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Didactic Foundations Of Using Innovative Pedagogical Technologies In Physics Lessons

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Abstract. This article highlights the didactic foundations of using innovative pedagogical technologies in teaching physics, as well as the importance of modern educational methods and interactive approaches in developing students' knowledge, skills, and competencies. Furthermore, the effectiveness of information and communication technologies, multimedia tools, the STEAM approach, distance learning, and problem-based learning methods in organizing physics lessons is analyzed. The article demonstrates the opportunities for developing students' independent thinking, creative approach, and practical activities through innovative pedagogical technologies. It also broadly discusses the methodological aspects of effectively organizing physics lessons based on the didactic principles of modern education.

Keywords. Physics education, innovative pedagogical technologies, didactics, interactive methods, STEAM education, information and communication technologies, multimedia, problem-based learning, competency-based approach, e-learning, laboratory activities, pedagogical innovation.

Introduction. In today's globalization process, the requirements imposed on the education system are undergoing fundamental changes. Preparing highly qualified specialists who are independent thinkers, creative, and capable of generating innovative ideas has become an urgent issue for modern society. Therefore, organizing the educational process on the basis of innovative pedagogical technologies in general secondary schools and higher educational institutions is gaining significant importance.

Physics occupies a special place within the system of natural sciences. Through this subject, students acquire scientific knowledge about natural phenomena, laws of nature, and the foundations of technological development.

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Effective teaching of physics requires not only the mastery of theoretical knowledge, but also practical experiments, observation, and analytical thinking. In this regard, the application of innovative pedagogical technologies in physics lessons is considered an important factor in improving the quality of education.

In traditional teaching methods, the student mainly participates as a recipient of ready-made knowledge. In contrast, innovative pedagogical technologies turn the student into an active participant in the educational process. This helps develop students' skills in independent learning, problem-solving, scientific research, and conducting practical experiments.

The reforms being implemented in our country's education system also require the introduction of modern pedagogical technologies. In particular, the widespread use of digital technologies, electronic textbooks, virtual laboratories, and multimedia tools is increasing the effectiveness of teaching physics.

This article scientifically and methodologically analyzes the didactic foundations of using innovative pedagogical technologies in physics lessons, as well as their role and effectiveness in the educational process.

Main Part. Didactic Foundations of Physics Education: didactics is a branch of pedagogy that studies the theory of education and examines the goals, content, methods, and forms of teaching. Didactic principles play an important role in teaching physics. These include: the principle of scientificity; systematicity and consistency; visualization; conscious and active learning; the unity of theory and practice; as well as individualization and differentiation.

Following these principles in the effective organization of physics lessons contributes to improving students' level of knowledge. The information presented in physics classes should be based on the latest achievements of modern science. Explaining physical laws and phenomena on a scientific basis broadens students' worldview. Visualization plays a particularly important role in physics education. Experiments, models, video lessons, and simulations help students gain a deeper understanding of the subject. In addition to being a theoretical science, physics also has a practical orientation. Through laboratory work, experiments, and practical activities, students reinforce their theoretical knowledge.

Innovative pedagogical technologies are a set of modern methods, tools, and approaches aimed at effectively organizing the educational process. These

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technologies serve to improve the quality of education, increase student activity, and develop independent thinking. The main objectives of innovative technologies include: increasing students' interest in learning; developing independent learning skills; improving the effectiveness of education; ensuring interactivity; and implementing a competency-based approach.

Interactive methods ensure students' active participation during the lesson. The following interactive methods are widely used in physics classes: the "Brainstorming" method, which develops students' creative thinking. For example, through questions such as "Why do the stars in the sky twinkle?", students are encouraged to think independently and express their own ideas.

The "Cluster" method allows for the systematization of concepts related to a topic. In the topic of electrical phenomena, concepts such as electric current, voltage, resistance, and power are represented in the form of a cluster.

The "KWL" table: students analyze their knowledge based on the columns:

Know	Want to know	Learned

through which they evaluate and reflect on their learning process.

The "Debate" method: organizing discussions on scientific problems in physics develops students' critical thinking skills.

