ISSN: 2053-3578 I.F. 12.34

METHODS FOR DEVELOPING LOGICAL THINKING SKILLS IN PRIMARY SCHOOL MATHEMATICS LESSONS

Sanjarbek Mirzayevich Mamajonov
Associate Professor, Kokand University
Doctor of Philosophy (PhD) in Physics and Mathematics
Email: sanjarbekmamajonov@gmail.com, smamajonov@kokanduni.uz
Maxliyoxon Doniyorjon qizi Odilova
Third-Year Student, Primary Education Department, Kokand University
Email: odilovamaxliyo04@gmail.com

Abstract. This article explores innovative pedagogical approaches aimed at fostering logical thinking skills among primary school students during mathematics lessons. It examines the effectiveness of various teaching methods and tools that promote logical reasoning, which is essential for problem-solving and deep conceptual understanding. Through a comprehensive review of existing literature and practical investigations, the study identifies key strategies and best practices for integrating logical thinking into primary mathematics education. The article emphasizes the importance of creating an interactive and engaging learning environment to nurture students' mathematical reasoning, analytical, and justification skills. It also highlights the critical role of teachers in enhancing students' logical thinking potential through differentiated approaches and targeted activities. Overall, this research offers practical recommendations and strategies for advancing logical thinking in primary education.

Keywords: Mathematics, logical thinking, primary education, development, mathematical logic, pedagogical approach, problem-solving skills, integration.

INTRODUCTION

Developing logical thinking skills in primary school students is a cornerstone of their intellectual growth and mathematical literacy. Mathematics, with its theoretical foundations and structured nature, provides an ideal platform for cultivating systematic problem-solving and analytical skills. When strategies for logical thinking are effectively incorporated into primary mathematics lessons, they foster critical and creative thinking, as well as independent problem-solving abilities in students.

In Uzbekistan, several governmental initiatives underscore the importance of nurturing independent thinking and intellectual potential in the younger generation. For instance, the

ISSN: 2053-3578 I.F. 12.34

Concept for the Development of Public Education Until 2030 (April 29, 2019), the Action Strategy for 2017–2021, and Resolution No. 187 of the Cabinet of Ministers (April 6, 2017) prioritize these goals. As emphasized by the President of Uzbekistan, a well-rounded individual is one who thinks independently, possesses knowledge, sets a positive example through their conduct, and evaluates ideas critically. Logical thinking engages both hemispheres of the brain, paving the way for personal excellence.

From this perspective, fostering logical thinking in primary education is closely tied to developing clear, precise, and coherent mathematical expression. This is a fundamental objective of primary education. Classroom tasks should encourage independent thinking, comparison, observation, and analysis, while being age-appropriate and achievable for students.

Mathematics equips students with knowledge about quantitative relationships and spatial forms in real life. Solving mathematical problems hones their reasoning, analytical, and logical deduction skills. In 2020, a presidential decree titled Measures to Improve the Quality of Mathematics Education and Promote Research introduced systemic reforms to elevate mathematics education. New textbooks enriched with tasks that stimulate logical and critical thinking were developed as part of these efforts.

In summary, one of the primary goals of teaching mathematics in Uzbekistan's primary schools is to nurture well-rounded individuals equipped with robust intellectual skills.

LITERATURE REVIEW

Numerous scholars have explored the development of logical thinking skills in primary school mathematics. The renowned philosopher Abu Nasr al-Farabi provided a detailed analysis of logic in works such as Isagoge (Introduction), Categories, On Interpretation, Syllogism, Demonstration, Dialectics, Sophistics, Rhetoric, and Poetics. In treatises like On the Science of Logic, On Intellect, Conditional Judgments, and Syllogism, he elucidated the essence, structure, and role of logic in scientific systems.

Abu Rayhan al-Biruni emphasized the importance of logic, stating, "Humans need a criterion to distinguish truth from falsehood in expressing their thoughts, and that criterion is logic." He viewed logic as a vital tool for assessing the reliability of ideas.

