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Technologies for the Formation of Creative Thinking Through Interactive and Innovative Approaches to Teaching Physics

Yusupov Kodirjan Batirovich
Leading Specialist, Agency for the Assessment of Knowledge and Competences under the Ministry of Higher Education, Science and Innovation of the Republic of Uzbekistan
yusupov_1970@outlook.com

Abstract:

This article highlights effective pedagogical technologies for the formation and development of creative thinking in students in the process of teaching physics. The study analyzed the issues of independent thinking of students, the ability to find solutions in problem situations and the development of creative approach skills through the use of interactive and innovative approaches in physics lessons. Also, the importance of methods such as problem education, project-based teaching, “brainstorming”, cluster, “mental attack”, debate, “case-study” in mastering physics topics is scientifically based.

The article describes the didactic conditions for integrating interactive methods into the course process, new requirements for the activities of the teacher, as well as mechanisms for creating an innovative educational environment. According to the results of the study, it was found that the educational process, based on interactive and innovative approaches, has a high efficiency in connecting theoretical knowledge of students with practice, forming a culture of scientific thinking and developing creative thinking. This article contains scientific and practical recommendations aimed at modernizing the process of physical education and improving the effectiveness of the quality of Education.

Keywords: Physics education, creative thinking, innovative approach, interactive methods, problem Education, case-study, project-based teaching, creative competence.

Introduction

In the conditions of today's globalization and the development of digital technologies, new tasks are being set for the educational system. In modern society, competencies such as not only the acquisition of ready-made knowledge, but also independent thinking, finding quick solutions in problem situations, a creative approach and being able to form innovative ideas are gaining importance [1]. One of the pressing issues is the development of creative thinking of students, especially in the process of Natural Sciences, in particular in the educational process of physics. Because the science of physics serves to explain natural phenomena on a scientific basis, to determine laws through experiments and observations, and to form scientific thinking.

In the course of teaching physics, students often face complex formulas, abstract concepts, and theoretical laws. Since traditional lesson methods are more focused on memorizing information, students may not have an adequate understanding of the nature of physical processes, linking knowledge to real life, and opportunities for creative thinking [2]. Therefore, the introduction of interactive and innovative approaches in physics education is considered an effective factor in increasing students' interest in the subject, ensuring their active participation, and developing their creative thinking.

Interactive methods activate the learning process of students, encouraging them to think, discuss, analyze the results of the experiment, and draw independent conclusions. Innovative approaches, on the other hand, expand the circle of students ' thinking by introducing new pedagogical technologies, digital tools, virtual laboratories, modeling programs and tasks based on problem situations into the teaching process. Especially problematic teaching methods such as project-based learning, case study, brainstorming, debate, and cluster serve to increase students' creative thinking potential in physics lessons [3].

Also, the formation of creative thinking in physics education is not limited to strengthening only the theoretical knowledge of the student, but is aimed at finding new solutions based on the development of scientific research skills, the formation of a culture of experimentation and the analysis of problem situations. This process brings to the surface such qualities in students as being able to relate physical laws to real-life technological processes, advancing scientific hypotheses, reaching conclusions through analytical and logical thinking. As a result, the reader perceives physics not only as theoretical knowledge, but also as a vital necessity and an important scientific basis for practical activities [4].

Theoretical and Methodological Basis

The theoretical and methodological foundations of this research are aimed at scientifically substantiating the pedagogical capabilities of interactive and innovative approaches to the formation of creative thinking of students in the process of physical education. The theoretical foundation of the study is inextricably linked with the conceptual approaches formed in the field of modern pedagogy, psychology and educational technologies, which determines the need to organize the educational process on the basis of a competency, activity-oriented and personality-oriented paradigm.

Theoretical foundations of research

The issue of the development of creative thinking in the teaching of physics is first explained by the concept of creativity and its psychological and pedagogical essence [5]. Creative thinking is characterized by the reader's intellectual processes such as being able to analyze a problem situation, developing new solutions, comparing different ideas, drawing logical conclusions, and advancing scientific hypotheses. Therefore, the formation of creative thinking in physics lessons is carried out by directing students to research and research activities, rather than mastering knowledge in a reproductive way.

