ORIGINAL ARTICLE

INTERNATIONAL JOURNAL OF ARTIFICIAL INTELLIGENCE

ISSN: 2692-5206, Impact Factor: 12,23

American Academic publishers, volume 05, issue 10,2025

Journal: https://www.academicpublishers.org/journals/index.php/ijai

DEVELOPMENT OF STUDENTS' CREATIVE THINKING IN MATHEMATICS LESSONS THROUGH THE STEAM APPROACH

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Abstract: The Steam approach, unlike traditional teaching methods, ensures interdisciplinary integration and serves to develop students' independent thinking, creative solutions in problem situations, collaborative work, and practical skills. The significance of the STEAM (Science, Technology, Engineering, Art, Mathematics) approach in teaching mathematics and the possibilities of developing students' creative thinking potential through it are analyzed.

Keywords: steam approach, mathematical education, innovative pedagogy, creative thinking, interactive methods, integration, educational activity.

One of the most important tasks facing the education system today is the training of individuals who can think creatively, critically, and find new approaches to problems. The STEAM approach deserves special attention as one of the important trends in modern education. Through this approach, it is possible to strengthen interdisciplinary connections, teach students to apply theoretical knowledge in practice, and develop innovative thinking. Mathematics plays a central role in this process, as it develops skills such as analytical thinking, logical reasoning, and systematic problem-solving. Therefore, the application of the STEAM approach in mathematics lessons is an effective tool for developing students' creative thinking.

Analysis of the literature: The educational paradigm of the 21st century directs students not only to acquire knowledge, but also to be able to apply knowledge in practice, analyze problems, and acquire skills of creativity and critical thinking. For this purpose, the STEAM approach (Science - Technology - Engineering - Art - Mathematics), widely used in the world, is considered an innovative direction in education. This concept first appeared in the US education system and was initially used in the form of STEM (Science, Technology, Engineering, Mathematics). Later, the element "A" - art (Art) was added to it, and creativity, design thinking, and an aesthetic approach were introduced into the educational process.

Methodology: The scientific foundations of the STEAM approach are based on the theory of constructivism. According to this theory, the student forms knowledge in their consciousness not in a ready-made form, but through experience, observation, and active participation. Therefore, the introduction of the STEAM concept in mathematics lessons shapes the student not as a learner, but as a knowledge-creating subject.

Mathematics is the subject at the center of the STEAM system, which is the main language and logical foundation of all natural and technical sciences master the skills of modeling, algorithmization, analysis and synthesis;

• learn the mathematical representation of technological processes and engineering projects;

• develop aesthetic and design thinking (for example, symmetry, proportion, fractals).

In mathematics lessons, the STEAM approach teaches students not only to memorize formulas, but also to apply them in solving real problems. For example: The problem "Determining the height of a building using its shadow" shows the integration of mathematics and physics;

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• "3D Shape Making" - combines elements of engineering and art;
• "Solving equations through programming" - demonstrates the connection between mathematics and technology.

1. The essence and purpose of the STEAM approach.

STEAM (Science, Technology, Engineering, Art, Mathematics) is an interdisciplinary educational concept that provides for the organization of the educational process in an integrated, problem-oriented, and practical form. The STEAM approach allows students not only to acquire theoretical knowledge, but also to apply it in real-life situations.

STEAM approach:
• Science - teaches observation and analysis based on natural sciences,
• Technology - forms a culture of using technical means,
• Engineering - directs the search for technical solutions in solving problems,
• Art - develops aesthetic thinking and a creative approach,
• Mathematics - teaches analysis, calculation, and modeling.

When these elements are combined in mathematics lessons, the student feels like a creator who solves real-life problems.

2. Application of the STEAM approach in mathematics lessons.

When organizing lessons, the mathematics teacher should pay attention to the following stages:
Creating a problem situation. At the beginning of the lesson, students are given a life problem or a practical situation. For example: "What mathematical model can be constructed to determine the volume of a reservoir?"
Interdisciplinary integration. In the process of solving a mathematical problem, elements related to technology (computer programs), physics, engineering, or art are used.
Project Activity. Students work in small groups and present their solutions. In this process, skills of creative thinking, communication, and cooperation are developed.
Analysis and evaluation of results. The results of each project are analyzed based on mathematical criteria. Students learn to justify their conclusions.

3. Mechanisms for the development of creative thinking in mathematics lessons:
• Application of game technologies (mathematical quests, interactive quizzes);
• Use of computer programs (GeoGebra, Desmos, Python programming environment);
• Project work (for example, "Mathematical modeling of the irrigation system in the school garden");
• Problem-based learning (open questions, multiple-choice problems);
• Visual modeling (using graphics, drawings, and 3D images).

These methods strengthen analytical thinking, a creative approach, and logical reasoning in students.

4. Advantages of the STEAM approach:
• Increases students' interest in subjects;
• Develops independent and critical thinking skills;
• Allows the use of mathematical knowledge in solving practical problems;
• Forms a culture of working in a team, communicating, and defending one's opinion.

Studies show that students trained using the STEAM approach:
• acquire skills for independent decision-making and creative thinking;
• develop the ability to work in a team, communicate, and analyze problems;
• develop practical thinking and technical thinking;
• learn to apply mathematical knowledge to life problems.

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The STEAM approach elevates mathematics from the level of "dry formula memorization" to the level of problem-based thinking and creative exploration. This strengthens the student's motivation "I can use this knowledge in life."

Conclusion. The STEAM approach manifests itself as a new, effective, and integrated approach to teaching mathematics. With the help of this method, students not only deeply master mathematical knowledge, but also learn to apply it in solving real-life problems. The development of creative thinking in students is the main goal of modern education, and the STEAM approach is one of the most powerful tools in this process.

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