

**DEVELOPING DIGITAL AND INNOVATION COMPETENCE OF
TEACHERS THROUGH THE USE OF ARTIFICIAL INTELLIGENCE
TECHNOLOGIES IN HIGHER EDUCATIONAL INSTITUTIONS**

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Abstract, this article analyzes the theoretical foundations, practical aspects and methodological approaches to developing digital and innovative competence of teachers through the use of artificial intelligence technologies in higher education institutions. Models of integration of SI technologies into pedagogical activities, stages of competence development, as well as issues of psychological and technological readiness of professors and teachers for digital transformation are covered. The author proposes a systematic approach aimed at increasing the digital competence of pedagogical staff in higher education.

Keywords: artificial intelligence, digital competence, innovative competence, pedagogical activity, higher education, digital transformation, adaptive learning, professional development.

Introduction. The modern education system is rapidly developing under the influence of digital transformation processes. The widespread introduction of information and communication technologies, the popularization of artificial intelligence, distance learning and digital platforms are placing new demands on the professional activities of teachers. Therefore, the development of digital and innovative competence of teachers is currently one of the important directions of modernization of the education system.

Digital competence of teachers includes the effective use of modern technologies in the teaching process, the creation of educational materials in digital form, the skills of analyzing and transmitting information. Innovative competence is associated with the use of new pedagogical approaches, the introduction of creative solutions into the educational process and the development of independent thinking of students. These competencies, when combined with each other, increase the professional efficiency of the teacher. At the same time, an analysis of existing practice shows that the system for developing digital and innovative competence of teachers has not been sufficiently

improved. In many cases, teachers are limited to using technological tools and face difficulties in integrating them into the pedagogical process. This negatively affects the effectiveness of the educational process. In this regard, the relevance of this study is determined by the identification of pedagogical conditions for the development of digital and innovative competence of teachers, the development of effective methods and tools, and their introduction into the educational process. This article scientifically analyzes the theoretical foundations and practical ways of developing digital and innovative competence of teachers.

Relevance of the topic. Since the second decade of the 21st century, the global education system has entered a stage of fundamental changes. At the heart of these changes is the rapid introduction of digital technologies, in particular, artificial intelligence (AI) technologies into the educational process. Artificial intelligence is not only changing the content, methods, and organizational forms of education, but also fundamentally renewing the requirements for the professional activities of teachers. The development of digital and innovative competence of professors and teachers working in higher education institutions has become not only a personal matter, but also a strategic priority for the entire education system. In this regard, artificial intelligence technologies perform a dual function: on the one hand, they create new tools and opportunities for educators, and on the other hand, they require teachers to skillfully use these tools, understand their capabilities and limitations, and redesign the educational process based on them. The concept of digital competence is much broader than traditional computer literacy and includes the skills of searching for information, critically evaluating, processing, communicating in a digital environment, observing digital security, and most importantly, the effective use of digital tools for pedagogical purposes. Innovative competence is the ability to create new ideas, implement them in practice, constantly improve pedagogical processes, and ensure flexibility in changing conditions. Artificial intelligence technologies require a synthesis of these two types of competencies, because working with them requires not only technical skills, but also innovative thinking, a new approach to problems, and a departure from the traditional pedagogical paradigm.

Currently, the application of artificial intelligence technologies in higher education is manifested in several main areas.

The first direction is the possibility of forming learning trajectories adapted to the individual characteristics of students through adaptive learning systems. Such systems determine the level of knowledge, speed of mastering, difficulties of students and

recommend appropriate educational materials for them. For teachers, this, in turn, allows them to individualize the learning process, deepen work with each student, but for this the teacher must have the competence to configure adaptive systems, analyze the information provided by them and make pedagogical decisions based on this analysis.

The second direction is intelligent instructional systems and virtual assistants, which allow them to automatically answer the most common questions of students, provide 24/7 support in distance learning. This frees teachers from many routine tasks and allows them to devote more time to creative and individual work.