Al-Farabi, in his work What Must Be Known Before Studying Philosophy, argued that engaging with logic is essential to avoid errors, discern truth, and pursue knowledge accurately. Historically, logic has been interpreted in various ways: as an "organon" (a tool for constructing knowledge) in ancient times, a "scale distinguishing truth from falsehood" by Eastern thinkers,

ISSN: 2053-3578 I.F. 12.34

and a “method of discovery” or “canon” by European philosophers like Immanuel Kant. Thus, logic can be regarded as a preparatory discipline for studying other sciences.

Ibn Sina (Avicenna) also devoted significant attention to logic in works like The Book of Healing, The Book of Salvation, and The Book of Knowledge. He described logic as a tool for separating truth from falsehood and a foundational element for mastering all sciences.

Contemporary research, such as Mohichehra Furqatovna Ibrohimova’s dissertation Developing Logical Thinking in Primary School Mathematics Lessons (Bukhara State University), recognizes logical thinking as a critical cognitive skill for primary students. The study analyzes pedagogical methods, including active learning, question-and-answer sessions, debates, real-life examples, and visual aids, emphasizing the teacher’s pivotal role in this process.

Gulnora Usmonovna Narmetova’s dissertation The Role of Problem-Solving Activities in Developing Logical Thinking in Primary School Mathematics (Samarkand State University) highlights problem-solving as a key tool for building logical skills. It recommends using open-ended problems, multi-step tasks, and inference-based exercises to enhance logical thinking, advocating for their integration into mathematics lessons.

Rakhmatulla Ergashovich Ibragimov’s study The Impact of Manipulatives on Developing Logical Thinking in Primary School Mathematics (National University of Uzbekistan) demonstrates that students using manipulatives achieved notable improvements in logical thinking. These hands-on tools enhanced students’ visualization, analysis, and understanding of cause-and-effect relationships.

Russian scholar A.L. Nikolskaya argues that logical thinking development should not be confined to primary education but should continue throughout the learning process, describing it as fostering a “culture of thinking.” Similarly, A.A. Stolyar’s research on logical pedagogy outlines a step-by-step approach to logical activities in arithmetic and set theory across primary, middle, and high school levels.

In conclusion, effective pedagogical strategies can cultivate students’ abilities to think independently, analyze, draw conclusions, and solve problems confidently.

METHODOLOGY

This study employed a survey method to assess and evaluate logical thinking skills in primary school mathematics lessons. Surveys were chosen for their ability to collect direct, precise data and systematically explore respondents’ perspectives, experiences, and practices.

Advantages of the Survey Method:

ISSN: 2053-3578 I.F. 12.34

- **Direct Data Collection:** Surveys provided firsthand insights into teachers' and students' experiences, challenges, and approaches to teaching logical thinking, uncovering new perspectives not found in secondary sources.

- **Quantitative and Qualitative Data:** Surveys combined numerical data with open-ended responses, offering a deeper understanding of factors influencing logical thinking.

Survey Design and Questions:

An online survey was created using Google Forms, incorporating:

- Tasks requiring logical thinking, such as "Spot the Pattern," "What Does This Look Like from Above?," and "Which One Would You Choose?," designed to assess students' observation, analytical, and problem-solving skills.

- Multiple-choice and open-ended questions to explore teachers' preferred methods and students' individual reasoning processes.

Data Analysis. Responses were analyzed statistically, with results presented in pie charts, bar graphs, and percentages. These visualizations helped identify the most effective pedagogical strategies for fostering logical thinking. Detailed findings are discussed in the Research Results section.

RESEARCH RESULTS

One effective method, the "Which One Doesn't Belong?" task, was tested with 20 first-grade students enrolled in a mental arithmetic course. The tasks aimed to evaluate cognitive skills like logical reasoning, analysis, differentiation, and conclusion-drawing.

