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Article

Optimization of mathematics lessons in elementary grades through problem solving

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Abstract

Educational process in terms of the paradigms created by the level of development of science and technology, which are among the leading trends in the globalized world. One of these tasks is the optimization of lessons to improve the educational process. The organization of the student's learning work in each lesson at the correct level , at the level of modern requirements. It should be borne in mind that since it is unrealistic to achieve the optimization of training in just one lesson , it is possible to achieve this optimization by effectively building a system of all lessons. On the other hand , optimizing the training process requires revealing internal, hidden opportunities that give impetus to increasing the effectiveness of training . From all of this, we can conclude that the main goal of optimization in teaching is to expand the didactic and educational opportunities of the lesson and to make the most of these opportunities. That is, the optimization of teaching is measured not only by the learning success of students, but also by their level of education. Problem solving plays an important role in optimizing mathematics education in primary schools . Because it is through problem solving that the content of this course is fully revealed and understood by students . For these reasons, it is important to deeply analyze the general issues of problem teaching in primary schools.

Keywords: mathematics lessons, elementary educational grades, optimization of education

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General provisions of optimization and problem solving training in training

It should be noted that the problem of optimizing teaching has been studied by prominent educators from various perspectives. However, the latest and most comprehensive research work in this area is Academician Yu. Babansky's «Optimization *of process* The series " *education* " can be shown. Enough thoughts were expressed about this in the introduction [48 , p.32] .

According to educators Prof. A.Agayev, N.Kazimov, F.Rustamov, Prof. F.Sadigov, Prof. A.Abbasov and the great Russian educator YM Kolyagin, optimization of the learning process means determining the optimal option for conducting learning at a pace in accordance with certain criteria [8; 86].

According to great educators and methodologists, optimization of the learning process can also be expressed as the degree of compliance of the lesson organization with modern requirements to achieve the set goal.

Clear from the above ideas, the optimization of the training process implies the maximum effective implementation of the goals and objectives set for training . All this requires the optimization of training. In this regard, we can list the following tasks facing the training process:

- Creating optimal conditions for teaching.
- Systematic monitoring of the training process.
- Creating optimal conditions for the use of training tools.
- Development of forms and methods of independent work.
- Enhancing the culture of teaching and learning.

It should be borne in mind that in optimizing training, the focus should be on optimizing the teaching and learning process on scientific grounds and the nature of the student's learning activity and its specific features should be taken into account. Optimizing training requires the creation of the most favorable relationship between the teacher and the student, both in the teaching and learning process, since this relationship becomes the main factor that ensures the maximum success of the interaction between the teacher and the student.

One of the important ways to optimize the learning process is to use learning tools. Because the optimal use of learning tools, first of all, saves the teacher from the difficulties associated with the lack of time, stimulates the implementation of the learning process in a more intensive form. This is also important in terms of minimizing the gap between the goal set for the learning process and its result.

Based on all of this, we can recommend the following requirements in order to create optimal conditions in the lesson for the student to effectively master the learning material during the teaching process:

In each lesson, students should be able to work independently and acquire knowledge independently.

Every student must have a deep understanding of the purpose and function of the learning materials.

Students need to understand their mistakes, know the reasons why they occur, and know how to overcome them.

However, it should not be forgotten that in order to optimize training, special attention should be paid to two issues in the teaching process. These issues include the following:

ASAdygozalov, S.Khamidov, G. V. Beltyukova , M. A. Bantova and other methodologists, when talking about the general issues of problem -solving training , have considered the following [4, 74]:

1. The educational and educational importance of problem solving.

2. The problem of calculation and its components.

3. Classification of calculation problems.

4. Stages of problem solving.

a) Preparatory work for resolving the issue,

b) Introducing students to problem solving,

c) Analysis of the issue,

d) Resolution of the issue,

e) Verification of the problem solution.

5. Formulation of the problem.

Since sufficient research and analysis has been conducted in Chapter I on the educational and educational importance of problem solving and the effective role it plays in this regard , it would be appropriate to move on to examining other issues here .

The formulation and structure of problems are important in terms of teaching problem solving. In general, elementary school problems can be divided into three components according to their structure:

The numerical values of quantities are called givens or knowns.

Verbal expression of the relationship between the known and the sought is called the condition of the matter .

The question of the problem or the value of the quantity required to be found.

For this purpose, we can consider the following problem: «In the competitions, 10 students *played chess, 3 times more than those who* played *football, and 6 times less than those who played football played checkers. How many students participated* in *the competitions in total?"*

In this problem , the expressions *"10 chess players - given "* , " *3 times more"* , " *6 times less "* are the conditions of the problem , and " How *many students participated in the competitions in total ?"* is the question of the problem , that is, the one being sought.

Consider the main requirements given to the issue:

It should not be forgotten that the data in the problem should be prepared in accordance with the mathematical preparation level of the students. Also, one of the important conditions is that the data in the content of the problem should be realistic and true.

The dependencies between quantities should be given clearly, clearly, and in a way that students can understand. The number of conditions in the problem should correspond to the number of given and sought. The question of the problem should be stated clearly, clearly, and briefly, and should be derived from its content.

The tools used in solving problems are divided into two types according to their number:

Problems that are solved by performing a single action (this does not mean that the same action is performed twice, three times, etc.) are called simple problems .

Problems that are solved by performing two or more actions are called complex problems.

Now let's give information about the structure of the problem and its types according to the form of its condition.

1. The dependencies between the given and the sought - after are given explicitly by means of action symbols . These are also called formal formulas and equations.

Problems in which the dependencies between quantities are expressed in words. These are also called arithmetic problems or text problems.

"When the numbers in the condition of *the problem and the relations between them and the unknowns are given only in words, such problems are called textual problems"* [122, p. 54].

For example, "First they bought the same 20 notebooks, then 25 of these notebooks, and the money given for the notebooks bought the second time was 20 manats more than the first time. How much money was given for all the notebooks in total? "

Solve these types of problems, it is more convenient to transform the dependence between quantities into an explicit form (i.e., a problem of the first type).

3. Obvious and non-obvious problems. In the elementary mathematics course, it is considered pedagogically important to have students solve such problems in a timely manner.

Problem: 16 manats were given for 4 identical bags. How much does one bag cost? This is considered an obvious problem. As can be seen, the number of given and sought items corresponds to the number of conditions of the problem, and the problem has a solution .

Now let's look at the following problem: "Two different bags are given 7 manats. How much does each bag cost?" Since there is no condition that determines the prices of the bags in this problem, the problem has more than one solution . Therefore , this problem is an intractable problem . The solution process of such problems is the same in all classes. It is possible to consider carrying out. Because the advantage of solving problems of this type is that they lay the foundation for students to find the domain of a function in the future . We should also require students to include the missing conditions in the implicit problem in these problems.