The third direction is the use of artificial intelligence in knowledge assessment systems. Unlike traditional tests, AI makes it possible to analyze and evaluate open-ended questions, essays, and even complex project work in an automated manner. However, the pedagogically correct use of such systems, the interpretation of assessment results, and their integration with the final assessment require new competencies from the teacher. The fourth area is the use of AI tools for data processing, visualization, and statistical analysis for educational and scientific research. Today, it is difficult to imagine scientific research in a number of specialties (engineering, medicine, economics, pedagogy, etc.) without AI tools. Therefore, the competence of professors and teachers to use artificial intelligence technologies in their scientific activities is becoming an integral part of their general professional skills.

The process of developing digital and innovative competence of teachers through artificial intelligence technologies should include several main stages.

The first stage is the stage of motivational and psychological preparation. Numerous studies show that the main obstacles for teachers to adopt new technologies are not related to technical aspects, but are psychological and motivational in nature. Factors such as the perception of artificial intelligence as a “teacher-replacing” technology, difficulties in mastering new tools, and fear of losing their professional identity can negatively affect the attitude of pedagogical personnel to the use of AI technologies. Therefore, competency development programs should first of all ensure that teachers have a correct idea of the essence of artificial intelligence, its capabilities and limitations, as well as its role in pedagogical activity. At this stage, it is important to teach them to view AI technologies as a tool that enhances, rather than negates, the human factor. The second stage is the stage of basic technological preparation. At this stage, faculty members are introduced to the basic concepts of artificial intelligence (e.g., machine learning, neural networks, natural language processing, big data

analytics). In practical terms, they acquire skills in working with specific AI tools (e.g., adaptive learning platforms, intelligent instructional systems, automated assessment systems, content-generating AI programs) that they can use in the educational process. An important aspect of this stage is that technological training should not be limited to the formation of technical skills, but should also include an understanding of the pedagogical capabilities of each tool, for which educational purposes and in what conditions it is effective to use it.

The third stage is the integration and innovation stage. At this stage, teachers develop the skills to integrate artificial intelligence tools within their disciplines, in accordance with specific educational goals and student contingents. This process requires the teacher not only to know the technology, but also to redesign their pedagogical system, transfer traditional educational materials to a digital and adaptive format, and redefine their role and functions as a result of using AI tools in the educational process. At a higher stage of integration, teachers themselves can rise to the level of creating educational resources based on artificial intelligence, adjusting existing tools based on pedagogical needs, and even developing new methodological solutions. It is at this stage that innovative competence is fully manifested, since the teacher no longer just becomes a user of existing tools, but also a creator of new pedagogical opportunities. A systematic and continuous approach to developing the digital and innovative competence of teachers through the use of artificial intelligence technologies is of great importance. Experience shows that one-time advanced training courses often do not produce the expected results, since technologies develop very quickly, and the tools taught can lose their relevance in a few months. Therefore, the system for developing digital and innovative competence of pedagogical staff in higher education institutions should be based on the principle of continuous professional development. This system may include the following elements: permanently operating digital transformation support centers, platforms for the exchange of experience between professors and teachers, methodological and technical consulting services, as well as mechanisms for supporting innovative projects using artificial intelligence tools. In addition, the use of modern mechanisms such as a micro-credit system, microqualifications, and digital certification in the process of developing competence is also effective. It should be noted that artificial intelligence technologies themselves are both a tool and an object in the development of digital and innovative competence of teachers. On the one hand, SI technologies serve to increase the competence of teachers as a means of supporting their professional activities, on the other hand, the

very process of mastering and applying these technologies forms new competencies. This two-way process turns the use of artificial intelligence in pedagogical activity into a complex but highly effective direction. For example, if a teacher uses artificial intelligence tools to analyze essays written by students, he will simultaneously speed up the assessment process and obtain deeper analytical information about typical errors and logical shortcomings in students' texts. This allows the teacher to improve his methodology and establish individual work with students. In this case, SI tools become a factor that not only increases labor productivity, but also analytically enriches pedagogical activity.

