

METHODOLOGY OF TEACHING COMBINATORICS PROBLEMS IN PRIMARY GRADES

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Abstract:

This article discusses the methodological foundations of teaching combinatorial problems to primary school students, the importance of such problems in developing students' logical, creative and mathematical thinking. The possibilities of using combinatorial problems in the process of primary education to form students' skills in combining objects and phenomena in various ways, systematically identifying options, comparing, generalizing and drawing independent conclusions are analyzed. Methodological recommendations are also given on gradually complicating combinatorial problems, starting from simple practical tasks, using tables, schemes, tree diagrams and modeling methods.

Keywords: Combinatorics, combinatorial problems, primary education, mathematics lesson, logical thinking, mathematical thinking, problem solving, modeling, tables, schemes, tree diagrams.

Introduction

One of the important tasks facing primary education today is not only to provide students with ready-made mathematical knowledge, but also to teach them to think independently, analyze problems, search for different solutions and justify their conclusions. From this point of view, the use of tasks with logical and combinatorial content in mathematics lessons is of particular importance.

Combinatorics is a branch of mathematics that studies methods for selecting, arranging and combining various objects based on certain conditions. It is not required to give complex theoretical concepts of combinatorics to primary school students in full. However, the formation of elements of combinatorial thinking through simple problems is an effective tool for developing students' mathematical thinking.

In primary school, combinatorial problems are often formulated based on situations close to everyday life. For example, tasks such as identifying different outfit options from several items of clothing, creating different pairs using colored pencils, creating different numbers

from given numbers, and choosing different dishes from a menu allow students to naturally understand combinatorial relationships.

The importance of combinatorial problems in primary education

The main feature of combinatorial problems is that their solution is often not limited to performing a single action. The student must identify the available possibilities, organize them, and make sure that all options have been considered.

Such problems develop the following skills in students:

- logical thinking;
- independent decision-making;
- systematization of options;
- comparison and grouping;
- observation and analysis;
- generalization;
- mathematical modeling;
- search for several solutions to the problem;
- mathematically justify their opinion.

Combinatorial problems encourage the student to ask questions such as “what other options are there?”, “have I found all the options?”, “have I repeated the same option?”, etc.

Types of combinatorial problems in primary grades

In primary grades, problems with combinatorial content can be conditionally divided into several groups.

1. Problems of determining pairs and combinations

For example:

Problem. Ali has 3 shirts and 2 pants. In how many different ways can he choose a shirt and pants?

The student can determine all the possibilities using a table or picture:

- 1-pants 2-pants
- 1-shirt 1-option 2-option
- 2-shirt 3-option 4-option
- 3-shirt 5-option 6-option

So, there are a total of 6 different options.

Through this problem, the student practically understands that each element in one group can be combined with each element in the second group.

2. Simple problems on permutation

For example:

Problem. Anvar, Dilshod and Madina are participating in a competition. In how many different orders can they be placed in three places?

Students create the following arrangements by enumerating the options:

- Anvar – Dilshod – Madina;

- Anvar – Madina – Dilshod;
- Dilshod – Anvar – Madina;
- Dilshod – Madina – Anvar;
- Madina – Anvar – Dilshod;
- Madina – Dilshod – Anvar.

There are 6 arrangements in total.

In the primary school, it is appropriate to explain this problem without using formulas, through practical counting and schematization.

3. Constructing numbers from given numbers

For example:

Problem. How many three-digit numbers can be formed using the numbers 1, 2, and 3 without repeating the digits?

Students write out the numbers in order:

123, 132, 213, 231, 312, 321.

Thus, 6 three-digit numbers are formed.

Such problems not only strengthen combinatorial thinking, but also knowledge of number structure and premises.

4. Selection problems

For example:

Problem. There are 4 different fruits: apples, pears, bananas, and oranges. How many ways are there to choose two of them?

Students identify all possible pairs:

- apples and pears;
- apples and bananas;
- apples and oranges;
- pears and bananas;
- pears and oranges;
- bananas and oranges.

There are 6 selection methods in total.

Stages of teaching combinatorial problems

It is important to adhere to the principle of consistency and gradualness when teaching combinatorial problems in primary grades.

The first stage is practical work with objects

First, students are given tasks using real objects. For example, pencils of different colors, geometric shapes, cards or pictures are used.

