



METHODS OF TEACHING MATHEMATICS AND THE
APPLICATION OF NEW PEDAGOGICAL TECHNOLOGIES IN REAL
LIFE

Zilolaxon Xabibulloxonovna Mamatova

Associate Professor, Doctor of Philosophy (PhD)

in Pedagogical Sciences

Fergana State University

E-mail: mamatova.zilolakhon@gmail.com

Isroiljon Mirzarabjonova Odina *daughter*

4st-year Student, Applied Mathematics Program

Group 22-08

Fergana State University

E-mail: ismoiljonovaodina88@gmail.com

Annotation: *This article highlights the importance of modern pedagogical technologies and innovative methods applied in the teaching of mathematics. Unlike traditional teaching approaches, it analyzes the role of interactive methods such as “Fishbone,” “Step by Step,” “Six Thinking Hats,” and “PMI” in developing students’ thinking skills through practical examples. Furthermore, the article discusses the effectiveness of teaching mathematics through digital technologies (GeoGebra, MATLAB, Python) and the teacher’s evolving role as a guide and motivator in the modern educational process. Based on real-life examples and classroom experiences, the paper substantiates the significance of mathematics in daily life and the positive impact of new pedagogical approaches on students’ holistic development.*

Keywords: *mathematics, teaching methods, new pedagogical technologies, interactive methods, “Fishbone,” “Step by Step,” “Six Thinking Hats,” “PMI,” STEAM, innovative education, digital technologies, independent thinking, creativity, logical reasoning.*



INTRODUCTION

In today's era of globalization and digital technologies, mathematics has deeply penetrated nearly every sphere of human activity. From simple phone calculators to online databases, artificial intelligence systems, and social media algorithms — all operate based on mathematical principles. Therefore, mathematics is not only a core subject within the education system but also a vital tool for developing logical reasoning, analytical thinking, scientific problem-solving, and sound decision-making skills.

To enhance the effectiveness of teaching mathematics in modern education, teachers must utilize not only traditional methods but also innovative pedagogical technologies and creative approaches. Organizing the learning process using advanced methods improves students' learning quality, fosters independent thinking and exploration, and teaches them to apply knowledge in practice. Consequently, improving mathematical teaching methods and effectively integrating new pedagogical technologies have become among the most urgent issues in contemporary education.

