

Methods for Developing Students' Mathematical Thinking Skills in Schools

Sanobar Ibragimovna Kenjayeva,

Lecturer at the Department of General Education Theory and Practice, Jizzakh State Pedagogical University +997974356979

Abstract: This article will focus on methods of developing students' mathematical thinking skills. At the same time, attention to the field of education, about types of thinking and questions that enhance mathematical thinking are also briefly covered.

Keywords: education, thinking, mathematics, school, teacher, student, abilities, life situations, problem solving.

The education system is the fundamental basis of all civilizations, as it is based on the presence and future of every field. Education teaches society to be interested in other cultures, to learn from the best of the past and present, and thereby creates a better foundation for the future.

In order to achieve this, it is necessary to focus on improving the quality of education. Constant changes alone do not help to continuously improve the quality of education. We know that education starts and is largely focused on the primary school level. Therefore, every year, by updating the curriculum or textbooks, the functional capabilities of modern education are being shortened, reduced, and made more precise, resulting in inefficient work being carried out. For this reason, it is necessary to take into account the opinions of school teachers in carrying out these tasks, and if necessary, to ensure their participation in these processes. In this regard, the emphasis of our respected leader on "Constitutionally defining the status of teachers" is not without reason, and the position of teachers in the state policy, undoubtedly, satisfies each teacher and, together with it, contributes to increasing their confidence, status, and responsibility towards their work. Improving the quality of education in schools and enhancing the influence of teachers in society are among the most important tasks in 2023.

"I consider it necessary to constitutionally define the status, dignity, and value of teachers in order to protect them," said our Uzbekistan president. "It is necessary to develop the independence, critical and creative thinking, teamwork, and communication skills of students. Therefore, how should our schools be equipped with a suitable environment?" The Uzbekistan leader noted that 130 schools in the country have already implemented the "Ey-Level" education program, which has been approved in many countries, in order to improve the quality of education in schools and enhance the influence of teachers in society.

All of these are well-thought-out reforms aimed at achieving a high-quality education level and ensuring that young people in our country occupy leading positions in all areas of our country's development with their knowledge in the future. To achieve this, it is necessary for us to work hard as teachers and not only provide students with knowledge and education but also give them love and care like our own children. In addition, students are required to have sufficient responsibility, accountability, and thinking skills. Especially, students with high-level thinking skills can deeply understand all subjects. Here, we pay attention to the meaning of the word "thinking". Thinking is the highest form of human mental activity; the process of reflecting the objective reality in the mind, the main condition for implementing human activity. Thinking plays a key role in understanding the environment, social events, and reality, as well as in implementing human activity. It is a process of high-level knowledge that fully and clearly reflects reality and the relationship between things and events through intuition, perception, and imagination. Thinking is the process of thinking, generalizing, and reflecting on the connection between things and events in the world.

Based on psychological principles, the right hemisphere of the brain is responsible for mental activities. People who are dominant in the right hemisphere are more emotional and have

imaginative thinking. These individuals have a humanitarian outlook. If the left hemisphere is dominant, the person is more practical, analytical in thinking, and has mathematical thinking.

There are 5 main types of human thinking:

- Practical thinking;
- Creative and imaginative thinking;
- Humanitarian thinking;
- Mathematical (analytical) thinking;
- Universal thinking (synthetic).

Mathematical thinking is a type of thinking that is based on processes such as learning, analyzing, arguing, finding formulas and algorithmic solutions, creating new formulas and solutions, and developing new methods for solving mathematical problems. Mathematical thinking is considered the highest level of mathematical reasoning. Mathematical (analytical) thinking is very similar to practical thinking. Developing the ability to think mathematically is crucial for students to deeply understand mathematics. This helps students to develop their own thinking skills when learning mathematics, solving problems, and dealing with important issues. Below are some ways to develop mathematical thinking skills:

1. Encouraging thinking during problem solving: Encouraging students to think during problem-solving is important for developing their thinking abilities. Students need to be encouraged to express their own thoughts and engage in discussions about problems so that they can develop their own thinking skills throughout the problem-solving process.

2. Reading mathematical problems: Reading mathematical problems helps students to develop their thinking skills when solving problems. It provides students with more freedom and allows them to become familiar with problem-solving methods that work best for them.

3. Finding alternative methods for solving mathematical problems: Finding alternative methods for solving mathematical problems helps students to develop their thinking skills when solving problems. These methods help students to find new problem-solving approaches and become familiar with problem-solving methods that work best for them.

4. Analyzing mathematical problems: Analyzing mathematical problems helps students to develop their thinking skills when solving problems. This method helps students to think about mathematical problems more deeply and to gain a better understanding of how to solve them.

5. Interactive mathematical activities: Interactive mathematical activities help students to develop their thinking skills when learning mathematics. These activities encourage students to express their own thoughts, find alternative methods for solving mathematical problems, and become familiar with problem-solving methods that work best for them.

Developing mathematical thinking skills requires using several methods to enhance students' ability to think about mathematics. These methods provide students with more independence in solving mathematical problems and encourage them to analyze and think about mathematical problems and work with interactive mathematical activities. These methods create more opportunities for learning mathematics and help students develop their ability to think mathematically.

The use of complex problems:

Complex problems can be an excellent tool for developing students' mathematical thinking. These problems present students with a difficult or complex form of analysis and problem-solving. Students need to think more about analyzing the problem and finding a solution. This helps develop students' mathematical thinking. Teachers can offer students problems, assignments, and learning materials to prepare complex problems.

