

The Importance of Advanced Pedagogical Innovative Technologies in Teaching Physics in Higher Education

Rakhmanov Valijan Turdaliyevich

Associate Professor at the Department of Physics, Faculty of Information Technology and Physics-Mathematics, Gulistan State University, PhD in Pedagogical Sciences, Uzbekistan

Received: 14 April 2025; **Accepted:** 10 May 2025; **Published:** 12 June 2025

Abstract: In the modern educational system, the use of advanced pedagogical innovative technologies in teaching physics at higher education institutions plays a crucial role. These technologies not only help students acquire theoretical knowledge but also develop practical skills, creative and critical thinking abilities. As a fundamental subject, physics benefits greatly from the application of innovative methods in the educational process, which prepares students to tackle contemporary scientific-technological challenges and increases their competitiveness in the global labor market. This article discusses the significance of advanced pedagogical innovative technologies in teaching physics in higher education.

Keywords: Higher education, modern science, physics, education, innovation, method, specialist, teacher, pedagogue, advanced pedagogical technologies, interactive methods, digital platforms, virtual laboratories, simulation programs, problem-based learning, project-based learning, artificial intelligence, students' independent research, education quality, teacher qualifications, material-technical base.

Introduction: The demands of the modern era are closely related to the rapid development of science and technology. This requires physics teachers to be comprehensively knowledgeable and cultured, with a deep understanding of natural laws and modern technology. The widespread application of modern technical and technological processes in today's world creates a need for highly intellectual personnel in production, placing great responsibilities on educators. One of the most important tasks is the implementation of education standards and the development and application of personal work plans in physics education.

With the advancement of science, technology, and the Internet, society is becoming increasingly information-oriented. The broad and intensive integration of information technologies into all areas of life lays the foundation for an information-based society, with the Internet being its organizational-technological core. Using modern teaching technologies that meet the requirements of this information society plays a crucial role in preparing competent specialists in higher education today. Interactive learning, in essence,

involves an “student (listener) – information and communication technologies” format, in which students acquire knowledge, skills, and abilities independently or under the guidance of a teacher using these technologies.

Requirements for Physics Teachers According to Regulatory Documents:

- Mastery of general secondary education content and curricula in physics.
- Understanding and applying methods in physics teaching.
- The ability to analyze various teaching aids, tools, and textbooks used in physics.
- Skills in conducting demonstrations and lab work using modern tools.
- Familiarity and practical application of interactive teaching methods and new pedagogical technologies.
- Knowledge of Uzbekistan's scientific, educational, and cultural heritage relevant to physics and incorporating it in education.
- Organizing and methodically ensuring

students' independent work in physics.

- Identifying talented students and applying differentiated teaching approaches.
- Teaching measurement methods and using international units, with the ability to conduct experimental tasks and explain them methodically.
- Emphasizing scientific-methodical analysis and developing problem-solving strategies in physics, including simple, complex, lesser-known, qualitative, quantitative, and experimental problems. Understanding interdisciplinary connections, the content of integrative knowledge in physics education, and organizing lab work accordingly. Familiarity with updated and improved regulatory documents developed by education centers for secondary schools. Organizing extracurricular activities such as "Physics Club," themed physics evenings, and evaluating the effectiveness of physics courses. Utilizing achievements of modern pedagogy, didactics, and psychology in improving the purpose and content of teaching physics in secondary schools.

The first stage of higher education, the bachelor's degree, ensures specialists are prepared for successful teaching in general education institutions. For physics teachers, this includes fulfilling requirements related to the core, professional, and specialized disciplines in

physics. Since physics is both a fundamental and experimental science, a physics teacher must possess a wide range of theoretical and practical competencies. A modern physics teacher is expected to have deep and robust knowledge of scientific achievements and discoveries. As society and its many dimensions, including science and technology, continue to evolve, so does the volume of educational and scientific content. Effectively incorporating this ever-growing information into the educational process requires strong methodological expertise from the teacher. The scope of a physics teacher's work is broad. Solving methodological challenges, such as effectively integrating vast amounts of information into teaching, depends on organizing independent learning in physics on a scientific basis. This highlights the importance of lifelong learning and continuity in education. From a methodological point of view, the goal of teaching physics is not simply to complete a topic but to leave room for its continued study in the future.