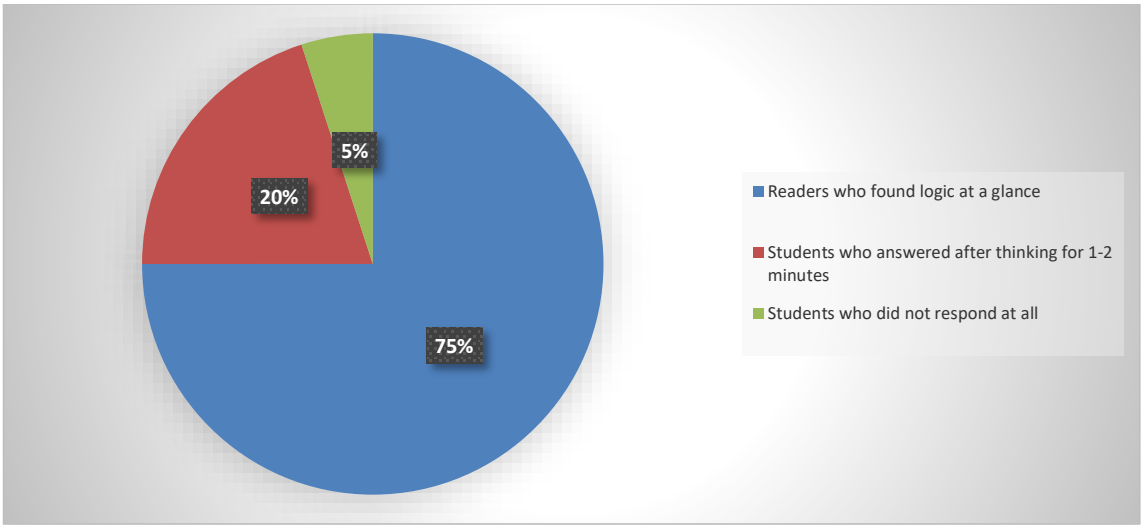

Figure 1: Results of the "Which One Doesn't Belong?" Method

ISSN: 2053-3578 I.F. 12.34

Logical problems are powerful tools for stimulating the mind. In this study, the "Which One Doesn't Belong?" method was tested with 20 first-grade students in a mental arithmetic course. Results showed:

- 15 students (75%) identified the correct answer immediately upon observing the image.

- 4 students (20%) provided the correct answer after 1–2 minutes of careful consideration.

- 1 student (5%) was unable to respond.

These results exceeded expectations, likely because the participants were enrolled in a mental arithmetic course, which enhances logical thinking and IQ compared to typical school students.

Other methods were tested at Secondary School No. 6 in Kokand. For example, the "What Does This Look Like from Above?" method was applied in third-grade mathematics lessons with 60 students.

