TEACHING STUDENTS IN ELEMENTARY MATHEMATICS TO SOLVE COMPLEX PROBLEMS

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Abstract. *Teaching problem solving, conducting preparatory work, simple problems, determining series connections between numbers, solving simple problems that are part of a complex problem, analyzing and solving the problem.*

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Introduction

Teaching children to solve problems means learning to identify the relationship between given and sought numbers and to choose and perform arithmetic operations based on this.

The teacher should take into account the steps aimed at certain goals in the methodology of teaching students to solve problems. At the first stage, the teacher prepares to solve the problems of the type under consideration.

In the second stage, the teacher introduces the students to the solution of the problems of the considered type. In the third stage, the teacher develops the ability to solve problems of the considered type.

Research materials and methodology

A complex problem in an elementary mathematics course consists of several simple problems, in which the simple problems are interconnected in such a way that the numbers sought for the same ones are the given numbers for the others. The solution of a complex problem is divided into different simple problems and solved gradually. Thus, in order to solve a complex problem, it is necessary to determine the series of connections between the given numbers and the desired number, to select arithmetic operations according to them, and then to perform these operations.

As an example, let's look at the following issue: "8 girls were on duty at the school, and there were 2 more boys. How many children were on duty at the school?"

This problem involves two simple issues:

1) 8 girls were on duty at the school. The boys were two more than them. How many boys were on duty?

2) 8 girls and 10 boys were on duty at the school. How many children were on duty at the school in total?

We can see that the desired number (number of boys) in the first problem is the given number (10 boys) in the second problem. Solving these problems in sequence is the solution of a complex problem:

1) 8+2=10; 2) 8+10=18.

Solving a complex problem has this important innovation compared to solving a simple problem: instead of a single connection, several connections are defined, and arithmetic operations are chosen accordingly. For this reason, a special work is carried out to introduce children to complex problems and to develop the ability to solve complex problems.

Research results

Introducing a complex problem and solving it formation of skills

The preparatory work for introduction to complex problems should help students to determine this main difference between a complex problem and a simple problem: complex problems cannot be solved at once, that is, with one operation, it is necessary to determine the appropriate connections between the numbers given for solving and the sought number, and divide them into simple problems. For this purpose, special exercises are provided:

1) Solving simple problems with insufficient numbers, for example:

a) The company had trucks and 4 cars. How many trucks and cars did the company have in total?

b) Boys and girls went on an excursion. How many children went on the excursion in total?

After reading such problems, he asks whether it is possible to know how many cars the company has in total (how many children went on an excursion) or why it is not possible (it is unknown how many trucks there are or how many boys and how many girls there are). Then the children choose numbers and solve the problem.

By performing these exercises, students will be convinced that it is not always possible to immediately answer the question of the problem, because there may be a lack of numerical data, in which case they are obtained, in this case, numbers are selected, and when solving complex problems, they are selected by performing the appropriate action.

2) Solving a pair of simple problems in which the number formed in the answer to the question of the first problem is one of the numbers given in the second problem, for example:

a) The girl had 3 more rabbits, and the boy had two more. How many rabbits did the boy have?

b) The girl had 3 rabbits and the boy had 5. How many rabbits did they have together?

The teacher says that two such problems can be replaced by the following one: "The girl had 3 more rabbits and the boy had 2 more. How many rabbits did they have together?'

Later, the children themselves replace such a pair of problems with a single problem.

3) Questioning the given condition.

I will tell you the condition of the problem, - says the teacher, you think and say what kind of question you can ask: "The students made 10 green and 8 light colored flags to decorate the school" (How many flags did the students make in total?)

4) Developing the ability to solve simple problems that are part of a complex problem. It should be kept in mind that children are able to solve simple problems that are part of a complex problem. Therefore, before entering certain structural problems, it is necessary to form the ability to solve simple problems.

Two to three lessons are allocated in the 1st grade for a special introduction to the complex problem, in which the main attention is focused on determining the connection between the given numbers and the desired number, drawing up a solution plan and writing the solution.

First, it is better to introduce problems in which two different arithmetic operations are performed: addition and subtraction. In this case, the content of the issues should allow them to be illustrated.

