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Developing Logical Thinking in Primary School Mathematics Lessons

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Abstract: This article focuses on developing the logical thinking skills of primary school students in mathematics lessons. Interactive methods, creative tasks, logical exercises, and game elements are proposed for fostering logical thinking. The article provides methods and practical recommendations to help students develop independent thinking, analyze problems, and find effective solutions.

Keywords: Logical thinking, mathematics, education system, logical problem, worldview, skills, thinking independently.

Introduction. In developed countries, education is recognized as the main driving force ensuring sustainable development. The new education concept, defined by international organizations and most countries of the world for the period up to 2030, highlights the critical task of "improving the processes and tools for assessing teaching quality and implementing mechanisms that enable the identification of achieved results." This, in turn, necessitates the improvement of methods for developing mathematical logical thinking activities in primary school students.

Currently, it is of paramount importance to develop and structure a methodological framework for shaping and enhancing the mathematical thinking activities of primary school students. Many researchers have explored the problem of developing mathematical thinking in students:

1. The methodology of teaching problem-solving in primary school classes through modular innovative technologies has been studied and acknowledged in the works of B. Abdullayeva, S. Burxonov, A. Sodiqova, M. Sultonov, and M. Tashpo'latova.
2. The foundations of the theory of developmental education in mathematics teaching have been elaborated in the studies of L.G. Peterson, X.J. G'aniyev, N.B. Istomina, Z.I. Slepkan, and I.G. Lipatnikova.
3. Various aspects of developing students' personalities during the process of mathematics education have been examined in the research of V.A. Gusev, N.R. G'aybullayev, V.A. Dalinger, J. Ikromov, Yu.M. Kolyagin, V.I. Manoxov, N.V. Metelskiy, A.G. Mordkovich, A.M. Pishkalo, G.I. Saransev, T.R. To'laganov, M. Toshev, A.A. Stolyar, M. Rayemov, P.M. Erdniyev, and N.O. Eshpo'latov.

4. The various facets of teaching mathematics in primary classes of general secondary education schools have been the subject of research by A.M. Pishkalo, N.U. Bikbayeva, L.Sh. Levenberg, E. Yangabayeva, Sh. Rayxonov, B.S. Abdullayeva, B.R. Adizov, A. Xaliloyev, M. Jumayev, M.A. Zayniddinova, O. Roziqov, R. Ibrogimov, F. Qosimov, Sh. Yunusova, M.J. Saidova, M. Ro'ziqulova, and E. Xudoynazarov.

E. Khudoynazarov studied and conducted research on improving the methodological framework for developing and shaping the mathematical thinking activities of primary school students. Primary education is considered a favorable period for the comprehensive development of students' personalities and the establishment of active thinking skills. Alongside the development of speech in primary school students, their active thinking abilities also begin to emerge. The initial skills of comparison, classification, generalization, and systematization allow students to present their thoughts logically, clearly, vividly, and fluently.

E. Khudoynazarov highlighted the following principles as priorities in teaching students mathematical thinking:

- The ability to clearly structure confirmation, engage in reasoning, and construct chains of evidence, emphasizing its connection to logic.
- Logical reasoning being unique to humans.
- The individual's capacity for learning and assimilation.
- Thinking processes possessing an active and creative character.
- The development of thinking in primary school students, enabling them to acquire methods of action, adapt them to circumstances, and solve self-set problems through exploration, which is a priority goal of the pedagogical process.
- Gradual formation of mental operations as one of the effective methods for enhancing the thinking activities of primary school students.

"Mathematical thinking refers to the process of indirectly reflecting the quantitative relationships and spatial forms of the objective world in human consciousness; it characterizes the learning activity of an individual as generalized and indirectly representing the world."

Primary education is the key stage where children's logical thinking skills develop. In particular, mathematics lessons provide a good opportunity to foster these skills because mathematics involves processes such as drawing logical conclusions, identifying patterns, and applying rules. It is also worth noting that solving mathematical problems is an important and fundamental part of teaching mathematics. It is unimaginable to study mathematics without solving problems. Problems serve as a useful tool for developing children's thinking abilities, as they typically involve acquiring certain knowledge. Solving these problems requires the problem solver to independently engage in analysis and synthesis, compare facts, generalize, and so on. Teaching these methods of cognition is one of the important goals of mathematics education. Solving problems develops interest in the subject, and in general, fosters independence, freedom, discipline, hard work, and goal orientation. Solving real-life problems also helps to expand the scope of students' thinking.

What is logical thinking?

Logical thinking is the ability to find connections based on information, draw conclusions, analyze problems, and search for solutions. This type of thinking develops a person's analytical approach, helping in reading, writing, communication, and problem-solving processes.

Characteristics of logical thinking:

1. Analytical approach: Studying a problem by breaking it down into parts.
2. Identifying cause-and-effect relationships: Predicting the outcome of each action in advance.

3. Seeking creative solutions: Finding different ways to solve the same problem.
4. Consistency and determination: Maintaining the correct order when drawing conclusions.

Primary school students are at a key stage of developing their logical thinking skills. Therefore, activities should be engaging and suited to their age characteristics. Developing logical thinking in primary school is an essential stage for shaping students' mental abilities and teaching them independent thinking. Below are effective methods for developing logical thinking:

Using Mathematical Games

- Problem-based tasks: Assign problems that encourage students to find logical connections. For example, tasks like "Which one is different?"
- Working with geometric shapes: Comparing shapes, arranging them in logical order.
- Sudoku, puzzles, and riddles: Such games enhance students' analytical thinking skills.

Creating Problem Situations

- Asking thought-provoking questions during lessons: Questions like "What should be done if this happens?" or "Why did this event occur?" can stimulate students to think.
- Tasks focused on comparison and cause-effect relationships.

Using Inductive and Deductive Thinking Methods

- Inductive method: Start with simple examples and allow students to derive general rules. For example, identifying mathematical rules through a series of examples.
- Deductive method: Provide a general rule and ask students to find examples that fit it.

Applying Interactive Methods

- Role-playing games: For example, organizing a "Logical Journey" using various maps.
- Discussions and group work: Solving problems in groups helps students learn communication and exchange of ideas.

Working with Crosswords and Diagrams

- Creating and solving crosswords related to the topic.
- Explaining and independently creating graphs and diagrams.

Observation and Analysis

- Assign tasks to observe phenomena in nature or daily life and provide logical explanations. For example: "Why is the Sun warmer during the day?" or "How do trees grow?"

Using Visual and Manipulative Materials

- Performing tasks involving numbers, shapes, and colors.
- Solving problems using manipulatives such as cubes, dominoes, and cards.

Encouraging Independent Thinking

- Allow students to freely express their opinions.
- Developing creative and critical thinking by finding multiple solutions to different problems.

Regular Assessment and Analysis

- Analyzing students' ideas at the end of each lesson and encouraging them.
- Reviewing and discussing completed tasks together.

Using Modern Technologies

- Engaging students through interactive programs (e.g., mathematical games and simulations).
- Offering logical tasks through mobile applications and online platforms.

Conclusion. Implementing these methods in primary school helps develop not only students' logical thinking but also their creative and analytical thinking skills.

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