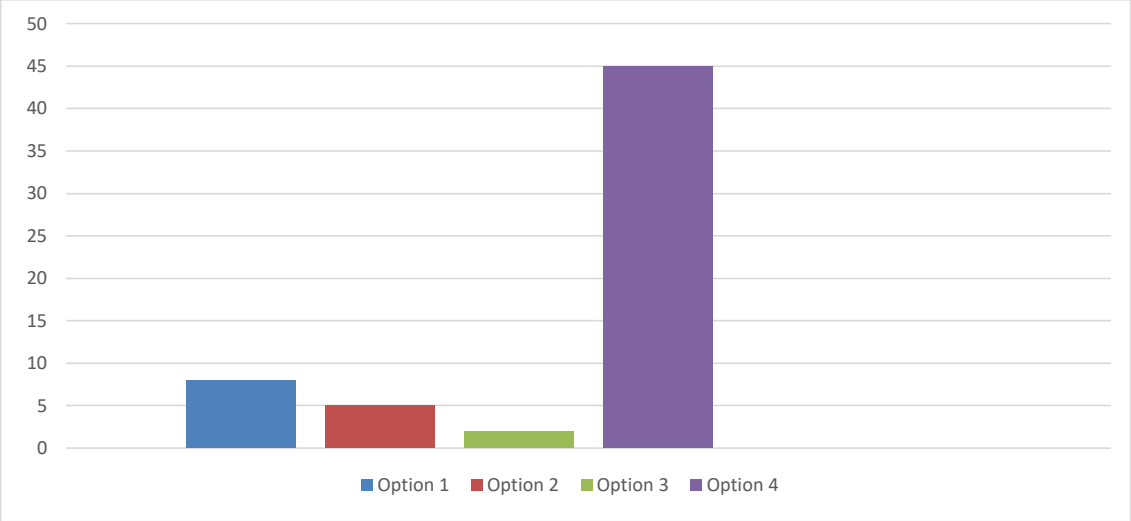

Figure 2: Results of the "What Does This Look Like from Above?" Method

Of the participants, 45 students (75%) selected the correct option (Option 4), while 15 students (25%) chose alternatives they believed were correct. When used during "brain break" moments or as independent tasks, these methods gradually enhance students' logical thinking, making lessons more engaging and interactive. They also help involve students who are less interested in mathematics or struggling academically.

To determine the optimal lesson segment for applying these methods, a survey was conducted among 25 primary school teachers from various schools.

ISSN: 2053-3578 I.F. 12.34

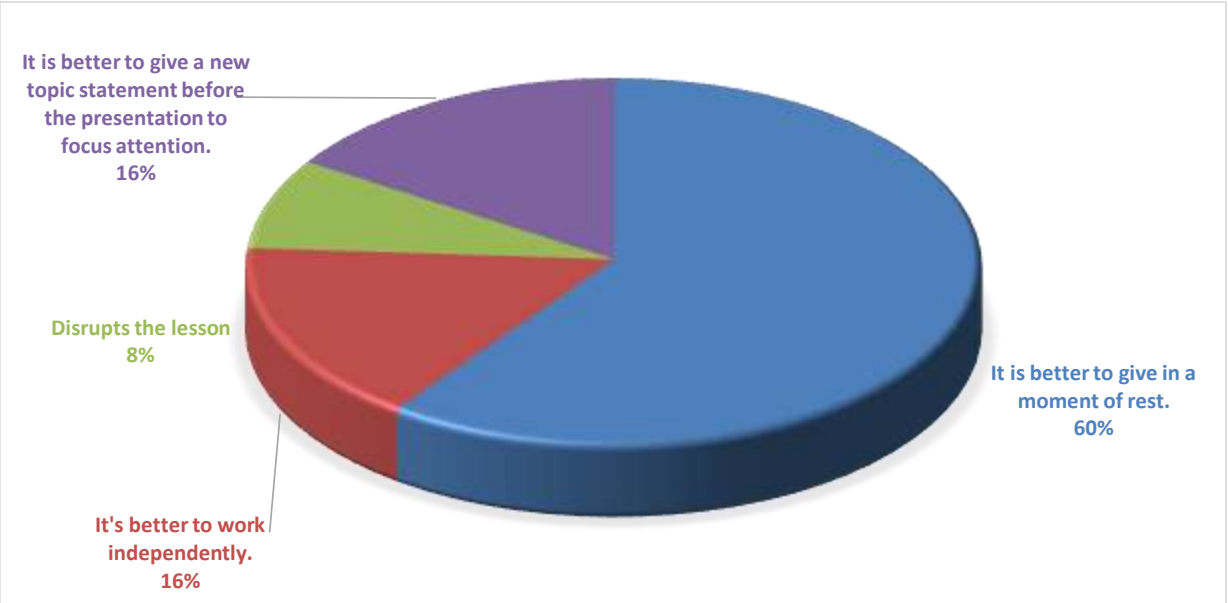

Figure 3: Survey Results Among Primary School Teachers

Findings revealed:

- 15 teachers (60%) preferred using these methods during “brain break” moments.

- 4 teachers (16%) suggested using them as examples for independent work after the lesson introduction.

- 2 teachers (8%) expressed concerns that these methods might disrupt lesson timing.

