

## "DEVELOPING LOGICAL THINKING SKILLS IN PRIMARY SCHOOL STUDENTS THROUGH MATHEMATICS INSTRUCTION"

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**Abstract:** *This article highlights the pedagogical significance, types, and methodological aspects of using logical reasoning models (LRM) in developing primary school students' logical thinking skills during mathematics lessons. Furthermore, the effectiveness of the instructional process organized on the basis of logical reasoning models is analyzed and substantiated.*

**Keywords:** *logical thinking, logical reasoning models, primary education, mathematics, teaching methodology.*

### INTRODUCTION

In the modern education system, one of the priority tasks is not only the acquisition of knowledge by students but also the development of their independent, critical, and logical thinking skills. In the educational process, it is essential for the learner to be formed as an active subject, acquiring knowledge not in a ready-made form but through inquiry, analysis, and drawing conclusions. In particular, the stage of primary education is considered a crucial period that lays the foundation for this process. Mathematics lessons in primary school play a leading role in developing students' logical thinking. This is because at this stage, the basic forms of thinking—analysis, comparison, generalization, classification, and drawing conclusions—begin to develop in children. The content of mathematics is based on concrete concepts, regularities, and logical relationships, which contribute to the consistent and systematic development of students' thinking processes. The utilization of logical reasoning models (LRMs) in this process serves as an effective pedagogical tool. LRMs assist students in analyzing problems through various approaches, identifying cause-and-effect relationships, and substantiating solutions. Through these models, students develop the ability to present their ideas in a logically coherent manner, make informed decisions, and defend their conclusions.

Concept of logical thinking and its significance in primary education.

Logical thinking is the ability of a learner to deeply analyze problems and situations, identify cause-and-effect relationships between them, compare facts, generalize information, and draw well-founded conclusions. In the process of logical thinking,

the learner acquires skills to apply knowledge in practice, approach problem situations creatively, and make independent decisions.

Developing logical thinking in primary school students serves as a strong foundation for their successful learning in subsequent stages of education. It is during this period that

students form their style of thinking, attitude toward knowledge, and interest in learning. If sufficient attention is given to logical reasoning in this process, students will be able to comprehend complex topics more easily and become prepared for independent learning.

Mathematics lessons represent one of the most effective subjects for developing logical thinking, as mathematics requires students to think precisely, perform sequential logical operations, and justify each solution. During problem-solving activities, learners go through different stages of reasoning, which positively influences their intellectual development. Therefore, the use of methods and instructional tools aimed at fostering logical thinking in primary school mathematics lessons, particularly logical reasoning models, holds significant pedagogical value.

Logical reasoning models (LRM) are a set of didactic models aimed at activating students' thinking processes and guiding them toward step-by-step problem solving. The logical reasoning models applied in primary school mathematics lessons are classified into the following main types:

1. Comparison model. This model enables students to identify similarities and differences between objects, numbers, or phenomena. The comparison model develops students' analytical and comparative skills, as well as their ability to express ideas clearly and logically.

Example:

Comparing the numbers 5 and 8, determining the difference between an equation and an expression.

2. Analysis and synthesis model. Analysis refers to the process of breaking a whole into parts, while synthesis involves reassembling the separated parts. This model helps students develop the ability to understand problems deeply and distinguish between essential and secondary information.

Example: In a word problem, identifying the statement, given information, and the required solution parts.

3. Generalization model. Through this model, students derive general rules or conclusions based on individual examples and cases. The generalization model develops students' theoretical and logical thinking.

Example: Deriving addition rules based on several addition examples.

4. Reasoning based on problem situations model. This model encourages students to think independently based on problematic questions or situations. Problem-based learning enhances students' creative and logical thinking activity.

Example: How does the result change if one operation is replaced with another?

5. Cause-and-effect relationship model. This model helps students understand the cause-and-effect relationships between performed operations and obtained results. It contributes to the development of logical chain reasoning.

Example: Why does the result increase in addition and decrease in subtraction?

6. Algorithmic thinking model. The algorithmic thinking model teaches students to work according to a sequence of steps. This model is especially effective in calculations and multi-step problem solving.

Example: Determining the sequence of operations in solving multi-step problems.

These models are applied in a simplified form appropriate to students' age characteristics.

“Using logical reasoning models (LRM) in primary education helps to organize the learning process effectively, develop students' logical thinking abilities, and ensure conscious acquisition of knowledge. This process is carried out on the basis of consistent and systematic methodological stages.”

### 1. Motivation stage.

The primary objective of the motivation stage is to arouse students' interest in the topic and direct them toward active thinking. At this stage, the teacher employs problem-based questions, real-life situations, and engaging examples and tasks.

