education system, the practical implementation of artificial intelligence (AI) tools has been extensively evaluated through the Eduten platform. Eduten is a digital mathematics platform incorporating gamification elements that has been developed in Finland using artificial intelligence (AI). The objective of the programme is threefold: firstly, to assess students' knowledge; secondly, to increase their motivation; and thirdly, to reduce teachers' workload. In September 2023, a 12-week project involving 527 Year 6 pupils was initiated in collaboration with UNICEF and the Ministry of Preschool and School Education of Uzbekistan. The initiative is regarded as a pilot scheme within the global EdTech for Good programme, with the objective of evaluating and implementing advanced digital solutions. A 16.9 per cent increase in mathematical aptitude was demonstrated by Eduten users, whilst educators were enabled to monitor pupils' progression through the utilisation of real-time learning analytics. It is important to acknowledge that the integration of the Smart School programme, which is founded on artificial intelligence (AI) technologies, into the educational framework of Fergana schools offers a multitude of advantages.

In the context of professional development, it is imperative to cultivate teachers' competencies in the effective utilisation of artificial intelligence. For this purpose, a model of professional development consisting of five stages can be applied.

Stage	Content	Outcome
1. Awareness	What is AI, how it works, safety and ethical considerations	Informed and positive attitude toward AI
2. Digital Literacy	Introduction to platforms: ChatGPT, Khanmigo, Eduten, MagicSchool AI, Eduaide.AI	Skills in selecting and effectively using AI tools
3. Pedagogical Integration	Integrating AI into lesson planning and teaching	Designing and delivering lessons with AI support
4. Learning Analytics	Using AI to analyze student activity and performance	Formative assessment and development of adaptive lessons
5. Reflection and Evaluation	Conducting trial lessons, evaluating outcomes, improving approaches	Proficient application of digital didactics

The Karakalpak Centre for Pedagogical Excellence conducted practical sessions on the utilisation of artificial intelligence (AI) for second and expert category trainees from February to May 2025. As part of the programme of study, participants engaged with ChatGPT, participated in question-and-answer sessions employing AI, created curricula through Eduaide.AI, developed AI-based methodological projects on selected topics, and visualised abstract mathematical concepts (functions, geometry) graphically. At the conclusion of the sessions, the participants completed questionnaires.

The acquisition of competencies in the utilisation of AI platforms such as Wolfram, MathGPT, Khanmigo (Khan Academy's AI), GeoGebra AI, Maktab.edu.uz + LMS, and Interactive Mathematics from MoPSE was undertaken. In particular, when learning dynamic mathematical graphs and statistical analysis on the GeoGebra AI platform, as well as when demonstrating differentiated tests using MagicSchool AI, 78% of the trainees at the reflection stage highly appreciated these AI capabilities.



Artificial intelligence tools in mathematics teaching improve the quality of lessons, reduce teacher workload and enhance student learning. Platforms such as Eduten, Khanmigo, Photomath and Desmos are among the most effective teaching tools available today. We believe it is appropriate to include a module on the use of AI in the professional development programmes (AAC and ASC) of teachers to ensure the effectiveness of AI application and information security in the professional development process.

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