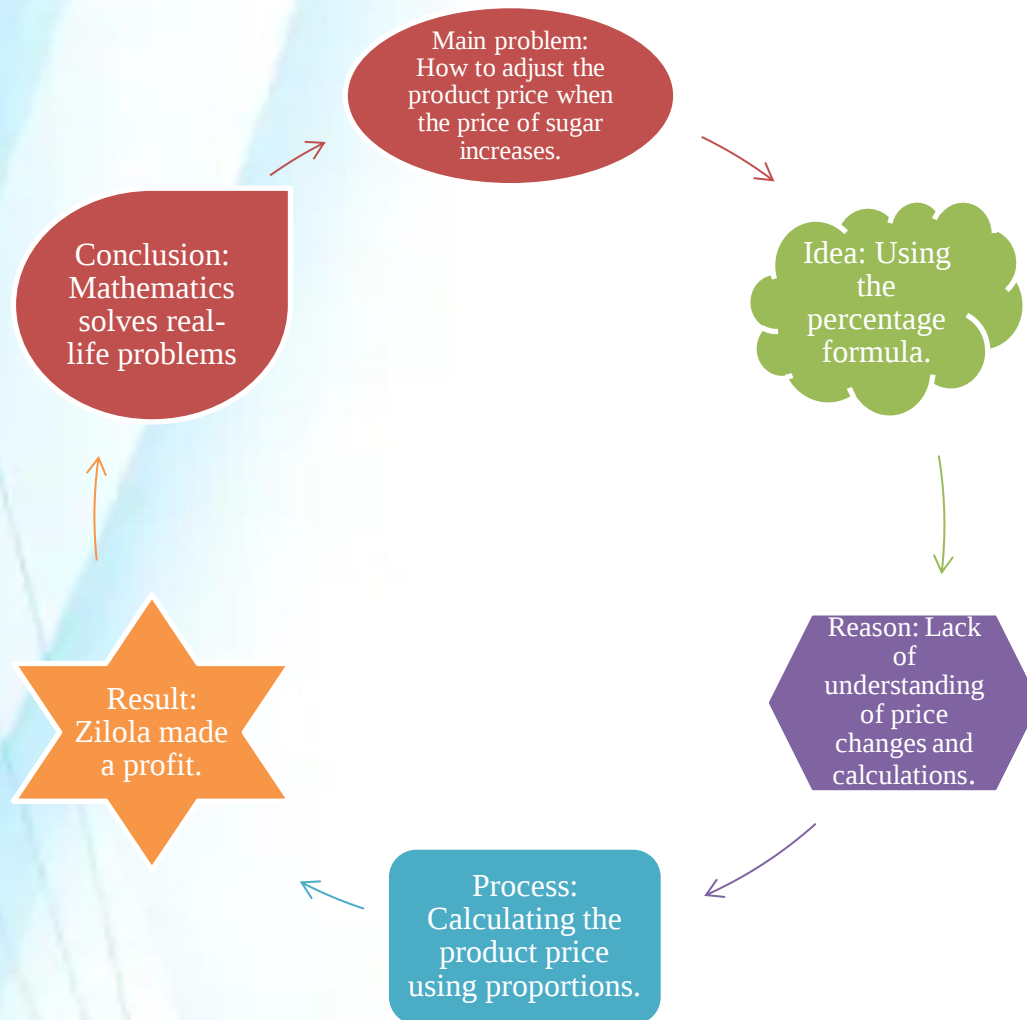
1. THE IMPORTANCE OF MATHEMATICS IN EVERYDAY LIFE

Many students often ask, “Will I ever need mathematics in real life?” — and life itself provides the answer. For instance, a student who aspires to become a designer works with measurements, proportions, symmetry, and coordinates in every project. A builder or architect needs geometric knowledge, while an entrepreneur relies on mathematical analysis when calculating percentages, profits, expenses, and balance.

Consider this real example: Zilola, a 9th-grade student from Fergana, decided to open a small confectionery shop. Initially, she lacked knowledge of economic calculations. Her mathematics teacher taught her the topic of “Percentages and Proportions” using a real-life example — how a rise in sugar prices affects product costs. As a result, Zilola learned to calculate prices and ensure profitability.



This case vividly demonstrates the practical value of mathematics.



2. TRADITIONAL AND MODERN TEACHING METHODS

In the past, lessons were mainly conducted through lectures and written exercises. Nowadays, interactive methods, digital technologies, and collaborative learning approaches are widely used.

For example, the “Lotus Blossom” or “Brainstorming” methods develop students’ independent thinking and creativity. However, recent years have shown particularly effective results in mathematics teaching through methods such as “6×6×6,” “Fishbone,” “Step by Step,” “Six Thinking Hats,” and “PMI.”

The “Fishbone” Method – Identifying Causes and Effects

The “Fishbone” method (also known as the “Ishikawa Diagram”) is an analytical and problem-solving tool designed to identify the root causes and effects of an issue. Developed by Japanese scholar Kaoru Ishikawa, this method helps students analyze relationships logically and visually.



The main idea of the method is that every problem (i.e., outcome) has several underlying causes. If these causes are correctly identified, solving the problem becomes much easier. The diagram is named “Fishbone” because its shape resembles the skeleton of a fish.



For example: “Causes of Students’ Fear of Mathematics.”



The “Six Thinking Hats” Method – Multifaceted Thinking

The “Six Thinking Hats” method, created by renowned psychologist and creativity theorist Edward de Bono, encourages students to analyze a problem from different perspectives, manage their thinking process, and enhance creativity.

Each “hat” represents a distinct thinking style — logical, emotional, critical, optimistic, creative, or managerial. When students metaphorically “wear” a hat of a specific color, they adopt that corresponding mode of thinking, which helps them explore complex problems from multiple viewpoints.



The PMI Method – Analyzing Positive, Negative, and Interesting Aspects

The PMI method is one of the strategies that develop students’ analytical and creative thinking abilities. The name of the method comes from the first letters of the English words “Plus, Minus, Interesting”, which mean Positive, Negative, and Interesting Aspects. The method was developed by the well-known psychologist Edward de Bono.

The main goal of the PMI method is to teach students to analyze a given topic, idea, or problem comprehensively — that is, to examine not only its positive



but also its negative and interesting sides. This approach fosters critical thinking, open-minded reflection, and objective evaluation skills in learners.

The method consists of three parts:

1. **P (Plus)** – Identifying the positive, beneficial, or advantageous aspects of the topic.
2. **M (Minus)** – Analyzing the negative, inconvenient, or disadvantageous aspects.
3. **I (Interesting)**- Exploring the interesting, unusual, or thought-provoking aspects of the topic.

Example: “Using a Calculator in Mathematics Lessons”



3.TEACHING MATHEMATICS THROUGH DIGITAL TECHNOLOGIES AND ARTIFICIAL INTELLIGENCE



The integration of digital technologies and artificial intelligence into education allows teachers to make lessons more interactive, visual, and analytical. In mathematics, this enables students to visualize formulas, connect abstract concepts with real-life phenomena, and engage in independent exploration.