A correspondence or not between the order in which the numbers are arranged in the presented condition of the problem and the sequence of actions in the solution of the problem:

1) If the given problem corresponds to the sequence of its solution, it is called a transformed problem. When looking at the structure of such problems, the progress of their solution is clearly visible.

2) If the numerical data in a problem are not arranged in the order in which they are applied during the solution process, it is called an untransformed problem. The structure of such problems does not indicate the course of the solution.

1) Problem: The width of the classroom is 3 m, the length is 5 m, and the height is 4 m. Since each student needs 3 cubic meters of air, how many students is this hall designed for?

The solution to this problem will be as follows:

$3 \cdot 5 \cdot 4 = 60$ cubic meters.

$60 : 3 = 20$ (people)

2) Problem: A car and a bus started moving towards each other at the same time from two points 300 km apart. They met after 6 hours. Knowing that the speed of the car is 60 km/h, find the speed of the bus.

Although students usually solve inverted problems easily, they encounter certain difficulties in solving non-inverted problems. Therefore, it is usually advisable to use inverted problems when starting to solve complex problems in school practice.

5. Problems are also divided into two groups according to the method of solution. The first of these are problems that have specific solution methods, and these types of problems are often called type (as well as group) problems. In this case, each type of problem has its own specific name.

As for problems that do not have specific solutions, these are called non-type (or non-group) problems.

6. It is recommended to include logical problems in primary grades, especially in the fourth quarter of the third grade and in the fourth grade. Including logical problems plays an important role in the development of mathematical thinking and in the revival of enthusiasm for mathematics. Unfortunately, such problems are rarely addressed in our schools.

7. We should also note that practical issues also play an important role in the teaching of mathematics in terms of their relevance to life. Therefore, we recommend that such issues be included and worked on in elementary grades.

When solving such problems, in addition to calculations, students have the opportunity to work with construction, measurement, tabulation, etc. In addition, thanks to practical problems, students can obtain interesting information from various areas of life.

In the elementary mathematics course, the stages of problem solving are considered one of the main problems of the problem-solving teaching methodology. For this reason, it is necessary to organize the stages of problem solving in such a way that students consciously understand the various dependencies between quantities. To do this, we must first take into account the following general methodological conditions:

1) Reading the question and understanding the text, in other words, understanding the meaning of each word and showing the situation given in the question.

2) Distinguish between the condition and question of the issue, what is sought and what is given.

3) To determine the relationship between the condition of the problem and the question, the sought-after and the given. In other words, to analyze the text of the problem and indicate the selection of the calculation operation necessary for its solution.

4) Write the solution and answer to the problem.

By the way, let's analyze the stages of solving the problem we mentioned at the beginning of the paragraph.

1. The preparatory work for solving the problem is the first stage and consists of the process of teaching students the relationship between what is given and what is sought. For this, it is necessary to use the same tools and didactic materials.

2. Introducing students to problem solving.

This process constitutes the second stage in problem solving. After students have identified the relationship between the given and sought quantities in the problem, they learn to select the necessary arithmetic operations based on this. Thus, students become familiar with the method of solving the type of problem under consideration.

Familiarization with the solution to the problem consists of the following steps:

-familiarity with the content of the issue,

-searching for a solution to the problem,

-analysis of the issue,

-solving the issue,

-verification of the problem solution.

These steps are organically interconnected and are carried out mainly under the guidance of the teacher.

It is appropriate to analyze each of these steps.

Experience shows that understanding the content of the problem usually does not cause any particular difficulties. This stage begins with reading the text of the problem. Usually, students read the problem themselves. However, in the first grade, it is considered more appropriate for the teacher to first read the problem and convey it to the students. When explaining the content of the problem, unfamiliar terms or concepts are explained, and if necessary, it is recommended to use visual aids for explanation. Finding a solution to the problem consists of discovering the relationship between the quantities included in the problem and selecting the necessary arithmetic operations based on this.

We should take into account that we mainly prefer to teach the method of solving the problem with words. Because in this case, students have a complete and clear idea of the relationship between quantities, their dependence on each other. A student who has deeply mastered the solution with words does not face difficulties in the process of solving with one or another mathematical number, and using the relationship and dependence between quantities, draws conclusions and manages to complete the solution.

Analysis of the issue.

One of the most effective methods for finding a solution to a new type of problem is problem analysis. At this stage, problems are usually broken down into simpler problems and the sequence between them is determined, in other words, a plan is created for solving the problem. That is, the search for ways to solve the problem, the clarification of the relationships between the given quantities and the sought quantity are carried out.

The existing methodological literature indicates two methods of problem analysis:

-analysis of the problem using a synthetic method,

-analysis of the problem using analytical methods.

Sometimes, in the analysis of complex problems, both methods are applied alternately. This method of analyzing a problem is called analysis using the analytical-synthetic method.

We should note that the unity of these two methods makes the solution to the problem more clear.

The synthetic method of the problem is not applied arbitrarily, in which case we use the analytical method in our thinking, assuming the sought quantity. When solving a problem with the analytical method, we determine the solution to the problem and then obtain the required quantity by applying the synthetic method. For this reason, it can be said that when solving a problem, it is always possible to say that the analytical-synthetic method is used.

In elementary school, solving a problem means performing arithmetic operations according to a solution plan.

It is possible to solve the problem orally and in writing. Since the writing skills of first-grade students and also of second-grade students in the first half of the school year are not sufficiently developed, it is advisable to give a wide place to the oral solution of problems in these classes. In the later stages of training, a solution plan for most problems is written or the results of actions are accompanied by brief explanations.

In elementary grades, the written form of problem solving is of great importance.

In this regard, we can note that there are different approaches to the written forms of problem solving in methodological literature. In this regard, we prefer the following written form:

The problem solution is written in a plan, the plan is given in the form of question sentences.

Carrying out the solution by explaining each action involved in solving the problem.

Formulating a statement based on the issue and calculating its value.

Providing a solution to the problem in a short written form.

Now, let's show examples of the problem solution in the above-mentioned writing forms.

In the version of writing the solution to the problem in a planned form, the plan is expressed in the form of question sentences.

Question: In school No. 25 in Ganja, there are 30 students in one class, 2 students less in the second class, and 5 students more in the third class? How many students are there in the third class?

Solution to the problem:

How many students are there in the second grade?

30 – 2 = 28 (student)

How many students are there in the third grade?

28 + 5 = 33 (student)

Answer: There are 33 students in the third grade.

2. Lets consider the option of writing the solution to the problem in separate actions.

Problem: 50 students were taken from school. 20 of them were sent to sports competitions and 10 to the choir. How many students were left?

Solution to the problem:

1) 20 +10 = 30 (student)

2) 50 – 30 = 20(students)

Answer: 20 students remained.

3. The solution to the problem can be written as an expression as follows .

Problem: Out of 45 students in the class, 15 remained in the class. The students who left were divided into 3 groups. How many students are there in each group?

Solution to the problem:

a) Gradual formulation of the statement.

1) 45 – 15 = 30 - the number of students who left.

