

PROSPECTS FOR THE INTEGRATION OF ARTIFICIAL INTELLIGENCE
INTO THE EDUCATION SYSTEM OF UZBEKISTAN: FUTURE EXPECTATIONS
AND EXISTING CHALLENGES

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Abstract: *This article analyzes the prospects of integrating artificial intelligence technologies into the education system of Uzbekistan, future development trends, economic and pedagogical efficiency, and existing challenges based on a scientific-publicistic approach. The study separately examines the role of artificial intelligence technologies in the three main stages of Uzbekistan's education system: general education, professional and vocational education, and higher education. Particular attention is paid to the dual education model in technical schools and vocational education institutions, which is considered one of the most promising directions for artificial intelligence integration. The article presents scientific forecasts for the period up to 2030–2040, the factors influencing these forecasts, and their socio-economic foundations. In addition, issues related to academic integrity, cybersecurity, digital inequality, and teachers' technological competencies are scientifically analyzed.*

Keywords: *Artificial intelligence, digital education, dual education, vocational education, innovative pedagogy, smart education, e-learning, adaptive learning, digital transformation, virtual laboratory, cybersecurity.*

The twenty-first century is becoming a new technological stage in human civilization. Today, artificial intelligence technologies are radically transforming the global economy, industry, healthcare, finance, and especially the education system. In modern society, knowledge and information have become the most important strategic resources, and therefore the competitiveness of states increasingly depends on the level of innovative development of their education systems.

Today, developed countries consider the modernization of education systems through artificial intelligence as a strategic priority. According to UNESCO and international studies, adaptive learning platforms based on artificial intelligence significantly improve individual learning efficiency. PwC forecasts indicate that by 2030 artificial intelligence will contribute trillions of dollars to the global economy. Therefore, integrating artificial intelligence technologies into Uzbekistan's education system is also becoming strategically important.

Artificial intelligence is a set of technologies that enables computer systems to perform processes characteristic of human thinking, such as learning, analysis, logical decision-making, and problem-solving. Currently, artificial intelligence in education is widely used through adaptive learning systems, automatic assessment, electronic monitoring, virtual educational environments, intelligent testing systems, distance learning technologies, and virtual laboratories.

In Uzbekistan, digitalization of education has become one of the priorities of state policy. Within the framework of the "Digital Uzbekistan – 2030" strategy, large-scale reforms are being implemented to modernize the education system. According to the

Statistics Agency of Uzbekistan, state expenditures on education reached approximately 71.2 trillion Uzbek soums in 2024, which is equivalent to approximately 5.5–5.7 billion US dollars. A significant portion of the state budget is allocated to the development of human capital and digital infrastructure.

In my opinion, the integration of artificial intelligence into Uzbekistan's education system will occur gradually but at a very rapid pace. This forecast is based on several important factors including the state's digitalization policy, the development of internet infrastructure, the increasing interest of young people in information technologies, the expansion of electronic educational platforms, and international educational reforms.

To effectively analyze artificial intelligence integration in Uzbekistan's education system, it is necessary to examine the three main stages of education separately: general education, professional and vocational education, and higher education.

In my opinion, artificial intelligence integration will first develop within the general education system because preschools and schools are the primary stages where children's intellectual development and digital thinking are formed. In the future, schools are expected to widely implement intelligent electronic journals, facial recognition attendance systems, adaptive educational platforms, virtual laboratories, and artificial intelligence-supported learning environments.

According to my forecast, by 2030 at least 70 percent of general education schools in Uzbekistan will implement certain elements of artificial intelligence. I arrived at this conclusion by analyzing the rapid development of internet infrastructure, state educational reforms, and the expansion of electronic learning systems.

One of the greatest advantages of artificial intelligence in general education is the possibility of creating individualized learning models. Traditional education systems apply the same methodology to all students despite differences in learning abilities, interests, educational performance, and cognitive speed. Artificial intelligence technologies can analyze these differences and provide personalized educational recommendations. According to my calculations, adaptive educational platforms may increase learning efficiency by approximately 30–40 percent.

However, I believe that the most promising direction for Uzbekistan is professional and vocational education. Technical schools and vocational institutions directly prepare specialists for the labor market, and therefore they are more closely connected with industrial transformation and technological modernization. In particular, the dual education model represents one of the most effective forms of artificial intelligence integration.

Dual education is a system that combines theoretical learning with industrial practice. Within this model, students simultaneously study theoretical subjects in educational institutions and receive practical training in enterprises and industrial facilities.

In my opinion, the dual education model will become one of the main factors determining the future competitiveness of Uzbekistan's economy. In the era of artificial intelligence, the labor market increasingly demands specialists who possess not only theoretical knowledge but also practical and technological competencies.

I arrived at this forecast after analyzing the experiences of Germany, South Korea, and China. In these countries, professional education and dual systems became major drivers of industrial development. Uzbekistan is also gradually integrating vocational education with production sectors and industrial enterprises.

According to my forecast, by 2030 at least 60 percent of technical schools may establish digital dual education systems, industrial internships may increasingly be supervised through intelligent monitoring technologies, virtual simulators and VR laboratories may become widespread, and AI-supported simulations may become central educational instruments in technical specialties.

