

DEVELOPMENT OF PRIMARY SCHOOL STUDENTS' MATHEMATICAL THINKING THROUGH MODERN PEDAGOGICAL TECHNOLOGIES

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Abstract. This article analyzes the theoretical and empirical foundations of using modern pedagogical technologies in the process of developing mathematical thinking among primary school students. Recent research and international experiences regarding the effectiveness of problem-based learning, information and communication technologies, game methods, and creative approaches are carefully examined.

Keywords: Mathematical thinking, pedagogical technologies, problem-based learning, game technologies, primary education.

Introduction. Globalization and the rapidly evolving digital era require education systems to nurture individuals capable of analytical thinking and problem-solving. Developing mathematical thinking at the primary education stage through mathematics serves as a vital foundation for enhancing students' cognitive, logical, and creative abilities. The article discusses not only pedagogical approaches but also scientific studies confirming their effectiveness.[1] **Discussion**

1. **Theoretical Foundations of Mathematical Thinking** Mathematical thinking refers to the ability to understand numbers, structures, and relationships, to make logical conclusions, and to solve problem situations. According to Piaget's theory, during the ages of 6–11, children transition to the concrete operational stage of cognitive development, which enables a deeper understanding of arithmetic and geometric concepts. Therefore, lessons should not only focus on calculations but also include problem situations, logical games, puzzles, and exercises. [2]

2. **Modern Pedagogical Technologies and Their Effectiveness** Problem-based learning teaches students to analyze problems independently. This approach is based on active exploration and experimentation rather than passive information reception. **Game-Based Learning.** Teaching through games not only increases motivation but also provides measurable results in strengthening specific mathematical skills. Interactive methods such as “Brainstorming” encourage creative thinking and idea generation by solving problems collectively. Other effective activities include “Continue the Sequence,” “Chain Game,” and “Quick Answer.” Studies show that traditional games significantly improve academic outcomes, especially in primary grades. [3] **Creative Tasks.** Assignments such as creating new shapes based on geometric figures, continuing logical sequences, or number series enhance students' creative thinking.

Individual Approach. Personalized assignments consider students' individual development stages, strengthen their strong sides, and help eliminate weaknesses.

3. Recommendations for Pedagogical Practice - Implement problem-based learning by linking exercises to real-life contexts.- Improve teachers' qualifications through ongoing training in ICT and pedagogical design.- Renew the assessment system to evaluate not only test results but also the process of solving problems and creative solutions. Today, the formation of students' independent, logical, and creative thinking is one of the main goals of education. Especially in teaching mathematics, the use of modern pedagogical technologies significantly increases the efficiency of developing mathematical thinking. Mathematical thinking is the ability to analyze problems, find logical relationships, work with abstract concepts, and discover new ways to solve problems.[4] Goal: To develop students' logical, creative, and practical thinking skills by effectively applying modern pedagogical technologies in the development of mathematical thinking among primary school students. Objectives:

- To define the essence of the concept of mathematical thinking in primary education.

- To analyze modern pedagogical technologies that contribute to the development of mathematical thinking.

- To select exercises, tasks, and interactive methods that activate students' thinking.

- To determine effectiveness through experimental lessons.

- To develop methodological recommendations for fostering logical and creative thinking. Modern Pedagogical Technologies The following technologies are effective in developing mathematical thinking in primary school students:

- Problem-Based Learning Technology – encourages students to analyze through problem situations.

- Interactive Methods (cluster, insert, brainstorming, Venn diagram) – develop group thinking and generalization skills.

- Information and Communication Technologies (ICT) – stimulate visual and logical thinking through digital tools (presentations, learning platforms, animations).

- 4K Technology – based on creativity, communication, collaboration, and critical thinking.

- Game Technologies – foster logical thinking through mathematical games and competition elements.

Ways to Develop Mathematical Thinking

- Regularly using logical exercises (ordering, comparing, finding analogies).
- Forming abstract thinking through graphic models (schemes, diagrams, drawings).
- Encouraging independent problem-solving by analyzing problem situations.
- Developing quick thinking through mathematical games and quizzes.

- Strengthening thinking through solving crosswords, rebuses, and logical chains.

Expected Results

- Development of analytical and logical thinking.
- Formation of creative application skills of mathematical concepts.
- Increased ability for independent work, reasoning, and problem analysis.
- Improved effectiveness in using ICT and interactive methods in the educational process.

Conclusion. Modern pedagogical technologies are powerful tools for developing mathematical thinking in primary school students. Through appropriate methodological integration, teacher preparation, and context-based program selection, these technologies can significantly improve educational outcomes. Empirical studies support the effectiveness of ICT, game-based, and interactive tools; however, their impact depends on design, implementation, and pedagogical skills. Developing mathematical thinking in primary school students is a key priority of modern education. Rational use of pedagogical technologies, fostering independent thinking, and applying creative and interactive methods ensure an effective learning process that develops not only mathematical but also life-oriented thinking skills.

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