2) (45 – 15): 3 - the number of students in each group.

Answer: There are 10 students in each group.

b) The formulation of a direct statement,

(45 – 15): 3= 10(students)

Answer: 10 students.

4. Providing a solution to the problem in a short form:

Problem: There were 20 cars in the parking lot. 5 of them were taken for repairs. How many cars were left in the parking lot?

Solution to the problem:

1) There are – 20 cars,

2) They took it for repair – 5 cars,

3) Left - ?

20 – 5 = 15(car)

Answer: 15 cars.

Verification of the solution.

is the process of determining whether the applied solution is correct or not .

In elementary grades , four main methods are used to check problem solving :

1) Formulating and solving the inverse problem of the given problem,

2) Determining the correspondence between the numbers obtained as a result of the solution and the numbers given in the problem,

3) Solving the problem using various methods,

4) Determining the limits of the number being searched .

In the first method, students formulate the inverse of the given problem and solve it . If the solution yields the number given in the previous problem, it means that the problem has been solved correctly.

Problem: 8 students from the class were taken to a competition. 25 students remained there. How many students were there in the class?

After solving this problem, we set the requirement to " formulate and solve 2 inverse problems . " At that time, we explain to the students that the purpose of formulating these problems is to be a means of checking the correctness of the solved problem .

of checking problem solutions can be started from grade 2. However, it should be noted that it is not mandatory to create a converse problem for every problem .

The corresponding arithmetic operations are performed on the given numbers with the result obtained as a result of solving the problem. If the number in the problem is obtained, then the problem has been solved correctly. For example, Sevinc had 20 books. He gave 5 of his books to his friend. How many books does he have left?

The students reason approximately like this. We got 15 books in the answer. These books are the ones that Sevinj left. If we add the books that Sevinj gave to his friend to the ones that remained in Sevinj, then we get the number of books that Sevinj had before. That is, by checking, we get 15 + 5 = 20, which also corresponds to the condition of the problem .

If it is possible to solve the problem in different ways , then the results obtained in all cases should be the same. This, in turn , proves that the problem was solved correctly. For example, two cars started moving towards each other at the same time . The speed of the first car was 80 km per hour, and the speed of the second car was 5 km faster than it. 3 hours after the start of the movement , the distance between them was 200 km. What was the distance between the cars at the beginning ?

of the problem using method I:

(2 · 80 + 5) · 3 + 200 = 695 (km)

Answer: 695 km.

Solution to the problem using method II:

[(80 + 5) + 80] · 3 + 200 = 695 (km)

Answer: 695 km.

As can be seen from the example , the problem has been solved correctly. Note that if two methods differ only in the order of actions , they cannot be called different methods.

4) The method of checking by determining the "limit" of the sought number is typical for solving simple problems.

It is also important to remember that after solving the problem indirectly , attention is paid to the relationship of the answer obtained with the given number , and the largeness or smallness of this number in relation to the given number . This method is used to check the solution of simple problems in grades I and II, as well as a number of complex problems.

Formulation of the issue.

As we have shown above, at the modern stage of mathematics education, more attention is paid to the formulation of problems by students. Observations show that students themselves show a great tendency to formulate problems . This is important in terms of contributing to the implementation of training in a mutually interactive form. The first step in formulating a problem is considered to be the correction of a problem similar to the solved one .

The students' work on problem formulation is remarkable for its versatility and variety. The following types of this independent work can be distinguished :

Creating a basic problem with pictures of objects ;

Formulation of a problem similar to the solved problem ;

Formulating a problem based on given numbers and actions ;

Formulating the issue only according to the given actions ;

Completing a problem with a missing question or question ;

Formulation of the problem according to the text and scheme ;

Formulating problems based on a given dependence between quantities ;

Formulating a problem based on the question and formula ;

Preparation of a problem based on the solution and shorthand ;

Formulating the problem according to the solution plan and table values ;

Formulating a problem based on a given equation ;

Formulation of the problem based on measurement work , etc.

Generally speaking, the teacher has the opportunity to use other ways of organizing the problem of theoretical propositions from mathematics through problem solving.

After clarifying the tasks of solving the problem, we determine the optimal content of the theoretical material to be studied (in accordance with the problem being solved), including the degree of difficulty, logical sequence, and other components. For this, it is essential to separate and group the concepts, operations, etc. in the problem . If these points we have listed are not taken into account, the main time is spent on solving secondary problems , and as a result, students are subjected to additional load.

Effective assimilation of theoretical material through problem solving, the optimal range of educational tasks (including educational , upbringing and developmental features) to be solved in the lesson should be determined. For this, the teacher is required to have the ability to choose the most appropriate version of the lesson structure and to draw up an optimal plan. In this regard, the selection of optimal methods, tools and forms to be used in solving the problem is also of great importance in ensuring the assimilation of theoretical material . In this case, it is necessary to approach the problem based on the tasks , content of the lesson, the students' ability to understand and work independently , and the allotted time. In solving the problem , along with the methods of training, it is also important to ensure the optimal connection of collective, group and individual forms of training organization [15, p.12].

In the textbook “Mathematics 3” published in 2018, the problem of optimizing the teaching of theoretical material in the elementary course of mathematics through problem solving is characterized by the optimal volume of problems, their difficulty, their difficulty for some students and their difficulty for others , individualization of homework , and additional tasks (provided that overload is prevented) [32; 33; 35].

In this work, it is of great importance to instill in students the ability to understand the condition of the problem, the ability to solve it, and the skills of independent work. It cannot be denied that the overall optimization of the learning process in primary schools is impossible without optimizing the solution.

In order to teach students to optimally organize their learning activities in problem solving, educators should focus on instilling in them some general skills and habits of independent problem solving. For example, we can show such an example from the Mathematics textbook for grade 3. [p. 40] Write down and solve the examples that result in 10 when adding the singular numbers in one column, and the rest in another column.

47+38; 52+27; 34+32; 72+19

Such general skills and habits include :

1. Ability to work independently with a book (separate the main idea, independently study the material, compose a brief summary of the issue) .

Ability to work at an optimal mathematical reading and mathematical writing pace .

3. Training Ability to plan activities (planning the text of the question , the answer, etc.).

4. The ability to check yourself .

We must bear in mind that the main characteristic of this process of leadership is not limited to simply learning one or another work skill . The student must learn to optimally use various types of skills according to his strengths and capabilities, and must also be able to apply memorization techniques. In this case, he can master the lesson in a reasonable way, spending relatively little time and effort .

Another important point is that the optimization of teaching through problem solving also imposes requirements for a new approach to the control of the educational process. Here, first of all, the teacher must analyze his work experience and be able to objectively evaluate his activities in terms of optimal organization of the lesson. At the same time, one should not forget that special attention should be paid to the following issues: to what extent has the lesson achieved a comprehensive planning and solution of educational, educational and developmental tasks; to what extent has the optimal selection of the content, forms and methods of the lesson been ensured; whether the optimal volume and difficulty of homework (problems) have been successful, and other such questions should be raised.