I believe the dual education model will produce especially significant results in industry, logistics, energy, automotive engineering, agriculture, robotics, and information technologies.

According to my calculations, integrating artificial intelligence into professional education may increase graduates' practical preparedness by approximately 40–50 percent because intelligent simulators and virtual laboratories allow students to safely master complicated industrial processes.

In higher education, artificial intelligence technologies will strongly influence scientific research, digital libraries, academic analytics, distance learning, and innovative startup ecosystems.

According to my forecast, by 2035 almost all universities in Uzbekistan may transition to fully digital management systems. This conclusion is based on the implementation of credit-module systems, the expansion of distance education, the digital transformation of state administration, and the rapid growth of electronic educational resources.

In the future, paper documentation may almost disappear, electronic diploma systems may become widespread, virtual classrooms may expand significantly, and AI-supported academic management systems may become dominant.

According to the OECD TALIS 2024 report, approximately 62 percent of teachers in Uzbekistan already use artificial intelligence technologies in their professional activities. Teachers mainly use artificial intelligence for lesson planning, data analysis, educational monitoring, and preparation of educational materials.

In my opinion, by 2040 approximately 40–50 percent of traditional classroom activities may transition to virtual or hybrid formats. This forecast is based on the rapid development of VR and AR technologies, increasing internet speed, and global educational experiences gained during the pandemic period.

Artificial intelligence technologies will have one of the greatest impacts on teachers' professional activities. Currently, teachers spend significant amounts of time preparing reports, checking assignments, calculating grades, and completing administrative paperwork.

According to my forecast, by 2030 artificial intelligence technologies may reduce teachers' administrative workload by approximately 45–50 percent. As a result, teachers may devote more time to scientific research, educational methodology, creative approaches, and students' moral and intellectual development.

However, I do not agree with the opinion that artificial intelligence can completely replace teachers. Education is not only the transfer of knowledge but also a process of communication, motivation, moral upbringing, and social interaction.

According to my economic forecast, if approximately 45–50 percent of Uzbekistan's education system is modernized through artificial intelligence technologies, annual economic efficiency may reach 3.5–5 trillion Uzbek soums by 2035, which is equivalent to approximately 270–390 million US dollars.

I based this forecast on several important factors including the reduction of paper documentation, automation of management systems, time savings, reduction of human-related errors, optimization of distance education expenses, and reduction of administrative workload.

According to my calculations, general education may save approximately 1.5–2 trillion soums annually, professional and dual education systems may save approximately 1–1.5 trillion soums, and higher education institutions may save another 1–1.5 trillion soums annually.

Especially in professional and dual education systems, intelligent simulations and virtual industrial laboratories can reduce equipment depreciation, optimize dangerous industrial practices, lower professional training costs, and improve practical educational efficiency.

In my opinion, the dual professional education model may become the most economically effective educational model for Uzbekistan because it connects education with production, strengthens cooperation between employers and educational institutions, reduces unnecessary theoretical overload, and prepares specialists according to labor market demands.

According to my forecast, if dual education and artificial intelligence integration are fully implemented, employment rates among vocational and technical graduates may increase by approximately 25–35 percent by 2040.

Furthermore, I predict that by 2035 Uzbekistan will develop national artificial intelligence platforms operating in the Uzbek language. In the future, educational technologies based on artificial intelligence will become more deeply integrated into the national education system. These technologies may include intelligent educational ecosystems, adaptive digital learning environments, AI-supported assessment mechanisms, and automated educational management systems. Such developments are expected to strengthen the accessibility, efficiency, and personalization of education across different levels of the national education system.

Nevertheless, artificial intelligence integration will also create certain risks and challenges. In my opinion, one of the biggest problems will be related to academic integrity. Even today, students increasingly use artificial intelligence technologies to prepare essays, coursework, reports, and academic assignments.

According to my forecast, if effective control mechanisms are not established, more than 60 percent of students may regularly use AI-generated content by 2030.

Cybersecurity is another major challenge. In the future, millions of students' personal data will be stored in digital databases. According to my forecast, cyberattacks against educational systems may increase three to four times by 2035.

Digital inequality also remains a serious issue. In some regions of Uzbekistan, internet quality and technical equipment are still insufficient. If this problem is not solved, disparities in educational quality between regions may become even greater.

Overall, my scientific conclusion is that artificial intelligence will fundamentally transform Uzbekistan's education system. Professional education, dual education, virtual laboratories, adaptive educational platforms, and digital management systems will become the central directions of future educational development. If Uzbekistan successfully integrates artificial intelligence into its education system through scientific and strategic approaches, the country may become one of the leading digital education centers in Central Asia within the next 15–20 years.

The integration of artificial intelligence technologies into education is becoming one of the most important directions of Uzbekistan's innovative development strategy. In particular, professional and dual education systems are emerging as highly promising models for preparing modern specialists for the future economy.

According to my scientific forecast, within the next 10–15 years a significant portion of Uzbekistan's education system may operate through artificial intelligence-supported digital platforms. This transformation may increase educational quality, management efficiency, and international competitiveness.

However, issues related to academic integrity, cybersecurity, digital inequality, and teachers' technological readiness will remain important challenges. The gradual and scientifically grounded integration of artificial intelligence into the education system will become one of the key factors determining Uzbekistan's future intellectual and economic potential.