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Innovative methodological foundations for developing digital competencies in engineering education

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Abstract: This article analyzes the innovative methodological foundations for developing digital competencies in engineering education. The necessity of enhancing digital literacy among engineering professionals in the context of digital transformation and developing their professional competencies based on new technologies is substantiated. Additionally, methodological approaches for fostering student competence through the use of digital tools, 3D technologies, artificial intelligence, and distance learning systems in the educational process have been developed.

Keywords: engineering education, digital competence, innovative methodology, digital technologies, 3D modeling, artificial intelligence, distance learning, digital transformation.

Today, the engineering education system is closely intertwined with modern digital technologies. In the context of the digital economy, all areas of engineering rely on automation, computer modeling, data analysis, and digital production systems. Consequently, developing digital competencies in future engineers is becoming a key indicator of their professional readiness.

The essence of digital competence and its role in engineering education. Digital competencies are a key factor in shaping the technological thinking of engineering specialists. These competencies encompass skills in working with digital information, collaborating in virtual environments, efficiently utilizing engineering software tools, ensuring data security, and developing algorithmic thinking and programming abilities.

2. Innovative methodological approaches. Project-based learning, digital laboratories, 3D modeling, and the incorporation of artificial intelligence and gamification elements play a crucial role in developing digital competencies in engineering education.

3. Advantages of the digital educational environment. The digital educational environment enables a personalized approach to organizing the learning process, promotes independent learning, and allows for rapid assessment of knowledge.

4. Recommendations for engineering education. It is essential to develop training modules aimed at enhancing digital competencies, improve the qualifications of educators, and implement innovative assessment systems.

The ongoing reforms in our country aimed at strengthening the material, technical, and information base of the educational process in higher education institutions, providing them with high-quality educational literature and advanced pedagogical technologies, and fostering cooperation with leading scientific and educational

institutions worldwide are intensifying the need for continuous improvement of modern professional knowledge and pedagogical skills among teaching staff. Measures to enhance the quality of education in higher educational institutions of the Republic of Uzbekistan have outlined tasks such as "increasing the participation and initiative of higher educational institutions in the comprehensive reforms being implemented in the country, and monitoring the knowledge and pedagogical proficiency of professors and teachers."

Any complex modern information and communication technologies, integrations, groundbreaking innovations in science, and digital trends are first mastered by the teacher, and then conveyed to the consciousness and thinking of students through the teacher's knowledge, expertise, and abilities. Year by year, the requirements for a teacher's professional activity are increasing. This is a demand of our time. Consequently, the term "pedagogical mastery" applied to teachers will never lose its significance; instead, it will continue to improve, enrich, and adapt to the demands of the era. In the development of a digital society, it is advisable to prepare future specialists in terms of professional potential based on knowledge related to technological production and societal laws that influence the field. The challenges of developing mechanisms, tools, and technologies for preparing teachers with digital competence for professional activities in the modern educational environment remain relevant. In turn, this indicates the need for a scientific understanding of the essence of training teachers with high digital competence in this field of activity.

The term "digital" originates from the Latin and English word "digital" and denotes a qualitative degree indicating "data in numbers, signal," or "step-by-step" sequence. This word, which entered the Uzbek language in the mid-90s of the last century, first appeared in the form of the phrase "digital economy." Even now, while not leaving the sphere of "economics," it has expanded its semantic range, entering other fields with a comprehensive connotation, and has become one of the important terms in the field of information technology. In terms of usage, this word has reached such a level of breadth and productivity that it has undoubtedly become a common word in the Uzbek language, rather than just a term. The phrase "digital competence" refers to "knowledge and skills in the application of digital equipment in connection with specialized field knowledge in various professional areas."

The concept of digital competencies is characterized as a specific feature of a person's (citizen, employee, student) ability to use information and communication technologies in various conditions (work, leisure, training) in order to increase the effectiveness of activities.

In other foreign sources, digital competence is defined as the reliable, critical, and creative use of ICT to achieve goals related to work, education, leisure, and participation in society.

Today, the development of specialists with digital competence is one of the main tasks of the modern society's education system. This task can only be achieved through targeted implementation of teaching methodology for ICT competence based on multimedia educational technologies. In this process, students should be given the opportunity to understand new knowledge, create innovations through skillful application of this knowledge in lessons, and effectively implement newly created methodologies in practice.

The formation of digital competencies in engineering education is one of the priority directions of innovative educational policy today. Organizing the educational process in a digital environment fosters technological thinking in students, developing their ability to analyze problematic situations and find practical solutions. Additionally, educational models created using digital tools enhance the quality of education, individualize the learning process, and increase the effectiveness of preparation for engineering activities.

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