For example: " *Tell the issues in your own words first, present your solution both orally and in writing.*

The length of the classroom is 5 m., and the length of the school corridor is 10 m. more than this. How many meters is the length of the corridor?" [34, p.42]

As can be seen, the optimization of the teaching of theoretical material in mathematics through problem solving also plays a major role as an important step towards mastering the scientific organization of applied pedagogical work. From what has been said, we can conclude that each teacher should gradually master not only its theory, but also the methodology of optimal organization of training.

Taking into account the conclusions we have drawn from the above, including theoretical explanations, let us look at specific issues related to the role of problem solving in optimizing the teaching of theoretical material in mathematics in elementary grades.

As we have noted, the main place in the formation of mathematical concepts in grade I is occupied by the solution of simple problems. The mathematical path chosen for solving the problem depends on the conclusion reached based on the analysis of its conditions. Thus, problems related to natural numbers and arithmetic operations are important in terms of creating an opportunity for first-grade students to form ideas about natural numbers and to consciously solve examples related to addition and subtraction operations.

When solving simple problems, students already consciously understand the meaning of this or that action, and they see and understand the various situations in which actions are applied.

Students begin to get acquainted with text problems at a later stage. Text problems are useful in optimizing the teaching of theoretical material in mathematics in primary grades and their application is widespread. However, it should not be forgotten that, unlike in higher grades, in the first grade, taking the content of text problems from life is also one of the necessary conditions. Thus, in solving problems, primary school teachers are faced with the problem of solving a number of problems, such as preventing students from being distracted, saving time, accustoming them to calculation habits, and teaching mathematical concepts. From this point of view, the role of life problems in solving the indicated problems is more pronounced and leads to better assimilation of the material by students.

As is known, the problem of distributing attention in first-grade students creates difficulties in assimilating the material, that is, when a formulated problem contains words that the student is unfamiliar with, the student is more interested in those words than in solving the problem, and instead of the essence of the problem, he begins to think about the meaning of those words and concepts (is it big, is it small, what color is it, is it bitter, is it sweet, etc.).

Example: " *There are 10 red and 5 yellow lilies in a vase. In a vase How many lilies are there?"* [32, p. 109].

Studies show that performing two or more mental activities at the same time creates difficulties for students . Therefore, each of the types of activities performed at this time should be familiar to the student . and one of these should relate to some extent to habitual , automated types of activity. In other words, it is advisable to take what is known from the life perceived by the student in the issues to be formulated .

Let us illustrate what we have said with the vital issues shown below .

Problem : The price of a notebook is 10 kopecks. The price of a pen is 2 kopecks more. How many kopecks does a pen cost?

Solution: 10 + 2 = 12 (q ə peak)

Question: They paid 90 cents for lunch and a lemonade. The lemonade costs 20 cents. How many cents does lunch cost?

Solution: 90 – 20 = 70 (kopecks)

Students are familiar with the concepts in both problems , so their attention is not distracted by extraneous concepts and they think directly about the solution of the problem . By learning to solve such simple problems related to addition and subtraction within 100 (I - practical problems) , children encounter operations with their components, and the results of operations and name them. Students get the opportunity to learn to explain concisely , accurately and correctly (with the teacher 's explanation) what is known and what is not known in a given problem , what meaning is derived from the conditions of the problem , and in what sequence the answer to the question of the problem is found . This , in turn, is important in terms of increasing the effectiveness of training [145].

In the first grade, where the new subject curriculum is being implemented, solving problems taken from life is also the main way to develop the formation of conscious and solid calculation habits in students. By acquiring conscious calculation habits, students quickly engage in the process of solving the problem and are able to solve more problems than the teacher intended . In this way, the teacher can optimize mathematics teaching (without affecting the legal time) , saving " *time* " allows you to increase the intensity and productivity of the lesson .

Example: " *At the camp, 5 students in a group were listening to a story read by teacher Nurana, while 6 students were watching a cartoon on TV. In this group, How many students were there?"* [32, p. 111]

Here we should also take into account that in the first grade , especially for 6-year-olds, problems are mainly given with visual aids and didactic materials, and this tendency can be considered appropriate . Also , the use of the expressions " *how many* times " *, "how much" in understanding the expressions "more", "* less " , " that *much* " by 6-year -olds is of great importance . Here, the main task facing the teacher is to choose visual aids and a system of appropriate practical exercises for the observers . These methods also form the necessary generalization skills in the students .

Example: *"Write 2 examples of addition and 2 examples of subtraction, according to the number of fish swimming left and right in the aquarium. In each case, what does the result represent? does ? "* [32, p.124]

Or another example says: "Write 4 examples of each:

Add or subtract, the result is 14.

Add or subtract , the result is 6" [32, p.124]

As is known, in the process of problem solving, the student's learning and the teacher's teaching activity are the main components that constitute the essence of training . Therefore , the main problem that is in the center of attention is the organization or optimization of the teaching and learning process on scientific grounds. It is necessary to treat it as such .

to the problem depends on the scientific organization and optimization of the learning process, starting from the second grade (in the first grade, mainly simple concepts are understood) , as well as on the nature of the student's learning activity , the specific characteristics of subject learning , as well as the teacher's work experience.

It should also not be forgotten that optimizing the teaching of theoretical material in mathematics through problem solving is also important in terms of requiring the creation of a favorable relationship between teachers and students , both in the teaching and learning process , so that this relationship is becomes a leading factor that maximizes the success of student activities .

problems were given on finding the sum of rectangles, squares, and their sides. It also proves to be a specific tool in optimizing the teaching of theoretical material in mathematics.

Problem : The length of a rectangular area is 100 m and the width is 50 m. What is the sum of the length and width of the rectangle?

100 m + 50 cm = 150 m

Therefore, it is appropriate to demonstrate operations and the expression of quantities with visual geometric materials in these classes, whenever appropriate. We can also express what we are saying with visual examples.

For example, let's use the problem of addition.

If a piece is made up of two pieces, then the length of the piece is the sum of the two pieces. This can actually be considered an application of the operation of finding the sum of two numbers to geometry.

Therefore, the selection of appropriate visual aids in problem solving in primary grades helps to activate learning and understand the topic. This shows that visual aids also play an important role in optimizing mathematical learning in the primary course of the curriculum and their use is essential.

Example: “We have pennies in our hands. 1 pennie, 3 pennies, 5 pennies, 10 pennies, and 20 pennies. How much would it be if we added them all up?” [32, p.126].

Analyzing all of this, we can conclude that the theoretical materials and problems taught in first grade mathematics in order to optimize its teaching can be grouped as follows.

Problems related to increasing and decreasing a number by several units.

Issues related to finding the sum.

Issues related to finding the remains.