During the application of logical reasoning models (LMM), students are asked questions such as Why?, How?, and What will happen if...?, which enhances their capacity for logical reasoning. This stage serves as psychological preparation for subsequent learning activities.

### 2. Explanation stage.

During the explanation stage, the new topic or concept is presented systematically and in an accessible manner based on logical reasoning models. The teacher does not merely provide ready-made information but guides students to draw conclusions independently through question-and-answer sessions, analysis, and comparison.

At this stage, models of analysis and synthesis, comparison, and generalization are actively employed. As a result, students acquire new knowledge consciously and learn to substantiate it through logical reasoning.

3. Practical activity stage. The practical activity stage is considered one of the most important stages in the use of Logical Reasoning Models (LRM). At this stage, students apply the knowledge they have acquired through exercises and problem-solving activities.

During the process of solving problems, students analyze the conditions, determine the required quantity, choose appropriate operations, and justify the solution, thereby engaging in logical reasoning. This helps to develop their independent thinking, algorithmic reasoning, and cause-and-effect analytical skills.

4. Consolidation stage. In the consolidation stage, the acquired knowledge, skills, and competencies are further strengthened. Various levels of independent tasks, logical exercises, test questions, and creative assignments are provided.

Tasks designed on the basis of LRM enable students not only to memorize knowledge but also to analyze and generalize information. As a result, students develop the ability to apply knowledge independently in practical situations.

5. Reflection Stage. The reflection stage enables students to evaluate their own activities, draw conclusions regarding the acquired knowledge, and express their opinions freely. During this stage, questions such as "What did we learn today?", "Which task was difficult?", and "How did we arrive at the solution?" are of significant importance. The reflection stage fosters the development of critical thinking, self-assessment, and deductive reasoning skills in students, providing a logical conclusion to the educational process.

Pedagogical experience and empirical observations indicate that the systematic and purposeful use of Logical Reasoning Models (LRM) in primary school mathematics lessons significantly enhances the efficiency of the educational process. In such lessons, students are not merely limited to acquiring ready-made knowledge but actively participate in the processes of independent comprehension, analysis, and synthesis of information.

The educational process organized on the basis of Logical Reasoning Models (LRM) increases students' interest and engagement in the lesson. This is because tasks utilizing logical reasoning models encourage students to think, involve them in solving problem-based situations, and ensure the active participation of every student. As a result, students acquire mathematical concepts more profoundly and consciously.

Furthermore, independent thinking skills are cultivated in lessons where LRMs are applied. In the process of problem-solving, students learn logical and critical thinking by selecting appropriate operations, justifying their solution methods, and verifying results. This, in turn, develops students' ability to apply knowledge in novel situations.

The educational process conducted on the basis of Logical Reasoning Models (LRM) also contributes to the development of creative thinking elements in students. Students strive to approach problems through various methods, propose multiple solution variants, and select the most optimal one. This process enhances their creative activity and forms the skill of expressing their opinions freely and with sound justification.

Furthermore, the use of logical reasoning models has a positive impact on the development of students' speech culture. Students learn to explain the solution process, justify their conclusions, and express their thoughts based on a logical chain. This not only develops their mathematical discourse but also increases their general communicative competencies.

In general, the educational process organized on the basis of Logical Reasoning Models (LRM) creates extensive opportunities for the development of primary school students' logical, critical, and creative thinking. It ensures the deep and sustainable acquisition of mathematical knowledge while enabling students to apply it effectively in practical activities.

### Results and Analysis of Experimental Work

Within the framework of the research, experimental work was conducted in primary classes to verify the effectiveness of Logical Reasoning Models (LRM). Class 3-A was selected as the experimental group, while Class 3-B served as the control group.

In the experimental group, mathematics lessons were systematically organized based on LRM (comparison, analysis-synthesis, and algorithmic models). In the control group, lessons were conducted using traditional methods. According to the results of logical tasks administered at the conclusion of the experiment, it was determined that the logical thinking indicators of students in the experimental group were 12-15% higher than those of the control group. In particular, a positive growth was observed in the students' skills of independent problem analysis and justification of solutions.

Conclusion. In summary, the application of Logical Reasoning Models (LRM) in primary school mathematics lessons holds significant pedagogical importance in developing students' logical thinking. Through LRM, students:

develop skills for step-by-step problem analysis and solution discovery;

gain the opportunity to acquire knowledge consciously and apply it in practice;

enhance independent thinking, algorithmic reasoning, and cause-and-effect analysis skills;

master creative thinking and the ability to select from various solution alternatives;

improve their speech culture and skills in providing logical explanations.

Therefore, the systematic and purposeful use of LRM by primary school teachers in mathematics lessons significantly increases the effectiveness of the educational process and ensures that students acquire knowledge firmly and consciously.

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