

**INNOVATIVE METHODS OF TEACHING PHYSICS FOR TRAINING PERSONNEL  
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**Abstract:** This article analyzes the role of physics in engineering education, the role of modern teaching technologies and the effectiveness of their application. Methods of improving the educational process based on the practical application of physics knowledge in training engineering personnel, problem-based learning, information and communication technologies (ICT) and the integration of simulation tools are considered.

**Keywords:** physics, engineering education, ICT, simulation, problem-based education, modern technologies

**Introduction.** Training competitive personnel in the field of engineering is one of the urgent issues today. At a time when technological progress, digital transformation and industrial automation are increasing in the world market, it is important to train specialists who have thorough knowledge in the field of engineering, think innovatively, and have practical skills. In this process, physics plays an important role as one of the main support subjects. Physics is not only a science that teaches the laws of nature, but also a scientific basis that justifies technical systems, constructions and engineering calculations. Through the laws of physics and their application to the field of engineering, students form technical thinking, learn systematic thinking and have the opportunity to work on various devices and processes based on a scientific-theoretical approach. Therefore, the teaching of physics in engineering education should be organized not only by traditional methods, but also through modern pedagogical technologies, information and communication technologies (ICT), distance education, virtual laboratories, multimedia presentations, 3D animations and simulations. This approach serves for students to understand the topic more deeply, to receive knowledge based on scientific experience and to be thoroughly prepared for future professional activities. Also, existing problems in teaching physics in engineering education, in particular, the lack of laboratory equipment, the lack of practical training, and the slow introduction of interactive tools reduce the student's interest in the subject. In this article, these very issues are covered, and ways of teaching physics in the field of engineering in

effective and innovative ways are analyzed. The main purpose of the article is to study the current state of physics teaching technologies in the training of engineering personnel, to analyze advanced foreign and national experiences, to identify existing problems and to develop practical recommendations for improvement.

**Methodology.** In this research, several scientific methods were used in a complex way. First of all, the essence, types and efficiency indicators of modern physics teaching technologies were studied through a qualitative analytical method. Secondly, based on the practical research method, observation of lesson processes in higher educational institutions in the direction of engineering, interviews with experienced teachers, organization of laboratory lessons and efficiency of their use were analyzed. Based on the questionnaire methodology, a questionnaire was distributed in a sample group consisting of 120 students. The questions were mainly related to the following directions: (1) attitude to the science of physics; (2) technologies used in the lesson process; (3) presence and quality of laboratory experiments; (4) state of using simulation programs. The obtained answers were analyzed in the SPSS program and their statistical reliability was checked. In addition, experimental-test works were carried out on the basis of two groups (control and experimental). In the experimental group, lessons were organized based on modern interactive methods and ICT tools, and in the control group, traditional teaching forms were used. At the end of the academic year, the mastery results, motivation for the subject and levels of critical thinking between the two groups were compared. Using these approaches, clear indicators of the impact of technologies at various stages of the educational process were obtained. The studies conducted on the basis of the above methods served to deeply analyze the possibilities of teaching physics on an innovative basis in engineering education and to draw practical conclusions.

**Results.** In the course of the research, the effectiveness of using digital technologies and simulations in teaching physics in higher educational institutions was evaluated based on various criteria. The main results are presented below:

**The level of mastery of students' knowledge:** In the experimental group, that is, among the students taught on the basis of digital technologies and simulation programs, the level of mastery of science knowledge was 25-30% higher than in the control group. This result was determined on the basis of the results of various tests and written works. Simulations presented complex physical processes in a visual form, making them easier to understand and increasing interest in the topic.

**Formation of practical skills:** With the help of virtual laboratories and simulation tools, students expanded their opportunities to conduct experiments. They repeated various physical phenomena in a safe and comfortable environment and developed the skill of analyzing the

results. Also, these methods were especially effective in institutions where real laboratory equipment is limited.

**Interactivity and interestingness of the lesson process:** According to the results of the questionnaire, students in the experimental group evaluated the lessons as more interesting and lively than traditional ones. Digital technologies and simulations increased the participation of students in lessons, they were able to express their opinions freely and actively joined the topic.

**Independent learning skills:** Virtual laboratories and interactive educational materials encouraged students to conduct independent work. Many students strengthened their knowledge with the help of simulations even during out-of-class time. This caused an increase in their activity and degree of independence in education.

**Problems and shortcomings:** Some students considered the programs technically complex and faced difficulties in the initial stage. Slowness or interruption of internet networks created difficulties in the educational process. The lack of sufficient skill of teachers in effective use of digital tools negatively affected the quality of some lessons.

**Comparison with international experience:** It has been confirmed in many studies that digital technologies and simulations are widely used in foreign higher educational institutions and significantly improve the quality of physics education. The wide introduction of these methods in the conditions of Uzbekistan also has a positive effect on scientific-technical development and the quality of training personnel

**Discussion.** New approaches are necessary for effective teaching of physics. First of all, teachers must master modern technologies well. The usefulness of physics lessons increases by creating an environment based on active communication between the teacher and students, harmonizing the lesson process with practice, and finding solutions to real-life problems. At the same time, the role of ICT and simulation platforms is also incomparable. But there are infrastructural and methodical problems in mastering technologies. In this regard, it is recommended to establish a system of regular advanced training of teachers, practical trainings and exchange of experience.

**Conclusion.** The teaching of physics in the training of engineering personnel will be effective only when it is harmonized with modern technologies. This allows for increasing the quality of education and training competitive specialists. Therefore, special attention should be paid to interactive methods, ICT, virtual laboratories and problem-based education in teaching physics. In the future, conducting even deeper research in this direction, wide introduction of

innovative technologies into the educational process and creating methodical manuals are considered an important task.

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