To help students master the process of solving such problems, we recommend schematically showing the actions performed by the students as follows:

The problems solved in the third grade of the four-year primary school and the second grade of the three-year primary school create conditions for optimizing the teaching of the theoretical material mentioned below in mathematics and, first of all, play a positive role in the teaching creativity of students.

Verification of the addition operation (in fact, this is considered preparation for the future definition of the subtraction operation, and this verification also introduces the concept of the inverse problem).

Verification of the deduction (clarifying the concepts of the subtractor, the subtracted, and the difference, and expressing the other through two of them, that is, establishing a certain mathematical dependence).

Adding plurals (the grouping law is made understandable to students and the indicated action is performed in the optimal way).

In addition to teaching the topic of multiplication and division, problems expressed in direct and inverse forms on increasing and decreasing a number several times, as well as problems on comparing times, are solved, which optimizes the learning of theoretical material - that is, they help to reveal the essence of a new concept - the concept of how many times one number is greater or smaller than another, and help students understand these concepts more deeply.

In addition, solving simple and complex problems related to multiplication, product, the law of commutation of multiplication, finding the unknown quotient, finding the unknown dividend and divisor, multiplying and dividing a sum by a number, dividing a difference by a number, comparing numbers, perimeter, checking the divisor with the product, finding a part of a number, and comparing parts play a major role in mastering the mentioned theoretical materials at a high level. Now let's look at optimizing the learning of theoretical material in mathematics with the help of specific problems.

Problem: There were 6 kg of raspberries in the bucket. 2 kg of raspberries were eaten. How many kg of raspberries were left in the bucket?

In solving this problem, students see that to find the unknown sum, it is enough to subtract the other sum from the sum. That is, with the help of solving such problems, the mathematical dependence (functional dependence in the future) between the subtractor, the subtracted, and the difference is conveyed to students, and preliminary preparation is underway for learning the definition of the subtraction operation in the future.

We should also note that such problems related to finding the unknown sum also serve as a means of understanding and comprehending the concept of equality.

Problems designed to introduce the concept of equations lead to students' better understanding of the concept of equations. In other words, if students' initial preparation for equations is appropriate for their age and knowledge, they will not have difficulty learning materials on this topic in the future.

However, it should not be forgotten that in methodological literature, there are different views on constructing equations depending on the condition of the problem. The reason for this is the complexity of constructing equations itself, as well as the impossibility of providing a general method or formula.

In addition to all this, in order to optimize mathematics teaching in primary schools, it is necessary to group problems in such a way that the problems in each group can be solved based on the same considerations. In this case, grouping problems allows them to be solved using the same methods.

Observations show that students have certain difficulties in inequality, finding the fraction of a number, and comparing fractions. Therefore, it is appropriate to use visual aids in learning this type of material. For example, to substantiate the above idea, let's look at a problem related to studying the concept of inequality and fraction. Cut a rectangle and divide it into 3, 4, 5 equal parts by folding it. How many thirds, fourths, and fifths are there in a rectangle? Which part is larger?

1/3 or 1/4?,1/4 or 1/5?, 1/3 or 1/5?

When students solve such problems, they also gain the opportunity to visually learn the parts of a number and how to compare parts with each other. In other words, students are prepared to understand the concepts of fractions, inequalities, and the comparison of fractions in the future. The solution of such problems is also useful in ensuring the successful mastery of the initial elements of geometry in higher grades [156].

According to the current approach, since the problems solved in the fourth (four-year school) and third grade (three-year school) of primary school fully cover the elementary course of mathematics, wide opportunities arise in terms of optimizing the teaching of theoretical material in mathematics in these grades.

This process can be carried out with the following problem types:

Simple and complex problems according to the number of operations used in their solution.

Complex issues themselves are divided into two parts:

a) Transformed problem, b) Untransformed problem.

Text problems are also divided into two categories depending on whether or not they have an algorithm for solving them.

Problems for which there is a specific algorithm for solution are called type problems.

a) problems solved by the unification method,

b) problems related to finding the unknown quantity given two given differences,

c) issues related to proportional distribution,

d) problems related to finding an unknown number from a given number and a given part,

e) issues related to movement , etc.

4. It is no coincidence that inverse problems are given great importance in mathematics. It is believed that for any problem to be considered solved, its inverse problem must be solved . From this, the importance of reciprocal inverse problems in the teaching of text problems becomes clear.

By the way, let us note that the comparison method should also be included in the process of solving arithmetic problems in elementary grades , because this method is of great importance in optimizing mathematical knowledge, including understanding the dependencies between quantities .

It would also be useful to explain the role of geometry and geometry inverse problems in optimizing the teaching of multiplication and division tables and theoretical materials related to some elements and concepts in geometry .

We must take into account that the direct problem also has two inverse problems :

It should be noted that solving inverse problems attracts attention in terms of developing logical thinking in students, forcing them to think, or rather, to make consistent judgments. On the other hand, as a result of studying the solution of these problems, students' interest in mathematics increases even more. As a result, the material can be mastered relatively quickly, that is, the learning process is optimized.

In general, learning how to solve inverse problems is of great importance for elementary school students, as solving such problems has a positive impact on students' more conscious assimilation of the functional dependence between quantities and produces a better effect.

Professor PA Kompanich writes in his book that "when solving a problem, direct and inverse problems should be distinguished from each other. Also, the construction (solution) of the problem, which is the inverse of the direct problem, should be started from the first grade."

Also, in the book of the prominent scientist PM Erdinev (Erdinev P.M. Mutually inverse actions in arithmetic II-IV classes. M., 1969), in the article by M. Muradov *("Physics - mathematics teaching "*, B., 1969), the need to pay special attention to solving reciprocal inverse actions, as well as direct and inverse problems, is reflected in detail. At the same time, it should be taken into account that students, along with direct actions of this type, can also consciously master inverse actions. Moreover, when solving problems of this type, students not only learn operations related to numbers, but also achieve serious achievements in terms of learning the correct spelling of names. We must note with regret that it is impossible to say that the situation in the field of studying inverse problems related to teaching areas is satisfactory in our schools. The fact that such issues are not given due attention also has serious negative effects on the process of mastering the inverse operations of calculation. Taking into account these points, it is necessary to give special attention to the solution of inverse problems on the topic of "calculation of areas".

Another benefit of teaching the process of solving direct and inverse problems in a comparative manner is explained by the wide opportunities it creates for students to learn difficult concepts related to arithmetic and geometry in an easier way.

Segments EF = 6cm and OP = 3cm are drawn through the midpoints of the sides of rectangle ABCD (Figure 2.3). What is the perimeter of rectangle ABCD?

P = 2(AB + AD) = 2(6 + 3) = 18 cm

(Figure 2.3)

In the converse problem, what is the sum of the sides of the rectangle given P = 18 cm?

AB + AD = P : 2

AB + AD = 18 : 2

AB + AD = 9 cm

In this regard, it would be useful to pay attention to the solution of another problem. The area of the rectangle is 18 sq. cm. The length of the rectangle is 6 cm (Figure 2.4). Find the width of this rectangle.

