

ADVANCING LIFELONG LEARNING: INTEGRATING NON-STANDARD TASKS IN PHYSICS EDUCATION

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Abstract: This article focuses on enhancing teaching methodology through an integrative approach, emphasizing the application of non-standard assignments within the physics curriculum. The study specifically addresses the integration of these assignments into the education of future educators in pedagogical higher education institutions. The article underscores the significance of this approach in elevating the professional training of prospective teachers, expanding students' knowledge, fostering interdisciplinary thinking, and stimulating interest in science. The research also delves into the development of a methodical system that incorporates problems, tests, and non-standard assignments, aiming to improve students' understanding of physics while highlighting interconnections with geography, biology, chemistry, and fostering a holistic approach to learning.

Keywords: non-standard tasks related to the topic, reproductive, productive and creative tasks, conclusion, interpretation of written answers, analysis and conclusion on the answers found, and formation of professional training.

Introduction

A non-standard problem in physics is a problem that differs from classical problems. Several parameters: the presence or absence of additional information, words, the conditions of the problem, and the method of solving it. A non-standard assignment in physics is designed to develop the general skills of students, necessary to solve any problems. In such tasks, students learn to determine the conditions, and requirements for the problem, and select data for solving. Solving these problems develops the skills of mental operations (analysis, synthesis, comparison, generalization, etc.), and also allows students to demonstrate their creative abilities, the desire to achieve a goal, and the ability to develop indicative bases for problem-solving. For easier use of non-standard problems in the educational process, we have developed the following classification of non-standard problems in physics (see Figure 1).

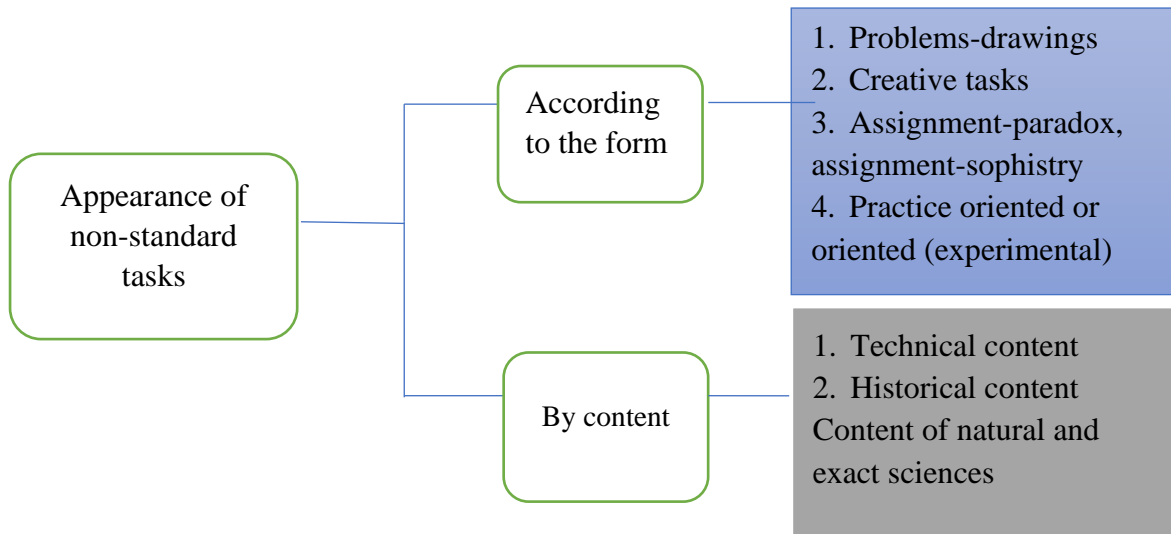


Figure 1. Classification of non-standard assignments

Non-standard assignments are assignments that contribute to the technical content "To introduce students to the principles and regulation of mechanisms and machines, energy transmission and conversion, industrial and agricultural production, management of tools, explaining the technical work of physical knowledge objects" Formation of a new generation of students is impossible without a holistic educational field: its continuity of general secondary education subjects at different levels. Future students, that is, teachers, should develop not special, but generalized skills. Therefore, there is a question about an integrated approach to teaching different subjects at school, which helps to develop the knowledge system, for schoolchildren to clearly see common ideas for different subjects, and to form a new, integrative way of thinking. This opens up the opportunity to justify the professional activity of future teachers in the continuous education system based on non-standard tasks in a creative-thinking society. The state educational standard for general secondary education forms the requirements for the results of students who have mastered the basic educational program, which records the results of subject mastery levels along with subject and personal results. The integration of mathematics and natural sciences to achieve the results of the subjects allows students to think in an unusual and creative way.

