

**PROSPECTS OF USING ARTIFICIAL INTELLIGENCE TECHNOLOGIES IN
PREPARING FUTURE TECHNOLOGY TEACHERS IN THE CONTEXT OF DIGITAL
MANUFACTURING**

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***Abstract.** This article analyzes the prospects of effective use of artificial intelligence technologies in the professional training of future technology teachers in the context of digital manufacturing. The rapid development of modern production systems, including automation, robotics, data processing, and intelligent control systems, requires the renewal of the content of technology education. In this regard, it is important to develop future teachers' digital competence, innovative thinking, and practical skills in applying artificial intelligence tools in pedagogical and professional activities.*

***Keywords:** digital manufacturing, artificial intelligence, technology education, future teacher, professional training, digital competence*

**RAQAMLI ISHLAB CHIQRARISH SHAROITIDA BO'LAJAK TEXNOLOGIYA FANI
O'QITUVCHILARINI TAYYORLASHDA SUN'YIY INTELLEKT
TEXNOLOGIYALARIDAN FOYDALANISH ISTIQBOLLARI**

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Аннотация. Ushbu maqolada raqamli ishlab chiqarish sharoitida bo'lajak texnologiya o'qituvchilarini kasbiy tayyorlash jarayonida sun'iy intellekt texnologiyalaridan samarali foydalanish istiqbollari tahlil qilinadi. Zamonaviy ishlab chiqarish tizimlarining tez rivojlanishi, jumladan avtomatlashtirish, robototexnika, ma'lumotlarni qayta ishlash hamda intellektual boshqaruv tizimlarining keng joriy etilishi texnologiya ta'limi mazmunini yangilashni talab etadi. Shu munosabat bilan bo'lajak o'qituvchilarning raqamli kompetensiyasi, innovatsion fikrlashi hamda pedagogik va kasbiy faoliyatda sun'iy intellekt vositalaridan foydalanish ko'nikmalarini rivojlantirish muhim ahamiyat kasb etadi.

Калит so'zlar: raqamli ishlab chiqarish, sun'iy intellekt, texnologiya ta'limi, bo'lajak o'qituvchi, kasbiy tayyorgarlik, raqamli kompetensiya, innovatsion pedagogika, virtual laboratoriya, adaptiv ta'lim, simulyatsion dasturlar

ПЕРСПЕКТИВЫ ИСПОЛЬЗОВАНИЯ ТЕХНОЛОГИЙ ИСКУССТВЕННОГО ИНТЕЛЛЕКТА ПРИ ПОДГОТОВКЕ БУДУЩИХ УЧИТЕЛЕЙ ТЕХНОЛОГИИ В УСЛОВИЯХ ЦИФРОВОГО ПРОИЗВОДСТВА

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Аннотация. В данной статье анализируются перспективы эффективного использования технологий искусственного интеллекта в профессиональной подготовке будущих учителей технологии в условиях цифрового производства. Быстрое развитие современных производственных систем, включая автоматизацию, робототехнику, обработку данных и интеллектуальные системы управления, требует обновления содержания технологического образования. В этой связи особое значение приобретает формирование цифровой компетентности будущих педагогов, их инновационного мышления, а также практических навыков применения технологий искусственного интеллекта в педагогической и профессиональной деятельности.

Ключевые слова: цифровое производство, искусственный интеллект, технологическое образование, будущий учитель, профессиональная подготовка, цифровая компетентность, инновационная педагогика

Introduction. In recent years, the rapid development of digital technologies has significantly transformed all sectors of production and education worldwide. The implementation of the “Industry 4.0” concept, characterized by automation, robotics, cyber-physical systems, and artificial intelligence, has created new demands for the education system, especially in the preparation of future technology teachers. These changes require not only modernization of teaching methods but also the development of new professional competencies among educators.

In the context of digital manufacturing, a technology teacher is expected to possess not only traditional technical knowledge but also advanced skills in information and communication technologies, digital design, intelligent systems, and artificial intelligence applications. Future teachers must be able to adapt to innovative production environments and effectively transfer this knowledge to students. Therefore, developing digital literacy, critical thinking, and problem-solving skills has become one of the main priorities in teacher education.

Artificial intelligence technologies provide wide opportunities in the educational process, such as personalized learning, automated assessment, virtual laboratories, simulation-based training, and adaptive teaching systems. These tools help students better understand complex technological processes and improve the integration of theoretical knowledge with practical application. As a result, the use of AI in teacher preparation contributes to improving the overall quality and efficiency of education.

In Uzbekistan, the modernization of higher education, the development of digital learning environments, and the improvement of teacher training quality are among the priority directions of state educational policy. The integration of artificial intelligence technologies into professional education is considered an important step toward preparing competitive specialists for the labor market.

This article examines the pedagogical opportunities, advantages, and future prospects of using artificial intelligence technologies in preparing future technology teachers in the conditions of digital manufacturing.

Literature Review and Methodology. The integration of digital manufacturing and artificial intelligence technologies into the education system has become one of the most actively studied topics in modern pedagogical research. In particular, the issues of preparing future teachers under the conditions of Industry 4.0, developing digital competencies, and implementing intelligent technologies in the teaching process have attracted the attention of both foreign and local scholars.