(Figure 2.4)

S of a rectangle is equal to the product of the length a and the width b. In the case of the problem, the product is 18 and one of the factors, the multiplicand (6), is known. The other factor, the multiplier (x), is unknown. To find xi, we need to divide 18 by 6.

x = 18 : 6 = 3 cm

x = 3 cm is obtained.

Thus, it turned out that the width of the rectangle is 3 cm.

In the second type of inverse problem, the width and area of a rectangle are given. In this case, the student is asked to find the length of the rectangle.

That is , to find the product xi, we need to divide the product (Si) by the multiplier (b).

As is known, multiplication is performed in the same way as in the case of a direct example . In the case of a check, on the contrary, division is performed.

in solving inverse problems , division is performed. In checking, multiplication is used. As can be seen, in solving direct and inverse problems, students have the opportunity to consciously understand the dependence between length, width, and area in accordance with the multiplicand , multiplier, and product .

Another problem, which is the opposite of the problem of calculating the area of a square given its side, also attracts attention . In this case , we are talking about calculating the side of a square given its area. For example , let 's say that the area of a square is known to be 25 sq.cm. Thus, in this problem, students are required to calculate the side of the square.

the problem , it is necessary to make such a judgment. The area of a square is 25 sq.cm, that is, 25 squares of 1 sq.cm each are located in the area of the square . This means that the figure is divided into 5 equal parts, both the length and width of which are equal to each other . Each of them has 5 strips of 5 sq.cm. In order for each strip to accommodate 5 sq.cm, its length should be 5 cm.

Therefore, this operation can be performed in the following order: 25 : 5 = 5 cm.

So, the side of the square is 5 cm. When solving problems of this type, we can make another judgment: for this we need to pay attention to the formula. As you can see, 25 is the product of two equal products. is equal to . Thus, we can conclude that the side of the square is 5 cm.

Let us note that the direct problem of calculating the perimeter of a rectangle given its length and width also has two inverse problems.

Inverse problem. 1) Calculate the width of a rectangle given the perimeter and length,

2) Calculate the length of a rectangle given its perimeter and width.

To illustrate the topic, it would be appropriate to turn to examples. For this purpose, let's solve the following problem: The perimeter of a rectangle is 12 cm and the width is 1 cm. We need to find the length of the rectangle.

We must remember that there are 4 cases in solving this problem.

Case I: The perimeter of the rectangle is 12 cm. Half of the perimeter is 12 : 2 = 6 cm.

Here 6 cm is the sum of the length and width of the rectangle. Since the width of the rectangle is 1 cm, its length will be 6 - 1 = 5 cm.

Case II: Since the width of the rectangle is 1 cm, the other opposite side will be 1 cm. The sum of its two sides is 1 + 1 = 2 cm. The sum of the two lengths of the rectangle is 12 - 2 = 10 cm. Then the length of the rectangle is 10 : 2 = 5 cm.

Case III: The sum of all sides of the rectangle is x + 1cm + x + 1cm = 12cm.

of permutation and grouping .

(x + x) + (1 + 1) = 12

2x + 2 = 12

2x = 12 – 2

2x = 10

x = 5 cm.

The length of the rectangle is 5 cm.

Case IV: The general solution to the problem is:

Let's write it according to the formula P = 2 (a + b).

12 = 2 (a + 1)

12 = 2a + 2

2a = 10

a = 5 cm.

inverse problem we showed above, which concerns calculating the length of a rectangle given its perimeter and width, should also be taught to students in the same way.

Solving problems of this type is considered quite useful and effective. As students solve such problems, their knowledge of arithmetic deepens and strengthens . Geometry material is more easily mastered when using this method.

After the research we conducted above, we can conclude that problem solving in elementary grades optimizes the consolidation of theoretical knowledge and the teaching of mathematics as a means of imparting new theoretical knowledge. From this point of view , we can show the characteristic features of problem solving as follows :

a) understanding the concept of natural numbers and teaching their properties and properties ,

b) to reveal the meaning of the concepts of sense , fraction, equality , inequality , unity , d .

c) providing functional concepts,

d) calculate the dimensions of the simplest geometric figures and visually demonstrate some algebraic concepts with the help of figures,

e) creates and serves the conditions for connecting learning with life , the formation of new concepts, the acquisition of knowledge by students , and independent thinking .

In the previous paragraph, ways to optimize the teaching of theoretical material in mathematics through problem solving were examined and a number of analyses were conducted in this regard. In this paragraph, we will specifically look at the problem of which problem solving method is possible to teach theoretical material.

As is known, in primary schools, theoretical knowledge of mathematics is mainly instilled through exercises and becomes a product of students' thinking processes. Experience shows that choosing this path in order to familiarize young schoolchildren with the basic mathematical concepts and prepare them for acquiring deep mathematical knowledge can be considered correct and expedient from a pedagogical point of view.

We recommend following the following steps to help students understand new material through problem solving:

1. Initial stage: creating enthusiasm and interest in understanding new material.

2. Perception of new material: making observations on visual facts and generalizing them (this method is also called the information method).

3. Understanding the material: proving the conclusion drawn.

4. Reinforcement of the learned material through practical application.

The main goal in solving problems that serve the study of theoretical material is to teach the transition from practical to theoretical material. For this, it is considered appropriate to create the following conditions in the training:

a) The educational material covered should be the student's goal of action.

b) Solving the problem should encourage the student to engage in active mental activity, thinking, creativity, and exploration.

c) The problem should arouse interest and enthusiasm in the student, both in terms of content and solution.

d) In the problem-solving process, the student's knowledge is revealed and strengthened by repeating previously learned materials, and in this way, the transition to new knowledge should be organized.

d) Various types of independent work should be carried out through problem solving.

The ways of using mathematical knowledge and skills in the theoretical course of primary grades are of great importance in terms of the learning process. It should be noted that in primary grades, the study, understanding, assimilation and application of theoretical material to practice are considered important problems of the methodology of teaching mathematics in the process of problem solving. From this point of view, it would be appropriate to look at different groups of simple problems.

Question 1: *"Three student brigades were working in the schoolyard. The first brigade had 18 people, the second had 20, and the third had 8 fewer than the first and second brigades. How many people were there in the third brigade?"*

Solution to the problem:

1) How many people were there in the first and second brigades together?

18+20=38 (people).

How many people were in the third brigade?

38-8=30 (people).

Answer: 30 people.

Problem 2: The sum of the numerator, denominator, and difference is 624. If the difference is 56 less than the denominator, find the numerator, denominator, and difference.

Solution: Let the numerator, denominator, and difference be a, b, and c, respectively. Then

$a - b = c \Rightarrow a + b + c = 624 \Rightarrow a = 312$

according to the condition

$312 = c + 56$

$c = 256$

$312 - 6 = 256$

$b = 56$

Problem 3: You need to find the last three digits of the product of the given natural numbers from 1 to 18.