The role of information and communication technologies: Today, it is difficult to imagine the educational process without ICT tools. The use of computer technologies in physics lessons creates the following opportunities: modeling complex physical processes, organizing virtual laboratories, creating multimedia presentations, using electronic tests, and implementing distance learning.

Advantages of multimedia tools: through multimedia resources, animations, videos, graphs, and interactive models are demonstrated. This helps students to better understand the topic. For example, explaining topics such as atomic structure or electromagnetic waves using animations produces effective learning outcomes.

The STEAM approach and its significance: STEAM is a modern educational model based on the integration of Science, Technology, Engineering, Art, and Mathematics. Teaching physics based on the STEAM approach connects theoretical knowledge with practice, develops problem-solving skills, strengthens

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project-based learning activities, and fosters innovative thinking. For example, students can implement the integration of physics, mathematics, and technology by creating a model powered by solar energy.

Problem-based learning technology: problem-based learning encourages students to engage in independent inquiry. The teacher does not provide ready-made knowledge but instead creates a problem situation. For example: “How can a magnet generate an electric current?” Students try to find the answer through experiments. This method develops creative thinking, research activity, and the ability to draw independent conclusions.

Use of virtual laboratories in physics lessons: Virtual laboratories make it possible to perform physical experiments in a safe and convenient environment. Their advantages include saving time, the ability to carry out dangerous experiments, modeling complex processes, and enabling students to work independently. For example, assembling electrical circuits in a virtual environment helps improve students’ practical skills.

Teaching physics based on a competency-based approach: The main goal of modern education is not only to provide knowledge, but also to develop competencies.

In physics, the following competencies are developed: communicative competence, information handling competence, problem-solving competence, socially active civic competence, and mathematical literacy. Innovative pedagogical technologies are considered an important tool in developing these competencies.

The effective use of innovative technologies requires a high level of pedagogical skill from the teacher. A modern physics teacher should be able to use ICT, be familiar with interactive methods, be creative, and work in collaboration with students. The teacher’s innovative activity contributes to improving the quality of education.

Advantages of using the project method in physics lessons: the project method is based on students’ independent activity. Students conduct research on a specific problem. Examples include creating a solar cooker model, building a wind generator, and designing energy-efficient devices. This method develops practical skills, teamwork, and scientific research abilities.

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The importance of electronic learning resources: Electronic textbooks and online platforms increase the effectiveness of education. Their advantages include the ability to use them anywhere, the availability of interactive tasks, convenient knowledge assessment, and a wide range of visual materials.

The development of distance learning during the pandemic has further increased the importance of electronic resources.

In physics lessons, a differentiated approach is important because each student has a different level of knowledge. This approach allows teachers to assign more complex tasks to stronger students and provide individual support to those who face difficulties. As a result, the overall level of students' achievement improves.

Advantages of innovative technologies: the use of innovative pedagogical technologies in physics lessons produces the following results: students' interest in the lesson increases, independent thinking develops, the effectiveness of education improves, theory and practice are integrated, students' creative potential is enhanced, and interdisciplinary integration is strengthened.

In the application of innovative technologies, several problems are encountered in some educational institutions: a lack of technical equipment, low internet quality, insufficient ICT skills among teachers, and a shortage of electronic resources. To overcome these issues, it is necessary to strengthen the material and technical base, improve teachers' qualifications, and establish modern laboratories.

Research shows that in lessons where interactive and innovative methods are used, students' level of knowledge is higher compared to traditional lessons. The reason for this is that students actively participate, work independently, engage in practical activities, and freely express their opinions. As a result, students develop scientific thinking in physics.

Conclusion. The use of innovative pedagogical technologies in physics lessons is an important factor in improving the effectiveness of education. Modern pedagogical technologies develop students' independent thinking, creative activity, and practical skills. Interactive methods, ICT tools, virtual laboratories, and the STEAM approach create broad opportunities for teaching physics.

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In lessons organized on the basis of innovative technologies, students acquire knowledge not in a ready-made form, but through inquiry and research. This contributes to the formation of their scientific worldview. In order to further improve physics education in the future, it is important to increase the number of modern laboratories, develop electronic resources, improve teachers' qualifications, and widely implement digital technologies in education. Therefore, the application of innovative pedagogical technologies in physics lessons is one of the urgent tasks of today's education system.

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