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ANALYSIS OF FOREIGN AND LOCAL EXPERIENCES ON FORMING RESEARCH SKILLS IN PHYSICS IN STUDENTS

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Annotation: This article analyzes foreign and local experiences on the formation of research skills in physics in students. It is emphasized that the use of experimental approaches, laboratory exercises, project methods and problem-based educational technologies in physics education motivates students to research and develops their scientific thinking. The experience of foreign countries shows that the integration of physics with other disciplines based on "STEM" and "STEAM" programs has yielded effective results in involving students in scientific research. In the local experience, the work carried out in the Uzbek education system to develop students' research skills based on laboratory work, scientific circles, science olympiads, and practical projects in teaching physics was analyzed. At the same time, the relevance of forming students' skills in connecting physical phenomena with practice, applying them in everyday life, and scientifically approaching problem situations was substantiated. Research shows that by adapting foreign advanced experiences to the national education system, students' research skills in physics can be developed more effectively.
Keywords: physics education, research skills, foreign experience, local experience, STEM education, STEAM program, laboratory exercises, project method, problem-based learning, student creativity.

In today's era of globalization and information flow, it is not enough for students to acquire only theoretical knowledge in the educational process. The formation of skills in them to conduct independent research, conduct research, take a new approach to scientific problems and promote innovative ideas is becoming one of the most important tasks of modern pedagogy. In particular, in teaching physics, research activities are of particular importance not only in consolidating theoretical knowledge in students, but also in forming scientific thinking based on practical experience.

The modern educational process is one of the important factors of human development, serving to form the younger generation as educated, qualified and independent-thinking individuals. In today's era of globalization and information flow, the main task of education is not only to provide ready-made knowledge, but also to involve students in research, experimentation, and scientific research activities. In this regard, the formation of experimental and research skills is becoming an integral part of the educational process.

As the field of education develops, the integration of technology into the teaching and learning processes is gaining great importance. In science education in particular, technology is providing new opportunities to engage students and help them understand complex concepts more deeply. Physics, a science based on theoretical understanding and practical experience, is benefiting greatly from digital development.

Physics, as one of the central areas of natural sciences, plays an important role in human development. The knowledge based on it is a decisive force in the development of technical,

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economic and social spheres of society. For this reason, it is an urgent task to form research skills in physics among schoolchildren, to direct them to independent research, and to implement international experiences in the national education system. This article will comprehensively cover the issues of developing research skills in physics education based on an analysis of foreign and domestic experiences.

The research skills that should be developed in students during the study of physics are:

1. The ability to see a scientific problem and ask questions - to identify a problematic situation by analyzing the essence of a phenomenon or process.
2. Hypothesis - to create a scientific assumption about a physical phenomenon.
3. Experimental design - to determine the appropriate conditions, methods and tools for conducting an experiment.
4. Data collection and recording - to collect evidence based on observation, experimentation, measurement and calculations.
5. Analysis of results - to summarize the results of an experiment using statistical and mathematical methods.
6. Conclusion and presentation of results - to confirm or refute the correctness of the hypothesis.
7. Practical application - to apply the results obtained in solving life processes or technical problems.

These skills are important for understanding theoretically complex topics in physics, as well as for shaping students as creative and independent thinkers.[3]

There are many advanced experiences in physics education around the world aimed at developing research skills. They can be considered in several areas:

STEM and STEAM education. STEM (Science, Technology, Engineering, Mathematics) and STEAM (including Art) education, which are widely used in the USA, Europe and Asian countries, strengthen students' research activities by integrating physics with other subjects. In this approach, physics theory is strengthened through practical projects. For example, students apply the laws of physics in practice when creating small robots and developing projects to save electricity.

Laboratory exercises and virtual laboratories. Abroad, in particular, in the educational system of Germany, Japan and the USA, modern laboratory equipment, computer simulations and virtual laboratories are widely used in teaching physics. Through these methods, students have the opportunity to test their theoretical knowledge safely and effectively.

