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METHODOLOGY OF USING INTERACTIVE METHODS IN DEVELOPING MATHEMATICAL CREATIVITY

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Abstract
This article scientifically reveals interactive methods and their effectiveness in developing mathematical creativity of high school students in the process of teaching mathematics.

Keywords: Mathematical creativity, brainstorming, group thinking, divergent thinking, strategic solutions, encouraging diversity of thought, competence.

Introduction

Modern educational methodology considers the development of student activity, subjective participation and creative thinking potential in the learning process to be a priority. Developing creativity in mathematics education is becoming one of the most relevant directions of modern educational concepts today.

Mathematics is an important tool for high school students that develops not only logical thinking, but also a creative approach. Currently, the modern education system requires that students be formed not only on the basis of knowledge, but also on the basis of competencies. This teaches students to think independently and look at the problem in a new way.

Example 1: How many different 3-digit numbers can be made from 3 different numbers?

Creative solution: 3! = 6 numbers are made. However, creativity can be increased by changing the task as follows: “Given the numbers 1, 3, 5, how many 3-digit numbers can be made that end with an even number?” In this case, the solution will be 0, because there is no even number among the given numbers.

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Example 2: Given 4 different numbers, how many 3-digit numbers can be formed from them?
Solution: Choose 3 of the 4 numbers and arrange them: A(4,3) = 4×3×2 = 24.

Example 3: How many 3-digit numbers are there that start with only odd numbers from the numbers 1, 2, 3, 4?
Solution: The first number: 1 or 3. Choose 2 of the remaining 3 and arrange them: 2×3×2 = 12.
Unlike traditional teaching methods, creative approaches develop students' individual thinking style, independent decision-making ability, and the ability to find the right way out in non-standard situations. Therefore, updating educational methods and directing them towards the formation of creative competencies is considered an important strategic task in modern pedagogical practice.

1. Brainstorming method
Brainstorming is a method in which students collectively study a specific topic or problem based on free, unhindered thinking. This method was proposed by Alex Osborn and is widely used in the educational process as a means of activating creative thinking, enhancing the flow of ideas, and developing differential and divergent thinking.
Main goal:
- To strengthen students' confidence in free thinking;
- To expand creative possibilities by accepting unconventional, unusual ideas;
- To demonstrate the multi-solution nature of a problem.
- Practical application:
- For example, the topic of the lesson is given as: “Impossible ways to solve quadratic equations”.
- Students are divided into groups and each group freely offers its “incorrect or unusual” ideas.
- The goal is not to find a solution, but to expand the range of approaches by studying paths that do not lead to a solution.
- Impact on creativity:
- Students are freed from the limitations of thinking, which allows them to develop more strategies in the search for a real solution.

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➢ Brainstorming is not just a means of getting an answer, but also a means of developing the thinking process itself.
➢ The method strengthens collective thinking, that is, social creativity is formed.

2. Use of game technologies

The game method serves to form motivation, logical thinking, strategic thinking and creative approach in students by organizing education in an interesting and interactive way. This method is an invaluable tool for encouraging the active participation of young people, softening the mood in the lesson and turning mathematics into a "fun subject".

Types of games:

• Individual games: Sudoku, personal tasks;
• In pairs: “Who will find it faster?”, quiz tournaments;
• Group games: “Tangram constructor”, “Mathematical dominoes”, “Riddle-problem quests”.

Tools used in games:

• Cards, digital platforms (Kahoot, Quizizz), LEGO, tangram, paper models;
• Organization of visual and interactive mathematical activities through digital games.

Impact on creativity:

• In a game environment, the student is not afraid of mistakes, thinks freely;
• Game tasks encourage making various strategic decisions, which stimulates independent and unconventional thinking;
• Through the game, the student models, predicts and explores new situations - these are signs of a high level of creative thinking.

Examples:

• “Mathematical dominoes” - creating a sequence based on similarities;
• “Tangram” — creating new shapes based on geometry, expanding thinking through figure transformation;
• “Formula Quest” — searching for hidden algebraic formulas and applying them in a situation.

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3. Methodology of independent work with didactic materials

Mathematics - in many cases requires working with abstract concepts, models and formulas. For a deep understanding of such knowledge, descriptive, visual approaches are necessary. Didactic materials allow students to visually express ideas, concretize and model abstraction.

Didactic tools:

• Graphs, drawings, tables and diagrams;
• Paper models (polygons, cones, parts of a circle);
• LEGO, tangram, virtual geometric environment (e.g. GeoGebra, Desmos).

Practical application:

• Students analyze algebraic formulas based on graphs;
• Understand geometric relationships by constructing polynomials;
• Model algebraic expressions with LEGO blocks and learn to write expressions based on structure.

Impact on creativity:

• The student "sees", "feels" and "creates" abstract concepts;
• Creates his own mathematical model through each material, which develops constructive thinking;
• Visual testing of mathematical ideas leads to creative synthesis.

The above-analyzed brainstorming, game technologies, and independent work based on didactic tools are methods that form not only knowledge, but also creative thinking in students. They perform the following pedagogical functions:

Method	Type of activity	Form of creativity	Main advantage
Brainstorming	Groupthink	Divergent thinking, strategic solutions	Encourages diversity of opinion
Gaming technologies	Individual and group play	Unusual thinking, logical-analytical thinking	Fun, motivation-based learning
Didactic materials	Descriptive model and modeling	Visual thinking, transfer and synthesis skills	The ability to concretize abstract concepts

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Each of the methods considered above has its own unique features, which serve to increase the activity of students, encourage them to research, logical and creative thinking, deepen mathematical knowledge and form skills for applying it to real life. Problem-based learning, heuristic conversation, creative laboratory, project method, brainstorming, independent work based on game technologies and didactic materials - all this serves to develop students not only as knowledge acquirers, but also as creative subjects.

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