Discussions. The question arises: which mathematical structural problem should be introduced first? There are two opinions about this:

1) Start by solving two practical problems involving simple sum and remainder problems, for example: "Mother picked 5 apples from one apple tree and 3 apples from another; He gave 6 apples to his children. How many apples does mother have left?' After that, other structural issues should be introduced.

2) Start by solving simple two-step problems involving subtracting a number by a few units and finding the sum, for example: "There are 7 candies in one vase, and 4 candies in the other. How many candies are there in two vases?' Later, you can look at the solution of another mathematically structured problem.

The first of the considered problems clearly differs from the simple problem - there are three numbers in its condition, that is, both simple problems are distinguished here. This should help children to quickly understand this important symptom of a complex problem - that it cannot be solved by one action. Here, the content of the issue helps to identify the links correctly. In this case, it is easier for children to formulate an expression on the issue.

The condition of the second of the given problems is two numbers, which makes it look like a simple problem, so students tend to solve such problems in one step. Moreover, the problem of reducing the number involved in this complex problem by several units is more difficult than the problem of finding the remainder involved in the first complex problem.

We see that solving such issues is associated with a number of difficulties. For this reason, it is good to start with solving complex problems involving three numbers, as experience has shown. Here's how to do it.

The teacher reads the problem: "The mother picked 5 apples from one apple tree and 3 apples from the other; He gave 6 apples to his children. How many apples does mother have left?'

What is known about apples? (The mother plucked 5 apples from one apple tree and 3 apples from the other). We will write it down briefly. What else is known? (The mother gave her children 6 apples).

We write.

What do you need to know? (How many apples does mother have left).

We write. The following entry is generated:

Picked - 5 apples and 3 apples.

Berdy - 6 apples.

Left - ?

Explain what each number represents in this entry. (They explain.) Say the problem question. (How many apples does mother have left?)

The illustration is done as follows: the girl on the board takes 5 apples cut out of cardboard from the first row and puts them in a basket, takes 3 apples from the second row and puts them in the same basket; then he takes 6 apples in the basket and gives them to the children. The remaining apples are uncountable.

Is it possible to immediately know how many apples the mother has left? (No.) Why? (It is not known how many apples the mother picked in total) Can it be known at once how many apples the mother picked in total? (It is possible to know.) How? (We add 3 to 5.) We write the sum, but do not count. (Inscription: 5+3.) What does this sum mean? What do we know after calculating?

(How many apples did the mother pick in total.) How many apples did the mother give to her children? (6.) Is it possible to find out how many apples the mother has left? (It is possible.) How? (6 is subtracted from the sum.) The expression is written on the board and in notebooks.
When analyzing a problem, it is natural that there will be outliers if students answer incorrectly. For example, students often calculate one of the actions by heart without thinking that they have performed it, and when writing the solution, they use the obtained result. In this case, the analysis can be carried out as follows:
Is it possible to immediately know how many apples the mother has left? (Possibly.) How? (Subtracting 6 from 8.) Where did the number 8 come from, wasn't it in the problem? (I added 3 to 5.) So you didn't find it all at once, but you found out first, what did you find out first? Etc.

Then, in this and the following lessons, similar problems are solved, in which children should work more independently.

After 2-3 lessons, you can introduce complex problems, one of which is about reducing a number by a few units, and the other is about finding the sum, and the condition is 2 numbers, for example: "Shahrukh had 10 books, and Bakhtiyar had 3 more books. How many books did Shahrukh and Bakhtiyar have together?". Work on this type of issues is carried out in a plan similar to the previously considered issues.

During the introduction of complex problems, children should be able to distinguish between complex and simple problems. For this purpose, it is necessary to mix complex problems with simple problems, in which case it is necessary to clarify why one of the problems is solved by one action and the other by two actions. It is also helpful to offer creative exercises. These are primarily the replacement of simple problems with complex problems and vice versa.
For example, the children solved the following problem: "Students have 10 days less rest during the winter vacation, and 2 days less during the spring vacation. How many days do students have during spring break?" The teacher offers to change the problem question so that the problem can be solved with two actions. (How many days off do students have during winter and spring break?)

At the same time, it is necessary to introduce exercises similar to a problem to be solved together with a ready-made problem.

