

DEVELOPING LOGICAL THINKING THROUGH TEACHING ELEMENTS OF COMBINATORICS IN PRIMARY SCHOOL MATHEMATICS LESSONS

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Abstract. Today, one of the most important tasks of the educational process is to develop students' independent and logical thinking skills. This is especially significant in primary school mathematics lessons, as it lays the foundation for successful learning at later stages.

Keywords: combinatorics, mathematics, logic, method, problem, student.

Introduction. The primary goal of teaching mathematics is to form students' abilities to think, analyze, compare, generalize, and draw conclusions. From this perspective, teaching elements of combinatorics plays a vital role in developing logical reasoning skills among learners.

Main Part. 1. The Meaning and Necessity of Teaching Combinatorics Elements

Combinatorics is a branch of mathematics that studies various ways of arranging, selecting, or grouping given elements.

In primary education, elements of combinatorics are taught without using complex formulas but through practical, real-life examples.

For instance:

A student has 2 types of hats and 3 types of shirts. How many different outfit combinations can be made?

$(2 \times 3 = 6)$.

Such problems help students understand quantitative relationships, learn ordering, and enhance logical reasoning.

2. Opportunities for Developing Logical Thinking through Combinatorics

For primary school students, combinatorics lessons are not only exercises in counting but also in logical reasoning. When solving such problems, students learn to search for different solution paths, analyze possible outcomes, and justify their conclusions.

Example:

If three balls (red, blue, yellow) are placed into two boxes, how many possible arrangements exist? Tasks like these require identifying order, counting possibilities, and generalizing results. Through this process, creativity and logical thinking are actively developed.

3. Effective Methods for Teaching Combinatorics in Primary Grades

To teach combinatorics effectively in primary mathematics, the following methods are recommended:

1. Visual Method:

2. Using colored shapes, flashcards, or real objects to complete practical exercises. Game-Based Method:

3. Engaging students in didactic games such as “*Guess It*” or “*What Are the Possible Options?*” to promote active thinking.

4. Question-Answer Technique: Asking guiding questions like “*If there were two shirts instead of one, would the result change?*” to encourage exploration.

5. Work with Tables and Schemes: Systematically listing options, comparing them, and making general conclusions.

4. The Role of Practical Exercises

Conducting combinatorial activities using various objects, colored figures, toys, or everyday materials captures students’ attention and helps them understand concepts practically.

Such exercises teach students not only to calculate but also to analyze options, recognize order, and make logical conclusions.

Examples of classroom activities:

1. Creating Combinations from Objects Students are shown pictures of 2 fruits (apple, banana) and 2 juices (orange, cherry). *Question:* How many different pairs can be formed? *Answer:* $2 \times 2 = 4$ pairs (apple–orange, apple–cherry, banana–orange, banana–cherry). This helps students understand cause-and-effect relationships.

2. Working with Colored Shapes The teacher asks students to place 3 colored circles (red, blue, green) into 2 boxes. Students list all possible combinations — developing imagination and analytical thinking.

3. Clothing Combination Task

A student has 3 shirts (red, yellow, blue) and 2 pants (black, white). *Question:* How many outfit combinations are possible? *Answer:* $3 \times 2 = 6$ combinations. This task connects mathematics to real-life contexts.

4. Game-Based Exercises

“*Which Path Is Shorter?*” — students find different routes from point A to point B, with each route representing a possible variant. “*I Choose*” — students select from various objects on the table (e.g., 3 pens and 2 notebooks) and count all possible combinations.

5. Use of Charts and Diagrams Students represent combinations using tables, diagrams, or tree schemes, which fosters visual thinking and logical sequencing.

Gradually increasing the complexity of combinatorial tasks creates a developmental learning environment suited to students' cognitive levels. Lessons begin with simple, concrete examples and progress to more abstract problems.

As a result, students develop mental agility, memory, observation, creativity, and analytical skills. Such combinatorial activities make mathematics lessons more engaging, interactive, and effective.

Conclusion

Teaching elements of combinatorics in primary school mathematics lessons not only builds computational skills but also actively develops students' reasoning, observation, and logical thinking abilities.

Combinatorics teaches students to search for multiple solution paths, analyze various options, and justify their ideas. Such exercises cultivate “*thinking about thinking*” — the habit of managing, analyzing, and reasoning through one's own thought process.

When working on combinatorial problems, the student deals not only with numbers but also with patterns, order, and logical connections. They do not simply find an answer — they seek to understand *why* and *how*. Consequently, students acquire analytical thinking, independent decision-making, generalization, and creative problem-solving skills.

The teacher plays a guiding and inspiring role in this process. Each lesson should include small combinatorial exercises, games, experiments, and visual tools to stimulate active thinking and sustain students' natural curiosity.

Through such an approach, mathematics lessons become not merely computational sessions but platforms for developing reasoning, creativity, and independence. By learning elements of combinatorics, students acquire not only mathematical understanding but also practical problem-solving skills applicable to daily life.

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