Opportunities for expressing opinions in math classes:

Opportunities for expressing opinions are crucial for developing students' mathematical thinking. Teachers can give students feedback to answer questions, understand mathematical concepts, and help them analyze and solve problems. This helps develop students' mathematical thinking. Paying attention to their questions, opinions, and helping them solve problems is one of the ways to develop their mathematical thinking.

Solving problems practically:

One of the best ways to develop mathematical thinking is to solve problems practically. Teachers can provide students with problems and assignments to solve, and they need to show their analysis and reasoning. This helps develop students' mathematical thinking because they learn how to discuss and solve problems. Students need to prepare practical exercises, practice solving problems, and create more opportunities for expressing their opinions.

Concepts and Connections:

One of the other good ways to develop mathematical thinking is through concepts and connections. This helps students understand mathematical concepts in relation to each other. Students develop mathematical thinking by identifying, analyzing, and solving concepts and connections. Providing examples and practical exercises that help students understand concepts and connections related to each other is a good way to understand them. This method is a good tool for enhancing students' mathematical thinking, as they learn to think about concepts and connections while analyzing and solving them.

Connecting Mathematics to Life:

Another method for developing mathematical thinking is connecting mathematics to real life. Providing advice on how to use mathematics in real life, preparing practical exercises, and teaching how to apply mathematics in real life can lead to positive results. Teachers can offer interesting exercises, concepts, and problems to teach students how to connect mathematics to real life. This method is a great tool for enhancing students' mathematical thinking, as they learn to use mathematics in real life situations and benefit from it.

Overall, methods such as solving complex problems, discussing and commenting on them, problem-solving, learning concepts and connections, and connecting mathematics to real life are helpful in developing mathematical thinking and serving students' understanding of mathematics and its practical applications.

Additionally, we suggest using the following additional methods to further develop mathematical thinking skills:

1. Reflecting on problem-solving processes: In this method, students learn to reflect on their problem-solving processes by learning various problem-solving methods and thinking about problems and their solutions.
2. Creating questions and problems: Students can develop their mathematical thinking skills by creating math questions and problems. This method allows students to enhance their critical thinking skills by creating questions and finding their answers.
3. Creating math journals or blogs: Students can develop their math thinking skills by writing about math questions or problems they encounter. This method helps students learn through reading, writing, and reflecting on math concepts.
4. Participating in math events: Students can develop their mathematical thinking skills by participating in math events such as math clubs or societies. This method provides opportunities for students to work together and solve math problems.
5. Using learning materials: Students can enhance their mathematical thinking skills by using learning materials such as math textbooks. This method helps students gain a deeper understanding of math concepts and develop their thinking skills.
6. Using math games: Students can develop their mathematical thinking skills by playing math games or solving math puzzles. This method provides an enjoyable way for students to practice math skills and develop their thinking skills.

"Thus, the methods mentioned above can be useful to develop students' mathematical thinking abilities. Developing mathematical thinking skills is of great importance for students to learn mathematics. It helps students to enhance their thinking abilities in learning mathematics, solving problems, and addressing important issues.

Let's stop at some examples given for the development of mathematical thinking."

In this problem, a store sells products for a holiday. Each product costs 25 USD. The store offers a 10% discount. The students have to determine the total profit made by the store.

Students begin to think mathematically to solve this problem. They think about income, value for money and prices and summarize their ideas as a team.

Solution: Since each product costs 25 USD and there is a 10% discount, the discounted price for each product is 22.5 USD. If 10 products are sold, the total profit made by the store can be calculated as follows:

$$\text{Total profit} = 10 * 22.5 = 225 \text{ USD}$$

In another problem, a store sells 10 products with a 20% discount. Later, the store offers another 5% discount on the sold products. The students have to determine the total profit made by the store. This problem allows students to solve calculation problems related to sales, discounts and income. In answering this question, students think about how much profit the store should make. To solve this problem, they should use formulas related to discounts, prices and revenues.

Solution: If the store offers a 20% discount, the cost of each product is 80% of the original price. So, the cost of each product is $0.8x$, where x is the original price of each product. After the additional 5% discount, the cost of each product becomes $0.95 * 0.8x = 0.76x$. Therefore, the total profit made by the store can be calculated as:

$$\text{Total profit} = (10 * 0.76x) - (10 * x * 0.25) = -0.4x$$

This shows that the store incurred a loss from the sales of these products.

There are many other interesting and acceptable problems in mathematics. For example:

1. "Combinatorics and the Theory of Counting: Combinatorics and the theory of counting require students to understand the methods used to count, order, and select products and categories. For example, students may be asked how to arrange multiple products, how to choose from multiple products, and other related questions.

2. Mathematics Tables and Coordinates: Mathematics tables and coordinates help students solve mathematical problems directly through coordinate tables. For example, students can learn to solve geometric shapes through coordinate tables, solve functions and their graphs, and learn to use coordinates and tables for many other purposes.

3. Differential and integral calculus: Differential and integral calculus is an important field in mathematics that is used in many different areas. For example, students can learn to find derivatives and integrals of functions, solve piecewise functions, and gain an understanding of the geometric meaning of integrals."

4. "Geometry: Geometry is a branch of mathematics that has influenced many different fields. For example, students can learn to solve geometric shapes, solve geometric problems and formulas, use geometric coordinates, and other purposes that require an understanding of geometry.

5. Mathematical Modeling: Mathematical modeling is the process of using mathematics to imagine possibilities on a higher level. For example, students can learn to solve problems and formulas using mathematical modeling techniques, create various mathematical models, learn to apply mathematical models, and work with mathematical modeling for many other purposes.

There are many interesting and popular problems in mathematics. These problems help students develop their mathematical thinking abilities and understand mathematics better. However, due to our limited space, we have only touched on a few problems. In the future, we will provide more articles and information on this topic."

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