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PEDAGOGICAL AND METHODOLOGICAL FACTORS AFFECTING THE FORMATION OF CREATIVE THINKING IN THE PROCESS OF TEACHING PHYSICS

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Abstract
This article analyzes pedagogical and methodological factors that affect the formation of creative thinking in students during the teaching of physics. The study scientifically and theoretically substantiates the content of physics education, modern approaches used in the lesson, and methods that serve to develop students' independent thinking and creative problem-solving skills. It also highlights the effectiveness of problem-based learning, interactive methods, experimental and laboratory exercises, project-based learning, and the use of information and communication technologies in the formation of creative thinking. According to the results of the study, the need to organize the educational process based on innovative methods, increase student activity, and integrate theoretical knowledge with practical activities is justified in order to develop creative thinking in physics lessons.

Keywords: Physics education, creative thinking, creative thinking, pedagogical factors, methodological factors, problem-based learning, interactive methods, innovative approach, laboratory exercises, reflection.

INTRODUCTION

Today, in the process of reforms being implemented in the education system, one of the pressing issues is the formation of competencies in students to think independently, make quick decisions in problem situations, and apply knowledge in practice based on a creative approach. Especially in the teaching of natural sciences, in particular physics, it is considered an important condition for increasing the effectiveness of education not only to strengthen students' theoretical knowledge, but also to form a scientific worldview through the development of creative thinking in them.

Physics is a fundamental science that explains natural phenomena and laws on a scientific basis, and in the process of its teaching, such activities as experiments, observations, logical analysis and drawing scientific conclusions are widely used. This process creates a great opportunity for the formation of creative thinking in students[1,3]. Because understanding, analyzing and explaining physical phenomena requires the student not only to accept ready-made knowledge, but also to independently search for, compare, analyze knowledge and put forward new ideas. At the same time, in practice, there is an insufficient use of methods and tools that serve to develop creative thinking in teaching physics, and a more reproductive (repetition-based) approach prevails in lessons.

This prevents students from deeply mastering knowledge in the subject and fully demonstrating their intellectual potential. Therefore, identifying pedagogical and methodological factors that influence the formation of creative thinking in physics lessons, analyzing them on a scientific basis, and developing

mechanisms for their effective application are important scientific and practical tasks for today's educational process.

THEORETICAL AND METHODOLOGICAL BASIS

The concept of creative thinking is pedagogically explained by the student's ability to think independently, find new solutions to problem situations, apply existing knowledge in new conditions, and put forward scientific hypotheses [4]. Also, the development of creative thinking is an important factor activating the intellectual activity of a person, which is manifested in the process of cognition through cognitive operations such as logical thinking, analysis, synthesis, generalization, and conclusion. Therefore, the formation of students' creative thinking in the process of teaching physics requires a special methodological approach from a scientific and didactic point of view.

A systematic approach plays an important role in determining the methodological direction of the research [5]. A systematic approach allows us to view the process of teaching physics as a single didactic system and analyze the interrelationship of its goal, content, method, means, and result components. Also, based on an integrative approach, taking into account the inextricable link between physics and mathematics, computer science, and technology, mechanisms for forming creative thinking through interdisciplinary integration were based.

This study used scientific methods such as theoretical analysis, pedagogical observation, comparison, generalization, study of scientific sources, and systematization. Through these methods, pedagogical conditions and methodological factors affecting the development of creative thinking in teaching physics were identified, and their effectiveness was scientifically demonstrated.

RESULTS AND ANALYSIS

Analysis of factors influencing the formation of creative thinking in physics education.

The analysis has shown that one of the most important conditions for the development of creative thinking is the integration of theoretical knowledge with practical activities in physics lessons. If a student learns physical laws only by memorization, then the creative thinking process will not occur. On the contrary, when theoretical knowledge is connected with practice through experience, observation, and problem situations, the student's thinking will enter an active state.

Results formed on the basis of pedagogical factors

The study found that pedagogical factors have a strong impact on the development of creative thinking in the following areas:

1. The influence of the motivational factor

The formation of creative thinking in students is primarily associated with internal motivation, and students with a strong interest in physics develop a creative approach faster. As a result of observations, it was found that when real-life examples, modern technologies, and questions based on physical phenomena in everyday life are used in the lesson process, students' interest in science increases significantly.

2. Creative and pedagogical competence of the teacher

According to the results of the study, the pedagogical skills of the teacher are manifested as a decisive factor in the formation of creative thinking. If the teacher conducts the lesson in the form of standard

explanations and exercises, the student will not need creative thinking. The results of the analysis showed that in lessons focused on creative thinking, the teacher plays a more facilitator role, while the student actively participates as a research subject.