The study pays special attention to the theory of problem education, on the basis that it is possible to activate the thinking process of the student by creating a problem situation in physics lessons. A problem education student has a “why?” , "how?"and “what's that?", which raises questions and encourages him to pursue science. In the process, the reader does not accept knowledge ready-made, but tries to track it down independently, examine it through experience, and draw conclusions. As a result, physics lessons become an educational space that increases the intellectual activity of the student, develops his creative thinking [6].

The principles of a constructive approach on the theoretical basis of research also occupy an important place. According to this approach, knowledge is not given ready-made by the teacher, but is formed by the student in the process of active assimilation. The fact that physical science is based on experience and practice creates favorable conditions for the application of constructive education. In particular, such types of activities as laboratory work, modeling, experimental problem solving serve the development of creative thinking in students.

A competency approach in the theoretical direction of research is also considered as the main methodological support. In this approach, the reader is formed not only as a knowledge-taker, but as a person who can apply his knowledge in real-life situations [7]. The development of creative competence, R & D competence, communicative competence and decision-making competencies in problem situations in the process of physical education is one of the main tasks of interactive and innovative methods.

Methodological approaches to research

In this article, several methodological approaches were taken as the basis for determining the didactic capabilities of interactive and innovative methods:

1. Personality-oriented approach. In this approach, the student is seen as the central subject of the educational process. Taking into account the interest, ability and individual thinking characteristics of each student in physics lessons is an important condition for the formation of creative thinking.

2. An activity-oriented approach. This approach ensures that the student manifests himself as an active participant in the course of the lesson, and not just a listener. Practical experiments, problem solving, modeling and analysis of problem situations enhance the student's access to activities [8].

3. Innovative-technological approach. This approach is intended to increase educational effectiveness in physics lessons through the use of digital educational resources, electronic platforms, virtual laboratories, simulation programs, as well as modern didactic tools. Innovative technologies develop in students the skills of understanding interdisciplinary connections and relating physical phenomena to real life [9].

4. Problem-based learning approach. This approach is an important methodological basis for developing students' creative thinking and involves creating problem situations in the classroom, involving students in scientific research, and analyzing the results [10].

Methods used in the study

The following scientific and pedagogical methods were used in the research process:

* analysis and generalization of scientific literature;

* pedagogical observation;

* comparison and monitoring of the educational process;

* evaluation of the effectiveness of interactive methods;

* Organization of pilot training;

• analysis and conclusion of results.

The content significance of theoretical and methodological foundations

The theoretical and methodological foundations of the study serve to define the scientific mechanisms of the process of forming the creative thinking of students by using interactive and innovative approaches to teaching physics. The educational process, organized on the basis of these approaches, makes it possible for students to develop the skills of deep mastery of knowledge, scientific research, creative thinking in problem situations and making logical conclusions [11].

Thus, the theoretical and methodological foundation of this research is important for improving the quality of physical education, organizing classes based on innovative methods and scientifically substantiating the issues of forming creative competencies of students.

Research Results and Discussion

This research was aimed at determining the effectiveness of the formation of creative thinking in students through the use of interactive and innovative approaches in the process of teaching physics. In the course of the research, classes on the basis of problem education, interactive methods and innovative technologies in physics lessons were analyzed in terms of the influence of students on the level of knowledge acquisition and creative thinking skills.

The results of the study showed that classes organized on the basis of interactive methods compared to traditional lesson methods significantly increased the activity of students in the course process. In particular, in classes where methods such as" mental attack",", cluster",", debate",", case-study",", project method " were used, students showed high results in free expression of their opinion, making scientific arguments, interpreting physical phenomena and making logical conclusions. This situation confirms the fact that interactive approaches form students not only as a cognitive subject, but also as an active participant in the independent creation of knowledge.

When a lesson was organized on the basis of problematic educational elements in the research process, it was observed that the process of creative thinking in students intensified. For example, when, in explaining a physical phenomenon, the teacher created a problematic situation instead of giving a ready rule or formula, students, relying on their knowledge, advanced various hypotheses and sought to prove them experimentally [12]. As a result, creative competencies began to form in students, such as scientific research, analytical thinking, logical observation and solution development.