Using tools such as GeoGebra, Desmos, MATLAB, and Python, students can:

- ✓ Dynamically visualize and modify function graphs;
- ✓ Design and observe algorithms in real time;
- ✓ Solve practical problems through mathematical modeling.

Life example: “Square equation” approach to the theme digital

Example: When teaching “Quadratic Equations,” a teacher in Tashkent used GeoGebra to demonstrate how changes in the discriminant affect the shape of a parabola.

Students observed and concluded:

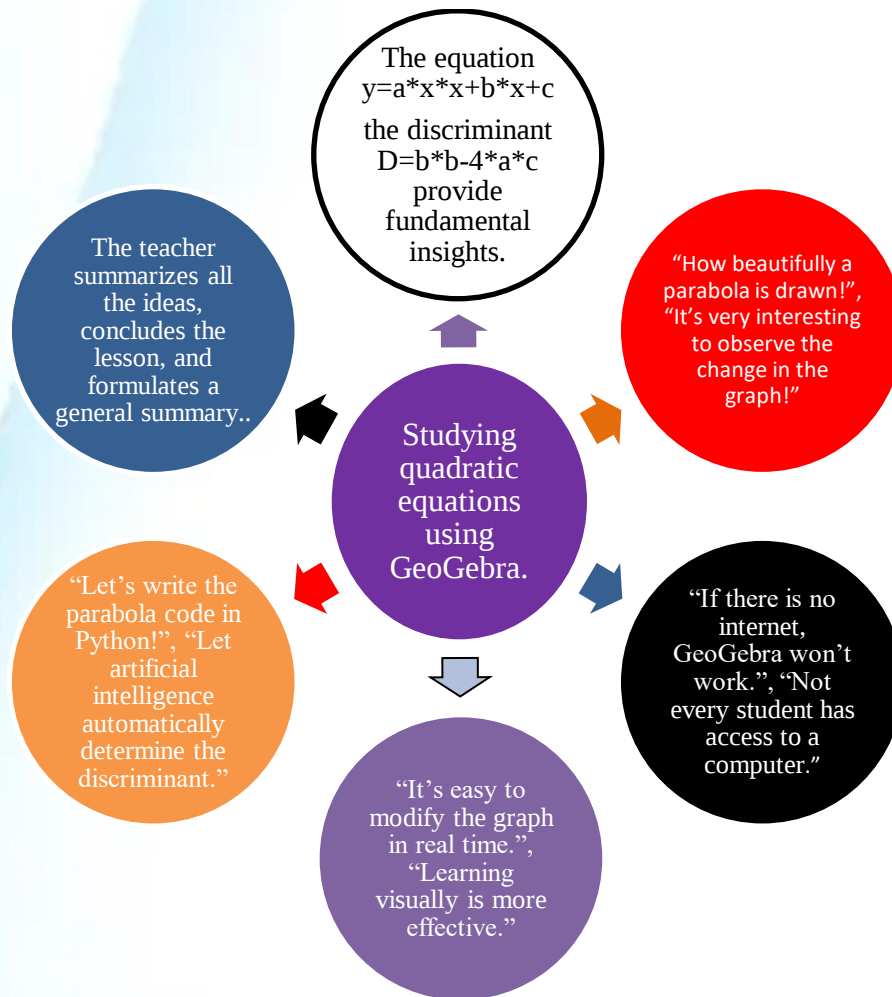
“If $D < 0$, the parabola does not intersect the x-axis because there are no real roots.”

Through this activity, students developed logical thinking, mathematical analysis, and visual perception skills.

Analysis Based on the “Six Thinking Hats” Method

The “Six Thinking Hats” method is an approach that teaches students to view a single problem from different perspectives.

Below is an analysis of the topic “Studying Quadratic Equations Using GeoGebra” based on this method:



Results: Through the “Six Thinking Hats” method, students:

- ✓ Learn to approach each problem from different perspectives,
- ✓ Develop critical and creative thinking when using digital technologies,
- ✓ Become accustomed to expressing their thoughts logically, clearly, and systematically.

4. THE ROLE OF THE TEACHER: GUIDE AND MOTIVATOR

In the modern education system, the teacher is no longer merely a source of knowledge but serves as a facilitator, consultant, and motivator. The teacher’s task is to guide students toward independent inquiry, critical thinking, and evidence-based reasoning.

In such lessons, learners do not receive ready-made information — they discover knowledge themselves. As a result, logical thinking, problem-solving, creativity, and communication skills are developed.