Nowadays, it is important to be able to incorporate knowledge of various disciplines and effectively apply it in practice. Interdisciplinary integration in the application and performance of non-standard tasks helps the integration of knowledge from different disciplines into one system, better absorption and retention in the memory of students for a long time. There are concepts that are studied both in mathematics and in natural sciences, and in the study of mathematical sciences, mathematical means of expressing the relationship between quantities are used. Natural sciences study the properties, relationships and interactions of biological, geographical, chemical, physical and technological objects. In addition, the environment



includes natural economic, social and cultural components. Students gain a holistic understanding of the facts and theories of natural science as well as related disciplines by solving environmental problems.

Their practices and professions, the development of the worldview of natural science. Students are given a foundation for lifelong learning that will help them make career choices. It is important to form an internally motivated student who is interested in natural sciences, feels and is aware of environmental problems, knows how to solve them, makes the right decisions, and predicts their impact on the natural and social environment. Integration within the cycle of educational subjects forms students' complex perception of nature as a whole system with specific cause-and-effect relationships. At the same time, students gain an understanding of the positive and negative effects of human activity on the natural environment, become aware of local and global environmental problems, and appreciate a sustainable and responsible lifestyle, including the rational and economical use of natural resources. learn and shape their own healthy lifestyle.

Characteristics of natural sciences

1. Biology forms in students a holistic understanding of the main objects and processes of living nature, as well as the relationships between living and non-living nature. The ability to solve problems related to the living environment is mastered, and the socialization of students is improved. At the same time, a positive attitude towards all living beings and the environment, preservation of natural diversity, as well as a responsible and sustainable lifestyle are formed.
2. Geography is a comprehensive educational subject, which is related to natural sciences, as well as social sciences and mathematics, and the study of geography is the phenomena and processes that occur in nature and society, their spatial scales and forms an understanding of their interrelationships. Special attention is paid to the development of students' ecological consciousness. The environment is considered as a unity of natural, economic, social and cultural components.
3. In physics, the main physical processes, techniques and possibilities of applying the laws of physics for the development of technology are understood. Solving problems for the formation of value relationships in students is related to the history of the development of science: the place of physicists in the history of science, from the point of view of the importance of physics and its practical application in human life. cultural and historical context is considered.
4. When studying chemistry, students gain an understanding of the properties of substances, the ability to control chemical phenomena, as well as the laws of chemical processes occurring in living nature and human activity. Students learn to understand the physical essence of chemical phenomena, the chemical basis of natural processes, the connections between the composition and structure of substances, as well as their properties. The ability to experiment and use household chemicals safely is developed.
5. The most important task of mathematical education is to equip students with general thinking techniques, and spatial imagination, understand the content of the task, be able to think



logically, and form algorithmic thinking skills. Everyone needs to learn to analyse, to separate hypothesis from fact, report.

6. Integration is possible, in which the next topic is derived from the previous topic.

Levels of integration

Several levels of integration can be distinguished as a methodological basis for the development of competencies in the continuing education system:

Stage 1- integration of natural and humanitarian sciences. It is important to combine these academic disciplines, to look for new approaches to a holistic view of the world in their interaction and diversity, and to reveal the spiritual potential of subjects.

Stage 2- integration of the subjects studied by teachers based on the development of uniform programs for the formation of leading concepts of an interdisciplinary, meta-subject nature in the educational process. Such work can be carried out based on determining the main educational directions of academic subjects.

Stage 3- integration by implementing and strengthening the practical direction of the cycle of subjects, based on the realization of the interdependence of not only the specific subject but also the subjects of study. It is important to create conditions for students to master the moral, spiritual, patriotic, and socio-economic foundations of human life and activity based on local studies, and this should become one of the main tasks of the school. It implies a direct appeal by the teacher to the subjective experience of the students and their understanding of it.

Stage 4- use of general scientific methods of knowledge, teaching these methods to students. It is known that scientific methods of knowledge primarily include experience, observation, hypothesis and experience.

Advantages and cases of application of the integrative approach in the application of non-standard assignments

An integrated approach to non-standard tasks in the continuing education system can be implemented through a variable part of the curriculum. In the study of individual subjects, several subjects can be integrated thematically, based on a project.