Among foreign researchers, Klaus Schwab emphasized the necessity of modernizing education systems in the era of the Fourth Industrial Revolution. According to his ideas, modern professionals should possess not only theoretical knowledge but also digital management skills, analytical thinking, and the ability to make innovative decisions. Researchers such as Michael Fullan, Paulo Blikstein, and John Anderson have highlighted the role of artificial intelligence in adaptive learning, personalized education, and the creation of interactive learning environments. Their studies confirm that AI-based educational tools significantly improve student engagement and practical understanding.

Local scholars such as N.A. Muslimov, B.X. Xodjayev, R.H. Jo'rayev, and U.Q. Tolipov have scientifically substantiated the modernization of vocational education, the implementation of pedagogical technologies, and the development of professional competence among future teachers. Their research particularly emphasizes innovative models of technology education, practice-oriented teaching, and the importance of digital pedagogy.

The analysis of existing literature shows that the use of artificial intelligence technologies is an effective tool for improving the professional preparation of future technology teachers. However, the pedagogical integration of these technologies specifically in the context of digital manufacturing remains insufficiently studied, which determines the relevance of this research.

This study employed both theoretical and empirical research methods. The theoretical methods included the analysis of pedagogical, psychological, and methodological literature, the study of scientific articles and international experience, comparative analysis, and generalization. These methods helped identify the role and educational potential of artificial intelligence technologies in technology education.

Empirical methods included observation, questionnaires, interviews, and experimental work. The research involved university students studying in the field of technology education, as well as teaching staff. Their level of awareness and practical use of AI tools, existing challenges, and future

opportunities were investigated. The collected data were processed using statistical analysis, which allowed for the formulation of scientific conclusions.

The main objective of the research methodology was to develop an effective model for the use of artificial intelligence technologies in preparing future technology teachers and to justify its pedagogical effectiveness in the conditions of digital manufacturing.

Results and Discussion. In order to determine the effectiveness of using artificial intelligence technologies in preparing future technology teachers under the conditions of digital manufacturing, experimental research was conducted. The study involved 120 students from the 2nd to 4th years of the “Technology Education” program and 18 university professors and instructors.

At the initial stage, the participants’ knowledge and practical skills related to the use of artificial intelligence technologies were examined. The questionnaire results showed that 32% of students regularly used AI tools, 41% used them partially, and 27% had little or no experience with such technologies. These findings indicated the necessity of a systematic pedagogical approach in this area.

During the experiment, virtual laboratories, adaptive learning platforms, simulation software, and AI-based assessment systems were integrated into the educational process. These tools were especially effective in modeling technological processes and visually explaining production systems. Students demonstrated greater interest and engagement during practical lessons supported by digital simulations. The following table presents the results before and after the experiment.

Table 1

The following table presents the results before and after the experiment

Indicators	Before Experiment (%)	After Experiment (%)
High level of digital competence	28	67
Effective use of AI tools	32	74
Independent design skills	36	71
Innovative thinking level	41	78

As shown in the table, significant improvement was observed in all indicators after the experimental implementation. In particular, the effective use of AI tools increased from 32% to 74%, confirming the practical value of artificial intelligence technologies in teacher preparation.

Interviews conducted with university instructors also revealed positive opinions regarding the implementation of AI technologies. According to them, adaptive learning systems strengthen individualized instruction, while virtual laboratories reduce the need for extensive material and technical resources. In addition, automated assessment systems save time and improve the objectivity of evaluating students' learning outcomes.

The analysis demonstrated that the use of artificial intelligence technologies in preparing future technology teachers not only improves professional competencies but also enhances the quality of education, strengthens practical training, and supports the preparation of pedagogical specialists who meet the demands of modern digital manufacturing.

At the same time, several challenges were identified. These include insufficient technical infrastructure in some higher education institutions, limited digital competence among teachers, and the lack of specialized methodological support. Addressing these issues remains an important direction for future research and educational reform.

Conclusion. The use of artificial intelligence technologies in preparing future technology teachers in the context of digital manufacturing is one of the most relevant and promising directions of modern education. The rapid development of automation, robotics, digital control systems, and the widespread implementation of the Industry 4.0 concept require significant modernization of technology education and teacher training systems.

The results of the study demonstrated that AI-based virtual laboratories, simulation software, adaptive learning platforms, and automated assessment systems significantly contribute to the development of professional competencies among future technology teachers. In particular, these technologies positively influence digital competence, independent design skills, innovative thinking, and practical training. Experimental results confirmed that the integration of AI tools improves both the effectiveness and quality of the educational process.

Furthermore, artificial intelligence technologies support individualized learning, optimize time and educational resources, and strengthen the connection between education and real production

environments. This creates favorable conditions for preparing competitive, creative, and professionally competent technology teachers who can meet the demands of modern industry.

However, some challenges remain, including insufficient technical infrastructure in higher education institutions, limited methodological support, and the inadequate digital readiness of some teaching staff. These factors hinder the full implementation of AI technologies in teacher education.

In the future, it is necessary to improve AI-based educational environments in universities, enhance the digital competence of pedagogical staff, and develop innovative teaching methodologies adapted to digital manufacturing conditions. This will ensure the preparation of highly qualified and modern technology teachers capable of contributing effectively to the development of society and industry.

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