- 4 teachers (16%) found them effective for focusing students’ attention before introducing new topics.

Despite varied teaching styles, 92% of teachers favored incorporating these methods into lessons.

Additionally, logical questions were posed to 30 community members to assess their logical thinking levels. Questions included:

1. Which letter is written similarly in nearly all alphabets worldwide? (Answer: O)

2. When do we say “ten” while looking at “two”? (Answer: When a clock’s hour hand is at 2)

3. What is small, gray, and resembles an elephant? (Answer: A baby elephant)

...

10. How did a man become a millionaire by buying apples at 500 soum and selling them at 300 soum? (Answer: He was already a billionaire)

ISSN: 2053-3578 I.F. 12.34

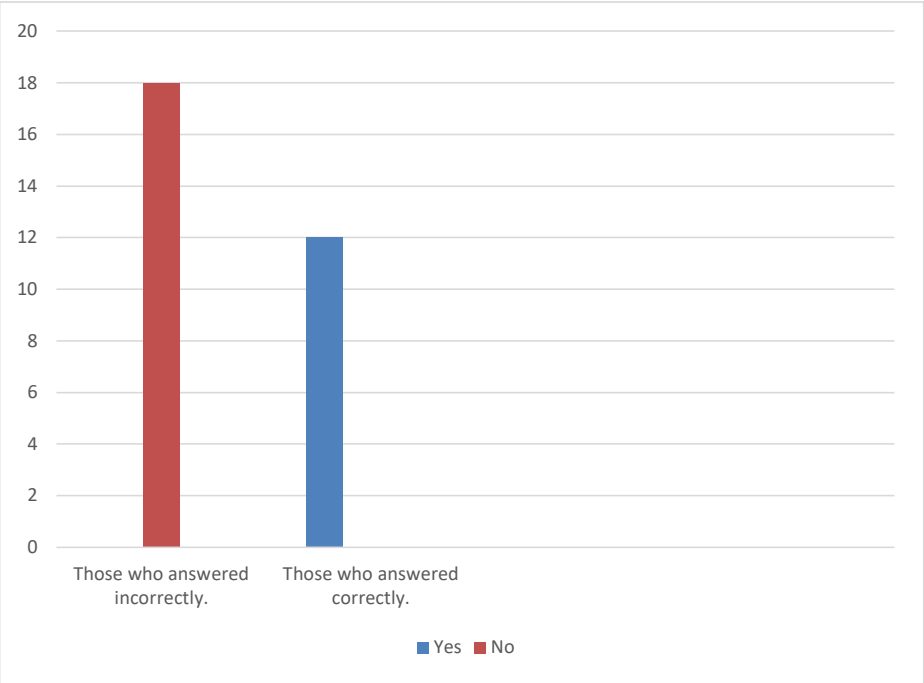

Figure 4: Overall Results of Logical Questions

Results showed that 18 respondents (60%) answered incorrectly, while 12 (40%) answered correctly.

DISCUSSION

The role of logic in mathematics education cannot be overstated. As a discipline grounded in evidence, mathematics serves as a foundation for developing logical and critical thinking. Gulnora Narmetova's research confirms that problem-solving is a highly effective method for fostering logical thinking in primary mathematics lessons. Observations indicate that logical question-and-answer activities enhance students' thinking speed and retention skills. A.A. Stolyar's studies further demonstrate that logical thinking is essential not only for primary students but also for middle and high school students.

This article underscores the importance of cultivating logical thinking across all educational stages, with mathematics providing a robust framework for developing systematic reasoning and intellectual growth.

RECOMMENDATIONS

Recommendations:

- Incorporate More Logical Questions: Using logical questions in mathematics lessons deepens students' thinking processes and makes lessons more engaging.

- Expand Use of Existing Methods: Methods like “What Does This Look Like from Above?,” “Connect the Dots,” “Which One Doesn’t Belong?,” “Math Puzzles,” and “Matchstick Puzzles” should be widely integrated to enhance thinking skills.