Project-Based Learning. In many foreign schools, physics education is organized on a project basis. Students develop a scientific project to solve a specific problem. This process strengthens their research skills and develops teamwork skills.

Scientific competitions and Olympiads. In foreign countries, many physics competitions, international Olympiads, and scientific competitions such as "Young Scientists" are regularly held to increase students' interest in scientific research.

A number of reforms are also being implemented in the education system of Uzbekistan to increase students' interest in physics and develop research skills in them.

1. Laboratory classes - physics lessons in secondary schools and academic lyceums are being enriched with laboratory work. This allows students to gain knowledge based on experience.

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2. Scientific circles and science olympiads - "Young physicists" circles are operating in schools, students participate in district, regional and republican Olympiads and present their research work.
3. Practical projects - based on the concept of "STEAM education", students participate in projects such as energy saving, ecology, robotics.
4. Scientific conferences - conferences are held with the participation of students at the regional and republican levels, and scientific research works in physics are discussed.
5. Introduction of digital technologies - interactive programs, simulation platforms, and electronic textbooks are being introduced in schools.[4]

In foreign experience, physics education is more technologically based, and great attention is paid to developing students' creativity and combining theory and practice. Local experience uses more laboratory exercises and traditional methods, but in recent years, work has begun to implement foreign best practices into the national education system through STEAM education.

Therefore, it is an important task for Uzbekistan to master foreign experiences and adapt them to local conditions. For example, it is necessary to further develop such areas as virtual laboratories, project-based education, and wide involvement in international competitions.

If we pay attention to the importance of physics in the educational process, first of all, it serves as a necessary source of knowledge about the environment for humanity. At the same time, it expands human capabilities and creates an opportunity to take bold steps towards technological progress. In addition, physics plays a major role in shaping a person's spiritual image, broadening his worldview, and increasing his spiritual and cultural wealth. Therefore, based on today's requirements, it can be said that since physics is an experience-based science, it is necessary to pay great attention to explaining the essence of processes in its teaching, as well as confirming them through practical experiments. Otherwise, the level of mastery of modern technologies by qualified specialists in production sectors will remain low. In order to quickly apply scientific achievements in practice, students must have the skills to independently conduct physics experiments. From this point of view, it is important to form the skills of students to perform laboratory work and apply the acquired knowledge in practical processes, starting from the secondary education stage. For this, it is of great importance to interest them in observing various physical processes, especially observing experiments related to semiconductors, optics, electrical engineering and magnetism, and directing them to determine their areas of application. After all, the large number of young people who have shown interest in physics and have the skills to conduct experiments during their school years creates a wide opportunity for the development of high technologies in our country.

Methods for developing research skills in physics

1. Problem-based learning - encouraging students to research by placing them in problem situations.
2. Project method - giving students the task of working on a scientific and practical project.
3. Laboratory work - to consolidate the laws of physics through experiments.
4. Experimentation and observation - to observe and analyze phenomena in real conditions.
5. Scientific conferences and seminars - to create an opportunity for students to present their research results.
6. Use of information technologies - to conduct research on simulations, virtual laboratories and online platforms.

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Students with research skills in physics will make a significant contribution to the development of science and technology in the future. Their research will help find new energy sources, solve environmental problems, and develop innovative solutions in industry and production. These skills will also develop the creative thinking of young people and shape them as competitive specialists in the international labor market.[6]

In conclusion, the formation of research skills in physics among students is an urgent task of the educational process. The experience of foreign countries shows that integrated approaches in physics education, project-based learning, virtual laboratories and international competitions effectively develop students' research activities. In recent years, the Uzbek education system has also taken important steps in this direction, including the introduction of STEAM education and the expansion of efforts to involve young people in innovative research.

Thus, by adapting foreign advanced practices to national conditions, developing laboratory and project-based education, and widely using digital technologies, it is possible to effectively form research skills in physics among students. This will create a solid foundation for the development of science, economic development and innovative achievements in the future.

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