Solution: The product shown here has three $(2 \cdot 5)$. Therefore, each of the last three digits is a "0".

The solution to the first group of simple problems is based on the specific meaning of arithmetic operations.

1. Finding the sum of two numbers: Ali picked 6 apples and Nargiz picked 4 apples. How many apples did Ali and Nargiz pick together?

Solution: 6+4=10 (apple)

2. Finding the remainder: There are 9 pencils in a box. 5 pencils were taken from that box. How many pencils are left in the box?

Solution: 9-5=4 (pencil)

3. Finding the sum of equal sums: Samir brought 4 boxes of pencils. If each box contains 5 pencils, how many pencils did Samir bring?

Solution: 4·5=20 (pencil) or 5+5+5+5=20 (pencil).

4. Division into equal parts: They divided 15 flowers equally among 3 students. How many flowers did each student get?

Solution: 15:3=5 (rose)

5. Division by content: They distributed 16 flowers equally among the students. Each student received 4 flowers. How many children did they distribute flowers to?

Solution: 16:4=4 (in the student)

In solving the second group of simple problems, students acquire knowledge (theoretical materials) about the relationship between components and the results of actions.

1. Finding the other sum given a known sum and one of the sums: There were 6 notebooks. After bringing in a few notebooks, there were 10 notebooks. How many notebooks were brought in then?

Solution: 10-6=4 (notebook) or x+6=10

x=10-6=4 (notebook)

2. Finding the subtraction from a given difference and subtraction: Jafar had several note-books. After giving 5 of them to his friend, he had 3 notebooks left. How many notebooks did Jafar have before?

Solution: 5+3=8 (notebook), x-5=3, x=8 (notebook).

3. Finding the subtraction from a given difference and subtraction: After Ilgar gave some of his 8 notebooks to his friend, he had 4 notebooks left. How many notebooks did Ilgar give to his friend?

Solution: 8-x=4, x=8-4, x=4 (notebook), or 8-4=4 (notebook)

4. Finding the other product from one of the products given the product and the product: Il-gar bought 5 pens for 20 manats. How much does one pen cost?

Solution: 20:5=4 (manat)

5. Finding the divisor by known divisor and by chance: Arif divided his pencils among 4 of his friends and found that each student received 5 pencils. How many pencils did Arif have at first?

Solution: x:4=5

X=4*5+20

20 (pencil)

6. Finding the unknown number by dividing a known divisor by the quotient: We divided 30 by the desired number and got 6 as the quotient. Find the desired number.

Solution: 30:x=6

X=30:6

X=5

It should also be noted that in the process of solving the third group of problems, a new meaning of arithmetic operations was discovered. This includes 6 types of simple problems related to the concept of difference and 6 types of simple problems related to the division relations of numbers.

1. Comparing two numbers by their difference or finding the difference of two numbers: The father's age is 30, and the son's age is 5. How many years older is the father than the son?

Solution: 30-5=25 (age)

2. Increasing a number by several units: Elmir solved 9 problems. Samir solved 3 more problems than him. How many problems did Samir solve?

Solution: 9+3=12 (problem)

3. A decrease in the number by several units: The students of the third grade went on a trip for 15 days. The students of the fourth grade went on a trip for 2 days less. How many days did the students of the fourth grade go on a trip?

Solution: 15-2=13 (days)

Now let us consider the issues related to the concept of division relation.

1) Finding the ratio of two numbers: An apple costs 30 manats and a potato costs 10 manats. How many times more expensive is an apple than a potato?

Solution: 30:10=3

3 (times)

2) Multiple multiplication: The school bought 7 tables and 3 times as many chairs. How many chairs did the school buy?

Solution: 7*3=21

21 (chair)

3) Reducing the number several times: The school bought 21 chairs and 3 times less tables. How many tables did the school buy?

Solution: 21:3=7

7(table)

We should also remember that each of the simple problems of Group III that we considered in the examples above is an indirect problem. The expression expressing the mathematical relationship in the condition of an indirect problem requires the inverse operation of the corresponding arithmetic operation.

The solution of the sample problems shown in all three groups is noteworthy in that it accustoms students to learning theoretical material.

Let's get acquainted with the different types of problems that we have designed at a level appropriate to the abilities and skills of a second-grade student of an eleven-year school, and consider how solving these problems helps in mastering theoretical material in mathematics.

I. Issues that serve to provide new mathematical knowledge:

a) Samir has 4 fairy tales and 6 story books. How many books does Samir have?

Solution: 4+6=10 (book)

b) Ilgar has 6 fairy tales and 4 story books. How many books does Ilgar have?

Solution: 4+6=10 (book)

The students saw that the answer to both problems was 10 , and that the sums were the same. So, what differences can be shown in the solutions to these problems ? When the student carefully analyzes the problem , he sees that only the sums have changed their places, but the result (sum) does not change. After solving several problems of this type, the students begin to clearly understand the principle that "the sum does not change when the sums are changed" .

II. Issues that serve to consolidate and repeat knowledge.

1) A brother has 40 manats and a sister has 60 manats. How many manats do they have together?

To solve this problem, let's use the following shorthand notation.

There were 40 people.

There were 60 people.

How much was it in total?

Solution: 40+60=100 man.

2) A brother and sister had 100 manats. The sister took 60 manats. How many manats did the brother have left?

There are - 100 people.

taken - 60 manats.

left- ?

Solution: 100-60=40 people.

3) There is 10 liters of milk in the milk jug. They took 4 liters of milk from this jug. How much milk is left in the jug?

4) The father bought 10 kg of apples and the mother bought 6 kg of apples. How many more apples did the father buy from the mother? How many fewer apples did the mother buy from the father?

5) Togrul played checkers for 20 minutes and chess for 3 more minutes. How many minutes did Togrul play?

Problems 1 and 2 are called reciprocal problems, and one of these problems serves to verify the other.

Solving the above-mentioned problems not only helps to master quantities and the dependencies between them, but also contains new theoretical material and the ability to express functional dependencies.

Let's look at the types of problems shown below to help students master multiplication and division.

Question: A bus ticket costs 5 manats. How much manats did 4 people pay for the ticket?

This problem should first be explained to students using the addition operation. That is, we add the ticket price to the number of people. Similarly, we can demonstrate the solution of the problem by multiplying the ticket price by the number of people using the multiplication operation.

So, after having students solve a few such problems, they understand that multiplication means adding the same sum.

Problem: 15 rabbits were put into 3 cages. How many rabbits were in each cage?

Here it is appropriate to use two different methods. We explain the problem both visually (by drawing) and with the help of multiplication. That is, we address them with the question: How many times does the number 3 occur in the number 15? - we address them with the question; 15 and 3 are known numbers, and 5 is an unknown number. Therefore, solving problems of this type creates interest in defining the division operation in students. Our observations have confirmed what we said. That is, the definition “ *when one of the quotients and the product are known, the operation of finding the other quotient is called division”* was obtained.