- Community Engagement: Online surveys with logical questions for community members, including parents, can promote logical thinking. These could be conducted via Telegram channels or groups.

CONCLUSION

Logical thinking requires constant cultivation. As Mawlana Asadullah Okhundzada noted, neglecting logic hinders one’s ability to benefit from scholarly works, akin to leading cattle through a barren valley. Embedding logical questions and tasks in primary mathematics lessons can elevate students’ IQ, broaden their thinking, and unlock new opportunities. Encouraging students to solve logical tasks with family members can further enhance their learning abilities.

Fostering logical thinking in primary mathematics education equips students with essential problem-solving skills, preparing them for academic and real-world challenges. Teachers can inspire critical thinking and analytical skills through puzzles, games, and real-life problem-solving. A supportive learning environment and positive teacher-student interactions are key to this process.

While challenges in implementing these strategies are acknowledged, collaboration among teachers, administrators, and policymakers can overcome them. By fostering logical thinking, educators lay a strong foundation for students’ academic success and lifelong learning.

REFERENCES

1. Presidential Decree No. PF-5712, April 29, 2019. Available at: https://lex.uz/docs/-4312785

2. Presidential Decree No. PQ-4947, February 7, 2017. People’s Word Newspaper, February 9, 2017.

3. Presidential Decree No. PQ-2909, December 31, 2016. People’s Word Newspaper, December 31, 2016.

4. Mirzayev, A.O., & Pozilova, O.D. (2022). The Role of TIMSS International Assessment in Enhancing Mathematics Teaching Effectiveness. Scientific Progress, 3(4), 77.

5. Presidential Decree No. PQ-4708, May 7, 2020.

6. Sharipov, M., & Fayzikhojayeva, D. (2004). Logic. Tashkent, p. 24.

7. Al-Biruni, A.R. (1982). Geodesy. Tashkent, p. 64.

8. Al-Farabi. (1975). Treatises. Tashkent: Fan, pp. 23-24.

9. Mamadaliyeva, N. (2021). Philosophy (Logic Section). Study Guide. Tashkent, p. 5.

10. Karimov, I.A. (2000). National Independence Ideology: People's Faith and Confidence in a Great Future. Fidokor Newspaper, Tashkent: Uzbekistan, p. 11.

11. Muhammadjonova, N. (2022). The Emergence and Development Stages of Logic. Third-Year Student, Khadichai Kubro Women's Islamic Education Institution.

12. Mamadiyeva, N. (2021). Philosophy (Logic Section). Study Guide. Tashkent, pp. 5-6.

13. https://jdpu.uz/3-sinf-matimatika-darslarida-mental-arifmetikaning-ahamiyati/

14. Toshmirzoyeva, E. The Role of Practical Exercises in Mathematics Lessons for Developing Logical Thinking. Student, FarDU.

15. Mirzakhidovna, M.B. (2022). Influence of Self-Consciousness on Family Relationships and Its Psycho-Correction. Web of Scientist: International Scientific Research Journal, 3(6), 272-277.

16. Mamaradjabova, B. (2020). Self-Awareness Strategy. Scientific Research Results in Pandemic Conditions (COVID-19), 1(03), 145-147.

17. Mamajonov, S., & Komilova, G. (2025). Boshlang'ich ta'lim yo'nalishi talabalariga "beshga bo'linish alomati" mavzusini o'qitishda zamonaviy yondashuv. Qo'qon universiteti xabarnomasi, 14, 114-116. https://doi.org/10.54613/ku.v14i.1136

18. Mamajonov, S. M. (2024). Differensial tenglamalar faniga kirish" mavzusini o'qitishda IQ testlardan foydalanish. *Journal of Science-Innovative Research in Uzbekistan*, *2*(2), 279-284.

19. Mamajonov Sanjarbek Mirzayevich. (2024). Maple dasturida funksiyalarning grafiklarini chizish. *University Research Base*, 475-480. Retrieved from https://scholar.kokanduni.uz/index.php/rb/article/view/371