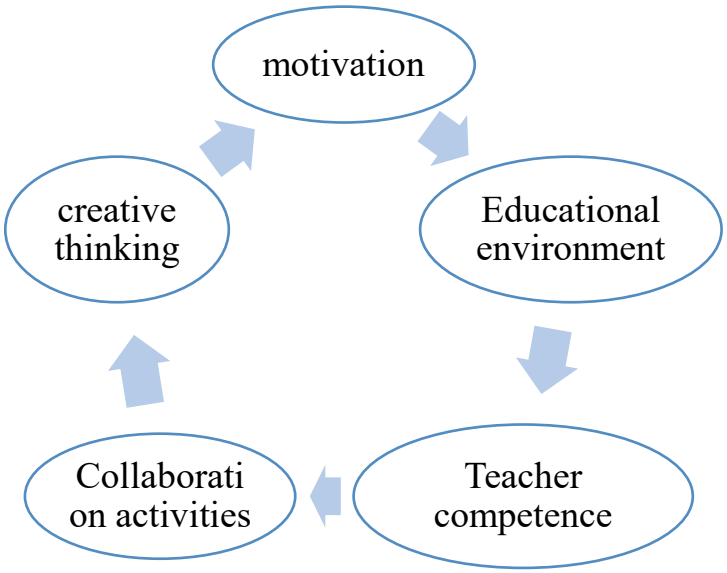

Figure 1. System of pedagogical factors influencing the formation of creative thinking in physics lessons

Results determined based on methodological factors

Methodological analysis has shown that the methods used in the development of creative thinking play an important role[9]. The study found that the effectiveness of problem-based learning, project-based learning, and laboratory experiments is high.

1. The effectiveness of the problem-based learning method

Problem-based learning is one of the most powerful methods for activating students' logical and creative thinking. During the study, it was observed that when problem situations were used in lessons, students' questioning activity, hypothesis-building, and conclusion-making skills increased.

2. The impact of laboratory exercises on creative thinking

According to the results of the study, laboratory and experimental exercises are the most effective methodological tools for developing creative thinking. This is because during the laboratory process, the student does not just receive ready-made information, but also observes the phenomenon with his own eyes, compares the results, and comes to a scientific conclusion.

The analysis revealed that in laboratory exercises, students acquire the following creative skills:

- hypothesize;
- verify the result by changing the experimental conditions;
- compare measurements;
- justify the conclusion.

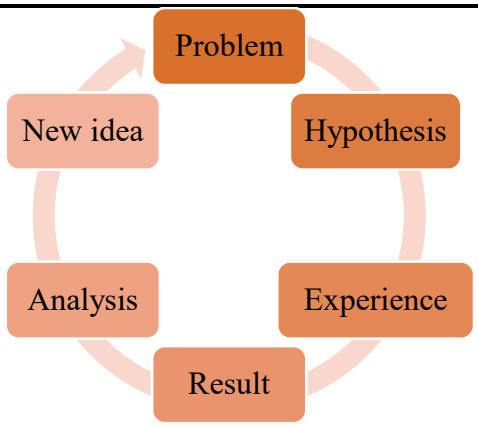

Figure 2. The process of forming creative thinking based on experience

Thus, the formation of creative thinking in physics education is ensured by a combination of pedagogical and methodological factors. Physics lessons organized on the basis of problem-based and practical approaches serve to reveal the intellectual potential of students.

CONCLUSION

The study revealed that among the pedagogical factors influencing the development of creative thinking, the motivation of students, the methodological skills of the teacher, the innovativeness of the educational environment and the presence of a collaborative learning process are of particular importance. In particular, it was established that the teacher's ability to create problem situations in the organization of the lesson, direct the student to research and use methods that stimulate creative thinking are one of the main conditions for the formation of creative thinking.

Also, the analysis of methodological factors showed that problem-based learning, interactive methods, project-based learning and laboratory experiments are highly effective in forming creative thinking. Experiments and laboratory exercises develop the student's scientific thinking and allow for the connection of theoretical knowledge with practice. Interactive and project methods form the skills of students to work together, exchange ideas and develop new solutions.

In general, the development of creative thinking can be achieved by creating problem situations in the educational process, widely using experimental activities, implementing innovative technologies, and directing students to independent research. The results of this study serve as an important basis for developing scientific and practical recommendations that serve to improve the methodology of physics education and form creative thinking competencies in students.

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