The student combines objects and practically determines their possibilities.

The second stage is drawing and modeling

At the next stage, instead of real objects, their drawings or conditional symbols are used.

This ensures that the student moves to abstract thinking.

For example, the task can be given to arrange red, blue and green balls in different orders.

The third stage is the use of tables and diagrams

As the number of options increases, it becomes difficult to simply list all the possibilities. Therefore, students are taught to make tables, draw diagrams and write down the options in order.

The fourth stage - using a tree diagram

A tree diagram is an effective tool for explaining combinatorial problems. In it, each choice is connected to the next choices.

For example, if there are 2 hats and 3 types of clothing, three options branch from each hat. This allows the student to visually see the total number of options.

Effective methods for teaching how to solve combinatorial problems

The “Counting Options” method

This is one of the simplest and most convenient methods for the initial stage. The student identifies all the options one by one.

The important point is not to repeat the options and not to leave any of them out.

The “Table” method

Using a table, you can combine elements of two or more groups. This method is especially effective in problems related to clothes, food, vehicles and other everyday life.

The “Scheme” method

The information in the problem statement is depicted using conditional symbols. This allows the student to better see the connections in the problem.

“Tree” method

As the number of options increases, it is advisable to use a tree-shaped diagram. Each branch represents a new opportunity.

“Problem situation” method

Instead of giving the student a ready-made algorithm, a problematic question is posed:

“How can I find all the options quickly and without errors?”

The students offer their own methods. Then, the teacher compares their methods and identifies the most convenient and systematic method.

Using didactic games

Didactic games increase the interest of students in teaching combinatorial problems.

For example, in the “How many methods?” game, students are given 3 different colored pencils and 2 different colored notebooks, and it is determined in how many different pairs they can be chosen.

In the “Number guessing” game, students are given cards with several numbers on them. They compose different numbers based on the given condition.

In the “Who can find them the fastest?” game, groups are given the same combinatorial task. The group that correctly and systematically identifies all the options wins.

Through such games, students not only develop their mathematical knowledge, but also their skills in working together, exchanging ideas, and defending their solutions.

Teacher's methodological approach

When teaching combinatorics, the teacher must adhere to the following methodological requirements:

1. Select problems appropriate to the age and level of knowledge of the students.
2. Initially use practical and real-life situations.
3. Organize problems from simple to complex.
4. Teach how to systematically identify each option.
5. Use tables, pictures, schemes and diagrams.
6. Direct the student to understand the essence of the problem, not to memorize a ready-made formula.
7. Allow the student to solve a problem in different ways.
8. Create conditions for independent thinking of students.
9. Analyze the causes of errors, not just correct them.
10. Pay attention to students' explanations and justifications of their solutions.

Complicating combinatorics problems

Problems should be gradually complicated. For example, if initially the task is to create options from 2 subjects, then 3-4 subjects can be used later.

Also, the tasks can be complicated by adding the following conditions:

- allowing or not to repeat subjects;
- mandatory participation of a certain subject;
- arranging subjects in a certain order;
- prohibiting certain options;
- separating options that meet the given condition.

For example:

“How many two-digit numbers can be formed using the numbers 1, 2, 3, 4?”

After the question:

“How many two-digit numbers can be formed using the numbers 1, 2, 3, 4?”

, additional conditions can be given such as:

“Do not repeat the numbers”,

“Make even numbers”,

“Let the number 2 participate”

This method expands the scope of students' thinking and teaches them to deeply analyze the condition of the problem.

Conclusion

Teaching combinatorial problems in primary grades expands the developmental possibilities of mathematics education. Such problems, while strengthening students' mathematical knowledge, serve to develop their logical and creative thinking.

In teaching combinatorial problems, starting with the use of real objects, gradually moving to pictures, tables, schemes and tree diagrams, gives effective results. It is important to

form the skills of students to systematically enumerate options, avoid repetitions, cover all possibilities and justify their own solutions.

Also, the use of didactic games, problem situations and group work increases interest in tasks with a combinatorial content. Most importantly, combinatorial problems in primary education should be considered not as a means of teaching complex mathematical formulas, but as an effective methodological tool that teaches students to search, think, see options and draw independent conclusions.

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