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METHODOLOGY OF DEVELOPING MATHEMATICAL COMPETENCE BY SOLVING TEXTUAL PROBLEMS

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Abstract

Solving textual problems creates favorable conditions for the development of students' thinking abilities, a deep understanding of the ideas of functional connection, the development of mathematical competence, and the growth of computing culture. As a result of solving such problems, students develop and develop the ability to model real objects and events.

There are two main ways to solve word problems in a math course: arithmetic and algebraic. The arithmetic method is determined by directly creating a numerical expression (numerical formula) of the required number of values and calculating the result. The algebraic method is based on the use of solving equations and their systems.

Solving problems by creating equations is one of the main problems of the algebra course. Students easily master the technique of solving first-order equations with one unknown, but experience shows that students find it difficult to solve problems, including solving problems by forming equations. The main reason for this is as follows:

According to the program, students should solve equations starting from the 5th grade. However, compared to school practice, students produce fewer word problems even when they give examples of equations, and some teachers even do not pay enough attention to solving word problems.

The experience of advanced teachers shows that the creation of equations for solving problems is divided into the following stages:

1. Analysis of the conditions of the issue.
2. Identifying unknowns, finding connections between known and unknown.
3. Create an equation.
4. Solving the equation.
5. Study and check the solutions of the equation.
6. Checking the compatibility of solutions with the conditions of the problem.
7. Writing the answer to the problem.

In order to solve the problem, it is necessary to teach each of the stages of the process of creating an equation, to carry out various trainings for students.

Now let's look at the steps of creating an equation to solve the problem.

1. Analysis of the conditions of the issue. Before creating an equation, students need to be taught the problem, that is, they should learn the basic conditions of the problem - what is unknown, what is known, and they should be able to analyze the relationship between them, to be able to say.

It is impossible to solve the problem without fully understanding and imagining the conditions of the problem.

2. Most of the students do not fully understand the information presented in the condition of the problem, they cannot present it, they do not see the connection between the known and the unknown. Such students' knowledge of problem solving is superficial and formal. Therefore, the teacher's task is to do a lot of exercises with students at this level, work on the principle of going from easy to difficult problems. Students must answer the first question as follows: they must know a certain quantity and its value.

It is necessary for them to determine which of the unknown quantities should be marked with the letter x, and to express the other unknown quantities with known values in the condition of the problem. One of the following three cases occurs when specifying an unknown value with a letter, that is, specifying which value should be treated as an unknown value.

a) the amount sought by the terms of the issue (the amount sought in the issue) is taken for an unknown amount;

b) one of the several unknown values (one of the questions of the problem) sought by the conditions of the problem is taken as an unknown quantity;

b) another value that is not in the problem is obtained for an unknown value.

Task 1. "14 days were planned to plow a certain hectare of land. The tractor plowed 20 hectares more than the daily plan, so he completed the work in ten days. How many hectares of land did the tractor have to plow in the daily plan, and how many hectares of land did he plow per day?"

Students should read the condition of the problem and explain the problem according to its content:

1. What conditions are mentioned in the problem?
2. Which of these values will change and which will not?
3. Which quantities are known and which quantities are unknown in the problem?

The following information is known to us: implementation of the approved plan in 14 days, the actual time is 10 days, 20 hectares is the difference between the actual daily rate and the planned daily rate. Students find it difficult to answer immediately. Therefore, it is necessary to create an equation suitable for the condition of the problem. They consist of:

1. Repeat the terms of the problem.
2. Name two quantities and determine which method can be used to find the value of one of them, using the condition of the problem for this.

From the condition of this problem, the total land area is unknown, we denote it by x. The field had to be plowed in 14 days, then per day $\frac{x}{14}$ the land had to be plowed according to the plan. In practice, per day $\frac{x}{10}$ the land was plowed. According to the conditions, it is 20 hectares more.

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Therefore, the following equation is formed:

$$\frac{x}{14} + 20 = \frac{x}{10}.$$

To solve the resulting equation, using the fact that the common denominator of 14 and 10 is 70

$$5x + 20 = 7x$$

we create a simple equation and solve it, we find that the land area is x=700, according to the plan, 700:14=50 hectares per day, and in practice 700:10=70 hectares of land were plowed.