When using artificial intelligence technologies, special attention should be paid to ethical and legal issues. Issues such as data privacy, protection of personal data of students and teachers, explainability of decisions of artificial intelligence algorithms, algorithmic impartiality are important components of digital competence of educators. When using artificial intelligence tools, professors and teachers need to understand issues such as what data is stored where, by whom and for what purposes, on what basis the algorithms make decisions, and be able to provide students with correct instructions in this regard. Otherwise, the process of introducing artificial intelligence into education may create new ethical problems, increase distrust and resistance.

An analysis of international experience shows that higher education institutions that have achieved success in developing the competence of pedagogical staff through artificial intelligence technologies have several common factors. These are: a clear strategy and roadmap for digital transformation; an infrastructure that technologically supports professors and teachers; an institutional culture that encourages the exchange of experience and cooperation; a system of financial and moral incentives that supports best practices in the use of artificial intelligence; as well as a mechanism for regular monitoring and evaluation of the process of developing competence. All of these factors together require a systematic approach not only technologically, but also organizationally, methodologically and socio-psychologically.

The issue of developing the digital and innovative competence of teachers through the use of artificial intelligence technologies is of particular relevance in the higher education system of Uzbekistan. In our country, as part of the transition to digital education, the “Digital Uzbekistan - 2030” strategy, and programs for the development of digital infrastructure in higher education institutions, great attention is paid to improving the digital literacy of professors and teachers. However, the existing system is mainly focused on the development of general digital competencies, and a systematic

approach that fully reveals the pedagogical potential of artificial intelligence technologies has not yet been fully formed. In this regard, the development of special training courses, modules, and advanced training programs on the use of artificial intelligence in higher education institutions, the involvement of the experience of leading foreign universities in this process, as well as the formation of local scientific and methodological schools are important tasks. Another important aspect in the process of developing digital and innovative competence of teachers through the use of artificial intelligence technologies is the determination of criteria and indicators for assessing these competencies. How can one objectively assess the development of a teacher's digital and innovative competence? There are several approaches to this: first, the frequency and variety of the teacher's use of artificial intelligence tools; second, the pedagogical effectiveness achieved in the learning process as a result of the use of these tools (students' mastery indicators, satisfaction level, activity); third, the innovative solutions created by the teacher in his work based on artificial intelligence; fourth, the teacher's methodological assistance to other colleagues in the use of artificial intelligence and participation in the dissemination of experience. Based on these criteria, it is possible to differentially assess the level of competence of professors and teachers and offer individual development trajectories accordingly.

In the future, as artificial intelligence technologies develop and their integration into education deepens, it is natural that the requirements for the digital and innovative competence of teachers will also become more complex. The popularization of generative artificial intelligence (for example, ChatGPT, Midjourney, etc.), the combination of AI with virtual and augmented reality technologies, the development of neural interfaces - all this requires new competencies in pedagogical activities. Therefore, the system for developing the digital and innovative competence of pedagogical staff in higher education institutions should be aimed not only at mastering current technologies, but also at forming the ability to adapt to future technological changes and foresee them. In conclusion, the development of digital and innovative competence of teachers through the use of artificial intelligence technologies in higher education institutions is a complex, multifactorial and systematic process that requires a comprehensive approach. This process is not limited to teaching technical skills, but also encompasses pedagogical thinking, methodological skills, moral responsibility and the desire for continuous development. The expected results can be achieved only when artificial intelligence technologies are viewed not as a replacement for teachers, but as a powerful tool that expands their professional capabilities, reveals their creative

potential, and improves the quality of work with students. The main task facing the leaders, organizers and methodologists of higher education institutions is to prepare professors and teachers for this process, support them and create the necessary conditions for their effective use of artificial intelligence technologies for pedagogical purposes. Systematic work in this direction serves as an important factor ensuring the competitiveness, innovative potential and integration into the global educational arena of not only individual teachers, but also the entire higher education system.

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