Then, complex problems related to the material studied in classes I, II and III are solved. For example, in class I, addition and subtraction operations are studied, and complex problems solved by these operations are introduced accordingly; In class II, the operations of multiplication and division are studied, accordingly, complex problems solved by these operations are introduced, while studying the properties of arithmetic operations, solving problems in different ways is considered.

As students learn, the problems become more difficult. Difficulty can be either by introducing new connections, that is, by introducing new types of simple problems, or by increasing the number of operations to be performed. However, the problems don't have to be very difficult and multi-tasking. There are certain limitations: in class I, more two-action problems are solved, in class II, two-three-action problems, and in class III, two-four-action problems are solved.

In relation to problem solving, it is important to teach children general methods of problem solving.

This means teaching children to independently analyze a problem, identify relevant connections, use images, plan a solution to the problem, solve it, and check the correctness of the solution.

Conclusion

In school work experience, the following method of problem-solving skills formation has proven itself. Students receive instruction in the form of exercises on how to solve a problem. Tasks are written on cards and distributed to students. When solving a problem, children always complete the task indicated on the cards in a strictly defined order, and acquire the skill of working on the problem as required by the tasks, that is, they form a general method of working on the problem.

Here is one variant of such assignments:

1. Read the issue and try to imagine what it says.
2. Briefly write or draw the problem.
3. Explain what each number represents and state the problem question.
4. Think about what number will be formed in the answer: more or less than the given numbers?
5. Think about whether it is possible to answer the question immediately, if not, say why. Make a plan to solve the problem.
6. Complete the solution.
7. Check the solution and answer the problem question.
8. Could there be more or less number than the found number in the answer? Think about it. Under what conditions can this be?

In order for working with cards to really help students acquire the ability to solve problems independently, certain steps should be taken into account.

At the first stage, children must learn the meaning of each task and learn to complete them. For example, they need to understand what is "Imagining what the issue is talking about", what is "making a solution plan", etc. They also need to know what is being discussed in the issue, how to make a solution plan, etc.

The stage of acquiring these skills takes place in the 1st grade, when the teacher tells and teaches to complete the task every time while solving the problem.

In the second stage (class II, at the beginning of the academic year), students get acquainted with the system of tasks and learn to use them in solving problems.

Students receive cards with tasks written on them. When working on each problem, approximately 6-10 lessons, each task is read aloud by one of the children, and reflection on their completion is also conducted aloud.

At the third stage, students should master the system of assignments and be able to use them independently to solve problems. For this purpose, in the next 10-15 lessons, students will continue to use assignment cards, but they will read the assignment inwardly, and they will pass the reasoning out loud. As a result of such work, students involuntarily master the assignment system.

In the fourth stage, students learn how to work on the problem according to the assignments. At this stage, children do not need cards, because the system of all tasks has been mastered by them in such a way that students can think quickly on their own based on it. This indicates that the student has developed a method of working on the problem.

Later, students will use this method both when working on a new type of problem and when generalizing the methods of solving problems with a familiar mathematical structure.

When formulating the general method of working on the problem, the teacher should take into account that not all children will be able to master this method at the same time: if it is enough for some children to work with cards for a month, for some children it will take 2-3 months. Therefore, it is not necessary to prevent children who have not yet mastered this general method from using cards. However, these tasks don't need to be memorized specifically - they should be learned by doing them many times.

When working on a particular type of problem, it is necessary to look at the use of tasks in a comprehensive way: at the stage of introducing a new type of problem, all tasks are performed more often, it is not required to do this at the stage of generalization of the solution method, otherwise it will become a single goal and lead to the slowing down of the generalization of the solution method.

At this stage, when the ability to solve a certain type of problem is formed, students should complete the tasks in order until they find a solution. If, after reading the problem, the student knows how to solve the problem, let him solve it, if he doesn't, let him complete the next task, i.e. "call his next assistant": write down the problem briefly and try to solve it, etc. If not too much, that is, if the student does not solve the problem after completing all the tasks, then the teacher himself will help.

Experience shows that when using task cards, problem-solving skills are formed more fully and much faster. In addition, problem-solving skills are acquired not only by students with strong and medium knowledge, but also by students with looser knowledge.

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