The results of the study also showed that when interactive methods are used, students ' motivation and interest in the lesson increase. The reason is that in such classes, the student feels as an active subject, expresses free opinion, strengthens his knowledge in the process of controversy [13]. In particular, debate and debate techniques, in addition to students ' logical thinking, also develop the skills of argument, reasoning, and dissent analysis. This condition is considered one of the important indicators of the formation of creative thinking.

At the same time, some problems were also identified in the research process. In particular, it was observed that the material and technical base will be sufficient for the full implementation of innovative technologies, the digital competence of teachers will be highly formed, and the time distribution for organizing classes on the basis of interactive methods will be properly planned [14]. If these conditions are not met, the effectiveness of interactive methods may not be as expected.

In general, the results of the study confirmed that the use of interactive and innovative approaches in physics lessons has a high efficiency in the formation of creative thinking of students. Such methods develop in students the skills of thinking in problem situations, conducting scientific research, associating theoretical knowledge with practice, and developing creative solutions [15]. As a result, the quality indicators of physical education will increase, and students will have the competencies necessary for successful activities in the future in technological and scientific

directions.

Conclusions and Recommendations

The results of this study showed that the use of interactive and innovative approaches to teaching physics is an important pedagogical factor in the formation of creative thinking of students. It was scientifically substantiated that it is possible to improve the effectiveness of the lesson by creating a problematic situation in the process of physical education, encouraging the student to think independently and directing him to scientific research. During the study, it was found that classes organized on the basis of interactive methods serve to develop students ' skills in deep understanding of knowledge, analysis, a creative approach to the problem and linking theoretical knowledge with practice.

The results of the study confirmed that interactive methods in relation to traditional lesson methods make students an active participant in the lesson process. Methods such as" mental attack","" cluster","" case-study", debate, project method activate scientific thinking in students, forming their ability to observe logic and develop a creative idea. In particular, the process of explaining physical phenomena based on a problem-based learning approach, where students make hypotheses and seek to prove them through experimentation, has had a strong impact on the development of creative thinking.

It has also been found that explaining physics topics in visual and practical form through innovative technologies, including virtual laboratories, modeling programs, and digital resources, broadens students ' perception of science. Such approaches help students to more quickly understand abstract concepts, relate phenomena to real life, and form independent analysis skills. As a result, students begin to perceive physics not only as a set of theoretical knowledge, but also as a scientific basis interpreting life processes.

At the conclusion of the study, the following conclusions were drawn:

• when Interactive and innovative methods are used in physics lessons, students develop creative thinking, independent thinking and competence to find solutions in problem situations;

• problematic education encourages students to seek, strengthening their ability to advance and infer scientific hypotheses;

• the educational process, organized through innovative technologies, facilitates the understanding of physical phenomena and increases the motivation of students in science;

• the project and case-study techniques are effective in shaping the culture of creative approach, teamwork and scientific discourse in students.

Based on the results of the study, the following proposals will be put forward to further improve the education of physics:

1. In physics lessons, it is necessary to regularly apply methods based on the creation of a problem situation and explain topics in connection with real-life examples.

2. To develop creative thinking of students, it is recommended to develop lesson developments and methodological manuals aimed at using interactive methods.

3. Expand the use of virtual laboratories, simulation programs, and digital platforms in physics education, and improve technical supportIn order to increase the innovative and digital competencies of teachers, it is necessary to strengthen interactive methods and practical trainings on modern educational technologies in training courses.

4. In the field of physics, it is necessary to pay special attention to the formation of research activities in students by introducing creative tasks based on the project method.

In conclusion, the widespread introduction of interactive and innovative approaches to teaching physics is one of the most important conditions for the development of creative thinking of students, the implementation of knowledge into practice and the improvement of the quality of Education. Classes organized on the basis of these approaches serve to form students as creative thinkers, scientific observers and competitive personalities in accordance with the requirements of modern education.

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