Technological Model Example

Below is Table 1, showing a technological model for the topic "The Importance of Advanced Pedagogical Innovative Technologies in Teaching Physics in Higher Education." This model outlines goals, content, tools, methods, and expected results based on advanced technologies used in the learning process:

№	Stage	Activity Content	Innovative Technologies	Result
1	Setting Goals	Orienting students to the topic; defining the goal of effective physics teaching	SMART goals technology	Clear, measurable, achievable, relevant, time-bound goals are set
2	Motivation	Arousing student interest in the topic	"Cluster" method, interactive video clips	Increased motivation through real-life connections to physics
3	Explaining New Content	Teaching physics sections using modern technologies	Multimedia presentations, simulations, virtual labs	Development of understanding and interest in the topic
4	Practice	Applying learned knowledge in practice	ICT-based interactive tests, gamification (Quizizz, Kahoot)	Reinforcement of knowledge and active participation

5	Analysis & Discussion	Thinking and reflecting on learned materials	“Debate,” “Fishbone” method	Development of critical thinking and analytical skills
6	Assessment	Measuring students’ knowledge and competencies	Rating system, peer assessment, “E-portfolio”	Monitoring of individual student achievements
7	Reflection	Student self-assessment and feedback	“3-2-1” technique: 3 learned things, 2 questions, 1 suggestion	Development of self-evaluation and improvement skills

CONCLUSION

In conclusion, the methodological preparedness of a physics teacher and the effectiveness of teaching methods are critical and should be a priority. In today's globalized world, the interdisciplinary integration of academic subjects is essential. It is increasingly difficult to fully explain phenomena within the boundaries of a single discipline, which makes integrative approaches vital in modern education.

In both higher and general education, improving the quality and effectiveness of physics education requires careful attention to teaching methods, learning control, and performance assessment. These elements must be thoroughly reflected in the teacher's methodological preparation.

REFERENCES

- Rahmonov V.T. Methods of teaching "Electromagnetic Oscillations and Waves" in general education schools. // NamDU Scientific Bulletin, 2021, Issue 4 // ISSN: 2181-0427 / pp. 430-433 (13.00.02. No. 30).
- Rakhmanov V.T. Creation of Demonstration Experimental Devices, Methods, and Principles of Their Use in the Lecture Process. // Eurasian Scientific Herald / ISSN: 2795-7365 / Volume 12 / September 2022. (Impact Factor: 8.225).
- Rahmonov V.T. Teaching Physics in General Education Schools Using Demonstration Experiments and Modern Devices to Improve the Efficiency of the Learning Process. // Scientific Bulletin of NamSU - Scientific Herald of NamNU-NamDU, 2022, Issue 4 / ISSN: 2181-0427 / pp. 725-728. (13.00.02. No. 30).
- Rahmonov V.T. Physics Demonstration Experiments in General Education Schools: Their Functions and System. // Scientific Bulletin of NamSU - Scientific Herald of NamNU-NamDU, 2022, Issue 1 / ISSN: 2181-

0427 / pp. 699-704. (13.00.02. No. 30).

Rahmonov V.T. The Role of Physics Demonstration Experiments and Constructed Devices in Physics Lessons in General Education Schools. // "Current Issues in Modern Physics" International Scientific and Scientific-Technical Conference, Bukhara, November 2022, pp. 494-495.

Rahmonov V.T. Prospects for the Effective Use of Solar Energy. // Denov Entrepreneurship and Pedagogy Institute, International Scientific-Practical Conference "The Use of Innovative Educational Technologies in the Context of Student Activity Development" Denov, September 29-30, 2023, pp. 316-322.