3. We make sure that the found ones satisfy the condition of the issue.

Task 2. "The ship sailed upstream for 4 hours and against the current for 5 hours between two piers. The speed of the river current is 2 km per hour. Find the distance between the two piers.

To help students master the second step of solving and constructing an equation that satisfies the condition of the problem, it is recommended to do the following exercises first.

It is known that the unknown quantity for solving the problem is the speed of the ship, and if we denote it by x, since the speed of the ship is added to its speed when it moves upstream, we get it as x+2, and against the current as x-2, and from the condition of the problem using

$$5(x-2) = 4(x+2)$$

we form the equation Take it off

$$5(x-2) = 4(x+2)$$
$$5x - 10 = 4x + 8$$
$$5x - 4x = 10 + 8$$
$$x = 18$$

, that is, we found that the speed of the ship is 18 km/s. Now we find the distance between the two piers: 5(18-2)=80 (km). We check that the obtained result satisfies the condition of the problem:

Ship on the stream $\frac{80}{18+2} = \frac{80}{20} = 4$ clockwise and against the current $\frac{80}{18-2} = \frac{80}{16} = 5$ the clock ticked. This is according to the condition of the matter. So, the issue was resolved correctly.

Answer: 80 km.

The following exercises are also very useful.

a) There are x students in one school, and the number of students in the second school is 4 more than the number of students in the first school. how to find how many students there are in a school? What happens if the number of students in the second school is equal to the number of students in the first school? What should be the difference between the answers to these two questions?

b) The price of an hour equal to x was reduced by 20%. How much does the watch cost?

c) the community received x kg of wheat from one plot of land. The following year, after the implementation of agrotechnical measures, wheat production increased by 30%. How many tons of wheat did the team harvest the following year?
d) The employee completed the assigned work within 12 hours. How much work did he do in one hour? What about at 8 o'clock?
e) If the cart wheel turns 5 times in x meters, what is the length of the circle? What happens if the wheel spins 18 times?
i) There are x people in the city. If the population of the city increases by 10% every year, how many people should there be in the city in one year?
The contents of the exercises are written on a short board. Such exercises do not take much time in the classroom. Therefore, it can be easily understood by the teacher and can be implemented anywhere, depending on the order of the lesson. At the same time, it should be noted that experienced teachers integrate not only the current topic, but also future topics and even topics for future lessons, such as preparing for a lesson, explaining a new topic or giving a problem. It prepares students to master the topics quickly. The following situation is observed in the work experience at school and in various educational manuals. Currently, teachers use the shorthand method of the problem condition for text problems (in short: identifying unknown quantities, known quantities, and the relationship between them). Of course, it is not a matter of which form of writing to use, but it is important that students (no matter how they write) understand correct and high-quality writing. We explain the problem condition and solution to each student by writing, and leave it up to the students to choose which type of writing to choose at this stage.
Task 3. "A group of students boarded a boat and went down the river to return after 4 hours. The speed of the river flow is 2 km per hour, the speed of the boat in still water is 8 km per hour. If the students stayed at the beach for two hours before returning, how far did they swim?
The issue of traffic. It tells about the path, time and speed of the boat. The speed of the boat is 10 km/h upstream, 6 km/h against the river, and the time changes and the distance does not change when swimming against the current. According to the problem, the direction and time of the boat are unknown, its speed is known.
We solve this problem using three unknown quantity expressions:
Method 1.
1) The boat sailed a total of x km in the river.
2) time to swim downstream in the river $\frac{x}{10}$ hour
3) time to swim against the river current $\frac{x}{6}$ hour
2 students rested by the river, only 2 hours were allotted for the journey:

$$\frac{x}{10}+\frac{x}{6}=2.$$

Method 2. Based on the condition of the problem, we make this table

	the way (km)	speed	time (per hour)
While swimming down the river	x	10	$\frac{x}{10}$
when swimming against the current of the river	x	6	$\frac{x}{6}$

After making the schedule, we pay attention to the following: Since the trip lasts only 2 hours:

$$\frac{x}{10}+\frac{x}{6}=2.$$

Usually, tabulating the problem statement is rarely used, and tabular writing is useful in the early stages of teaching problem solving.

According to our years of experience, the more such exercises are done, the faster students learn and understand how to solve equations. The knowledge of such students is thorough and high-quality, and their mathematical competence increases.

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