Example: In a school in Andijan, a mathematics teacher concludes each lesson with the question:

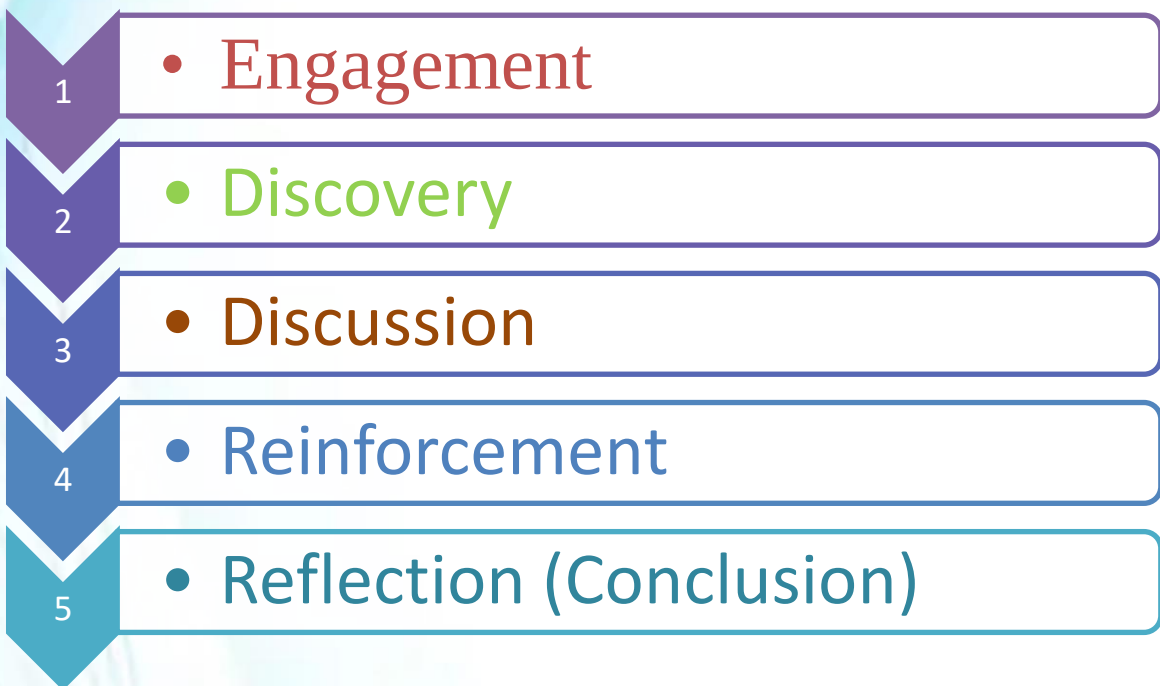
“Where can you apply today’s mathematics lesson in real life?”

Students respond orally or in writing:

- “When calculating discounts in a store.”
- “When measuring wall dimensions at home.”
- “When planning business budgets and percentages.”

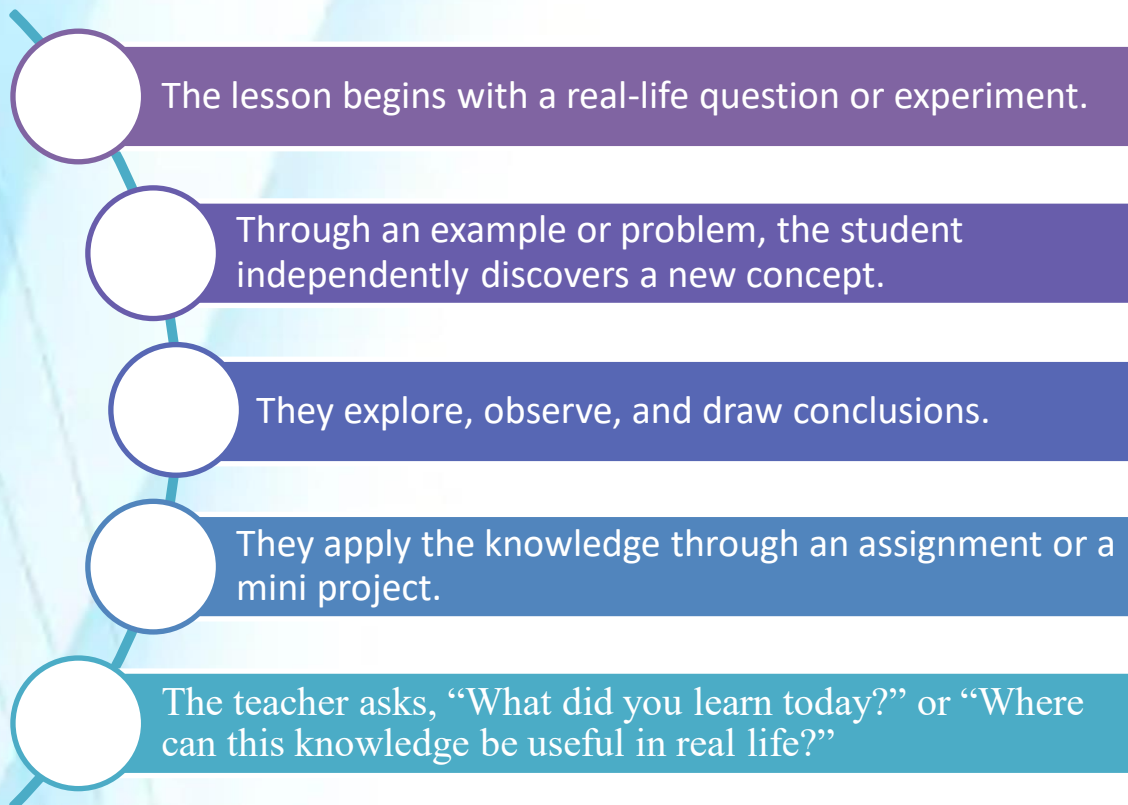
This simple yet powerful method encourages reflection, real-life connection, and self-expression.