Teachers use non-standard tasks based on integrated approaches in the following cases:

1. When repetition of the same material is found in educational programs and textbooks;
2. If there is a lack of time to study the subject and a desire to use ready-made content from a parallel subject;
3. In the study of interdisciplinary and general categories (movement, time, development, size, etc.), laws and principles covering various aspects of human life and activity"
4. In identifying contradictions in the description and interpretation of the same events, phenomena, and facts in different disciplines;
5. To show a broader field of manifestation of the studied phenomenon, leaving the scope of the studied topic;
6. In creating a problematic, developing methodology of teaching science.

The advantages of a multi-subject integrative lesson with non-standard tasks compared to a traditional single-subject lesson are obvious:

- in such a lesson, it is possible to create more favourable conditions for the development of various intellectual qualities of students;
- through this, you can develop broader scientific-theoretical and scientific-practical thinking in high school students;
- development of horizons, application of theoretical knowledge in practical life, real life, professional and scientific situations;
- integrative lessons bring the educational process closer to life, naturalize it, enliven it with the spirit of the times, and fill it with substance;
- integrated lessons help students to find and understand the general laws of various disciplines, effectively form the worldview of natural science;
- these lessons mutually enrich the teachers, bring them closer to each other, and contribute to the improvement of the psychological microclimate in the team and creative growth.

Examples of integrated content tasks

Physics - geography

Task 1. The Arctic is a vast area of the Northern Hemisphere. Most of the Arctic Ocean and marginal seas: Barents, Kara, Laptev, Eastern Siberia, Chukotka, etc. are covered with ice throughout the year, which moves from east to west. Ice fields move very slowly, only 1-2 km per year. Icebergs move 40 - 45 m in 24 hours. Determine the average speed of movement of large icebergs during the day (m/h).

Task 2. The ice on Lake Teletskoye is incredibly beautiful. It is amazingly transparent so that the bottom can be seen five to six meters deep because it is transparent. It is also very smooth. If the thickness of the ice is 50 cm and the viewing angle is 60 degrees, determine how much the object moves relative to the observer.

Physics - biology.

Task 3. The mass of our tongue is only 50 g, and its length is 9 centimetres. But it has at least 17 muscles. When eating, he makes 80 movements per minute. When tasting any product, 4,000 sensory plates with 50 receptors each transmit the received information to the brain. How does gravity affect the tongue?

Task 4. Brain mass decreases with age. At the age of 20, his weight is on average 1.4 kg, at the age of 70 - 1.3 kg, and at the age of 80 - 1.2 kg. It is important to remember that there is no correlation between brain size and intelligence. The "Computer" belonging to Turgenev had a very large volume - 2,012 kg, while Anatole France had only 1,017 kg. Marilyn Monroe's weight was 1,422 kg. The brain contains three-quarters of all nerve cells in the body. It reproduces up to the age of 15 and it works best from the age of 25. From the age of 45, the brain begins to decline. Determine the weight of the brains of Turgenev, France and Monroe. Consider the brain to be at rest.

Physics - chemistry - biology

Task 5. In the Mediterranean Sea, off the coast of Egypt, there is an amazing pike fish. Sensing that danger is approaching, the pike quickly swallows water. At the same time, the rapid



decomposition of products occurs with the release of a large number of gases in the fish oesophagus. Gases fill not only the active cavity of the oesophagus but also the peritoneum attached to it. As a result, the body of the phage becomes very swollen and it quickly floats to the surface of the reservoir. Here he hangs upside down and floats until the gases released from his body disappear. After that, it sinks back to the bottom. How does Phagak use Archimedes' force?

Task 6. A person can secrete 0.5-12 litres of sweat per day, it contains 98-99% water, 0.1% urea, milk, pyruvic, citric acids, ammonia, creatine, serine, fats, volatile fatty acids, cholesterol, aromatic oxides, acetone, mineral salts. Calculate, how much energy a person loses in this case? In this way, integrated content problems can be solved:

- 1) reasonable reduction of the amount of provided information;
- 2) more accurate systematization of the studied educational material;
- 3) to create a more complete understanding of the holistic naturalistic picture of the world.

An integrated lesson is a qualitatively separate type of lesson that combines the interaction of teaching and learning in several subjects at the same time in the study of one topic phenomenon or process. Solving problems with integrated content allows not only to organize the interdependence of knowledge in different subjects in one lesson but also can act as a combination of different technologies, methods, and teaching forms within a certain topic and even within the lesson.

Conclusions

This article describes the improvement of physics teaching in the continuous education system based on non-standard assignments. That is, the improvement of the educational process is aimed at developing the professional activity of future teachers studying in pedagogical universities, increasing their interest in science, and serving to form an interdisciplinary integrative approach.

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