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The Importance of The Digital Learning Environment in Engineering Education Based on Foreign Experience

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Abstract: This article analyzes the importance of the digital learning environment in engineering education based on foreign experience. It demonstrates that in developed countries, the widespread use of digital technologies, virtual laboratories, simulation programs, and online platforms significantly enhances the effectiveness of engineering education. The article highlights the role of the digital environment in developing students' independent thinking, problem-solving abilities, and practical skills. It also substantiates the importance of adapting international experience to the national education system. The research results show that the development of a digital learning environment is a key factor in improving the quality of engineering training.

Keywords: Engineering education, digital learning environment, foreign experience, virtual laboratories, simulation programs, online platforms, practical skills, independent thinking, problem-based learning, education effectiveness, innovative pedagogy, quality of personnel training.

Introduction: The rapid development of the modern economy and industry necessitates a fundamental re-evaluation of the system for training engineering personnel. Today, highly qualified engineers need not only theoretical knowledge but also practical skills, the ability to make decisions in complex situations, and the capacity to apply innovative approaches. From this perspective, studying international experience and adapting it to the national education system is of critical importance for improving engineering education.

In developed countries, digital learning environments are widely applied in the process of training engineers. Virtual laboratories, simulation programs, online platforms, and interactive educational resources enable students to consolidate knowledge, develop practical skills, and study complex technological processes in a safe environment. At the same time, the digital environment allows the learning process to be individualized, meaning that it can be adapted to each student's level of knowledge and specific needs. This plays a significant role in enhancing the quality of education and increasing student motivation.

International experience demonstrates that digital learning environments enable students to develop independent thinking, problem-solving abilities, project work skills, and teamwork competencies. For instance, in countries such as Germany, Japan, and South Korea, engineering education is implemented through project-based learning combined with simulation technologies. This approach significantly enhances graduates' professional preparedness and makes them competitive in the modern labor market.

DISCUSSION

At the same time, the digital learning environment needs to be implemented within the national education system. In higher education institutions of the Republic of Uzbekistan, a range of measures is being undertaken to modernize engineering education, integrate real industrial problems into the learning process, and widely apply digital technologies. However, challenges such as insufficient digital infrastructure, limited digital competencies of instructors, and a lack of modern

educational resources still exist. Therefore, studying international experiences and adapting them to national conditions is of critical importance.

The aim of this article is to determine the significance of the digital learning environment in engineering training based on international experience and to assess its effectiveness. To achieve this goal, the study examined the use of digital technologies in international education systems, the role of virtual laboratories and simulation platforms, and the possibilities of adapting these tools to the national education system. The results of the research aim to identify ways to make engineering education more effective, strengthen students' knowledge, and develop their practical skills.

This study focuses on assessing the role of the digital learning environment in engineering education based on international experience, employing a comprehensive research methodology that integrates both theoretical and empirical approaches. Several groups of sources were selected as research materials. First, international and national scientific literature, articles, monographs, and conference materials were analyzed. Particular attention was given to sources highlighting the effectiveness of digital learning platforms, virtual laboratories, simulation programs, and interactive educational resources in engineering education. Additionally, the experiences of higher education institutions in developed countries such as Germany, Japan, South Korea, and the United States were studied as part of the research.

Empirical data were obtained from surveys, interviews, and observations conducted with students, faculty members, and specialists from industrial enterprises. Surveys assessed students' level of digital tool usage, their motivation in the learning process, and the potential for developing practical skills. Interviews explored faculty members' experience in using digital platforms, their pedagogical approaches, and their views on adapting international experience to national conditions. At the same time, specialists from industrial enterprises evaluated graduates' practical readiness, their ability to adapt to technological processes, and their experience in applying digital technologies.

The object of the study was higher education institutions offering engineering programs and their learning processes. The subject of the study was the mechanisms for preparing students to address real industrial problems through the implementation of a digital learning environment. The study covered various fields, including mechanical engineering, electrical engineering, information technologies, and automation systems.

The methodological approach used in the research consisted of several stages. The theoretical analysis method examined the current state of engineering education, the opportunities provided by the digital learning environment, and international experience. The comparative method identified differences and similarities between national and international education systems and evaluated the possibilities for implementing advanced practices. Using a systemic approach, the curriculum, practical exercises, digital platforms, and the integration process with industry were analyzed as a whole.

Within the framework of empirical research, surveys, interviews, and observation methods were used in combination. Survey results were analyzed in terms of percentages and tables, while interviews were synthesized using qualitative analysis. Observations assessed the effectiveness of lessons conducted on digital platforms, student activity, and the degree of knowledge acquisition. Additionally, the experimental method was applied, and in some higher education institutions, classes were tested using virtual laboratories and simulation programs. During this process, students completed project-based tasks, analyzed real industrial problems, and developed solutions.

RESULTS

The results of the study are aimed at determining the effectiveness of the digital learning environment in engineering education based on international experience. The data obtained indicate that in developed countries, virtual laboratories, simulation programs, and interactive online platforms significantly improve the quality of engineering education. Students are able to study complex technological processes in a safe environment, develop independent thinking, and enhance their problem-solving skills in challenging situations.

Survey and interview results showed that the digital learning environment plays an important role in

enhancing students' practical skills and engaging them in project-based activities. Through virtual platforms, students were able to plan projects, simulate processes, and analyze errors, which strengthened their engineering decision-making skills.

Furthermore, the research results highlighted the necessity of adapting international experience to the national education system. In the context of Uzbekistan, the implementation of digital learning tools has proven effective for deepening students' knowledge, developing practical skills, and preparing them for the labor market.

The findings demonstrate that the digital learning environment plays a key role in engineering education based on international experience. In developed countries, students can use virtual laboratories, simulation programs, and interactive online platforms to study complex technological processes safely. At the same time, the digital environment helps develop students' abilities for independent thinking, problem-solving, and engaging in project-based work. This serves as an effective tool for practice-oriented engineering education and for preparing graduates to meet the demands of modern industry.

The discussion results indicate that the digital learning environment is not limited to knowledge transfer alone; it is also essential for fostering students' innovative approaches and engaging them in collaborative activities. However, limitations in digital infrastructure, internet speed, and low digital competencies of instructors present certain challenges in the national context. Therefore, studying international experiences and adapting them to the national education system is a critical factor in improving engineering education.

CONCLUSION

Foreign experiences show that the digital learning environment plays a crucial role in engineering education. Virtual laboratories, simulation programs, interactive online platforms, and other digital resources enable students to strengthen their knowledge, develop practical skills, and study complex technological processes safely. Additionally, the digital environment helps students develop independent thinking, problem-solving abilities, project work skills, and teamwork competencies. Experiences from developed countries such as Germany, Japan, and South Korea demonstrate that engineering education is successfully integrated with project-based learning and simulation technologies. Implementing digital learning tools in the national education system is also essential for modernizing engineering education, integrating real production challenges into the learning process, and preparing students for the demands of the modern labor market. Thus, the digital learning environment serves as an effective tool to enhance the quality of education, foster practical competencies, and ensure that future engineers are competitive and well-prepared for contemporary industrial requirements.

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