The “Step by Step” Method – Gradual Knowledge Formation





The “Step by Step” (Zinama-zina) method involves guiding students through gradual stages of learning — from simple to complex concepts.



- ✓ Teacher — now is not the person in the center but a reference and inspiring.
- ✓ Reader — active participants discover which knowledge itself.
- ✓ “By the stairs staircase” from using their own methods, each reader develops the ability to buck.

CONCLUSION

Modern methods of teaching mathematics and the application of new pedagogical technologies play a crucial role in developing students’ independent thinking, analytical reasoning, creativity, and problem-solving skills. These technologies transform the learning process from mere knowledge transmission into a platform for intellectual growth and practical skill-building.

The “Fishbone” method trains students to identify causes and effects logically.



The “Step by Step” method helps structure complex ideas into manageable parts.

The “Six Thinking Hats” method fosters multidimensional, creative, and critical thinking.

The “PMI” method develops comprehensive evaluation and reflective judgment.

The integration of these approaches makes mathematics lessons more interactive, engaging, and applicable to real-life situations. Students learn to use their knowledge practically, collaborate effectively, and think critically.

Ultimately, mathematics becomes not just a collection of formulas and calculations, but a laboratory of thought, creativity, and life learning. Thus, modern pedagogical technologies emerge as one of the most effective tools for enhancing educational quality and fostering students’ intellectual and personal growth.

REFERENCES

1. Jo‘rayev, A., & Ergasheva, M. (2021). Pedagogical Technologies and Interactive Methods. Tashkent: Fan va Texnologiya Publishing House.
2. Xoliqov, N., & Yuldasheva, Z. (2020). Methods of Teaching Mathematics. Tashkent: Uzbekistan National University Press.
3. G‘ulomov, M., & Yo‘ldoshev, Q. (2019). Modern Educational Technologies and Their Role in the Educational Process. Tashkent: TSPU Publishing House.
4. Saidova, D. (2022). Ways of Using Innovative Methods in Teaching Mathematics. Education and Innovations Scientific Journal, No. 3.
5. Shodmonov, S., & Hasanov, B. (2020). Pedagogical Mastery and Modern Teaching Methods. Tashkent: Ilm Ziyo Publishing House.
6. Karimova, N. (2021). The Effectiveness of Interactive Methods in Mathematics Education. TSPU Scientific Bulletin, No. 2.
7. Bloom, B. S. (1956). Taxonomy of Educational Objectives: The Classification of Educational Goals. New York: Longman.
8. De Bono, E. (1985). Six Thinking Hats. Boston: Little, Brown and Company.

ONLINE SOURCES



1. Official website of the Ministry of Public Education of the Republic of Uzbekistan — <https://www.uzedu.uz>
2. Ministry of Higher Education, Science and Innovation of the Republic of Uzbekistan — <https://www.uzfi.uz>
3. Portal on Pedagogical Technologies and Interactive Methods — <https://pedagog.uz>
4. Education and Innovations Scientific Journal — <https://journal.tdiu.uz>
5. Articles published on the ResearchGate platform — <https://www.researchgate.net>
6. Google Scholar academic article database — <https://scholar.google.com>
7. Edutopia – Modern Teaching Strategies Portal — <https://www.edutopia.org>