Students are able to independently draw general conclusions when solving problems related to the law of displacement of multiplication, calculating the perimeter of a triangle, rectangle, and square.

Problem: One side of a triangle is 7 cm, the second side is 5 cm, and the third side is 9 cm. What is the sum of the lengths of its sides?

Solution: 7+5+9=21

Problem: If one side of a square is 4 cm, find the sum of the lengths of its 4 sides.

Solution: 4+4+4+4=16

Or

4*4=16

Problem: The width of a rectangle is 6 cm and the length is 10 cm. Find the sum of the lengths of the sides of this rectangle.

Solution: 6+6+10+10=32

Or

6*2+10*2=32

The teacher notes that the lengths 21 cm, 16 cm, and 32 cm obtained in solving all three problems are the perimeters of the corresponding figures.

Thus, students independently understand that the perimeter of a polygon is equal to the sum of the lengths of its sides. The assimilation of this general rule (theoretical material) as a result of students' practical activities improves the quality of assimilation of theoretical material, creating conditions for the formation of their mathematical thinking activity.

Another aspect of problem solving that is beneficial for students' mental development and mathematical thinking is that it is based on the application of rules whose application is not obvious. Problems solved with rules whose application is not obvious have a positive effect on the formation of students' independent thinking and their overall development. Thus, even when the application of a certain rule or law is obvious, there are usually students who cannot apply these rules to solving problems normally. In this regard, when the application of any mathematical rule or law is not obvious, its explanation and teaching are of great importance in terms of ensuring the student's readiness to apply all mathematical rules and laws.

For example, how much money do you need to pay for 12 books, each costing 5 manats, and 5 pens, each costing 5 manats?

The teacher asks: - How much money should be paid for 12 books, each costing 5 manats, and 5 pens, each costing 5 manats?

The student answers: - You need to pay for 12 books, each worth 5 manats, and 5 pens, each worth 5 manats. You need to pay for all the things you buy.

How did you find this? – We first calculated the product, then the sum of the products, and then added the results.

By noting the correctness of the result, we learn how to calculate differently. After a certain explanation and independent mathematical activity of the students, the students discover that there is another method and realize that this way is more optimal. Thus, the students get the opportunity to develop their skills in independently making decisions in solving such problems. The strong and stable mathematical thinking acquired in this way is distinguished by its more dynamic and flexible nature. Also, in the primary grades, theoretical issues related to the perimeter, the broken line and its measurement, the circle, and the circle are also touched upon. Therefore, solving these types of problems is useful in terms of providing practical assistance to the students in effectively mastering the theoretical material.

In this regard, let's look at the solutions to the problems given below related to the study of theoretical material about the perimeter and area of certain figures.

Problem: Find the perimeter of a rectangle with sides of 4 cm and 2 cm (Figure 2.5).

(Figure 2.5)

Draw a square with this perimeter.

When solving the problem, we recommend that students approach it with creative questions such as:

1. Who can say what about the opposite sides of a rectangle? It is considered appropriate to formulate such questions after calculating the perimeter.

Using visuals in solving such problems helps students to grasp the content and essence of the theoretical material more quickly. In general, visuals are very useful in solving geometric problems.

NA Menchinskaya, M.I. Moro [14] show that in order to effectively master theoretical material, it is necessary to use the following rules in problem solving:

1. Do not start calculating without carefully studying the entire situation.

a) Read the issue completely and pay attention to its question.

b) Return to the circumstances of the case, separate and analyze the data that are related to each other.

c) If it is easy to separate a familiar problem from a given complex problem, separate it first and solve it. In this case, the problem will be simple and the process of solving it will also be easier.

2. Use a variety of tools and methods when solving a complex problem.

a) When solving a complex problem, first of all, try to clearly imagine what theoretical material is being discussed in the problem. To this end, changing the form of the problem (replacing large numbers with small numbers, thinking of a similar problem from your own life, and conversely, trying to express the content of the problem in mathematical language by asking yourself what is known from the problem conditions and what needs to be known) is considered a useful tool.

b) Pictures, tables, or diagrams can be of considerable help in solving difficult problems.

c) After starting the solution, when performing each operation on numbers, always ask yourself what you know about this operation and whether it is necessary to perform this operation in terms of the question of the problem.

3. After you finish solving, go back to the question and check whether you were able to answer it completely.

It should not be forgotten that if the above-mentioned rules are followed, then solving the problem will also accelerate the assimilation of theoretical material (relevant to the topic).

The following issues play a decisive role in the mastery of theoretical material to be learned through problem solving in the elementary mathematics course of the fourth grade of a four-year school:

1. Issues related to the relationship between price, quantity, and value.

2. Issues related to the relationship between speed, time, and distance.

3. Problems related to addition and subtraction (with properties). Practical problems.

4. Movement-related issues.

5. Issues related to multiplication and division (with properties) (numerical multiplication, division, checking the operation, etc.).

6. Issues related to constructing equations.

7. Issues related to quantities, units, and the relationship between them.

8. Issues related to finding geometric elements and learning some formulas, etc.

In this regard, let's look at the example questions given below.

Question: One general notebook costs 3 manats. How much do 2, 3, 4, 5 such notebooks cost?

The condition of this problem includes three quantities: price (the price of a book is a fixed quantity), value, and quantity (variable quantities).

Let's create the following table to track the change in value and quantity.

Quantity	1	2345
Value (in manats)	3691215	

As can be seen from the table , as quantity increases, there is a tendency for value to increase . If we look at the table from left to right, we can see that as the price of the first quantity decreases several times, the corresponding price of the second quantity decreases by the same amount . Therefore, we call two quantities of this type directly proportional. So, when the price is constant, quantity and value show themselves as directly proportional quantities. If we change the question and keep the value constant, then the relationship between price and quantity (which are variable quantities) will become an inversely proportional relationship. After this explanation, we can explain to the students that directly and inversely proportional quantities are called proportional quantities.

Later, if we continue this process during training with problems that are the opposite of the given problem, we will end up with 12 problems. Similarly, based on the text of each problem, which includes speed, distance and time, as well as work, work time and amount of work, it is possible to formulate 12 problems related to finding the fourth proportional quantity as above. Solving such problems helps students to understand the theoretical material related to direct and inverse proportional dependencies in the future and to understand it more easily. However, it should be remembered that in elementary grades, the method of proportions and formulas is not used when solving these problems.

As is known, the subject of time measurement is considered one of the most difficult subjects to master in elementary school. Experience shows that in the fourth and third grades, students somewhat generalize the knowledge they received in previous grades. In addition to the knowledge they have acquired, they also become familiar with new theoretical concepts. We have already noted that problem solving plays an important role in the qualitative mastering of these concepts. Thus, when studying concepts such as speed, time, distance, problems related to time measurements that arise during the teaching of the topics *"fractions "*, *" finding a part of a number and a number by its part "* are solved.

Question: a) What is one-third of a day when 6 hours are?

b) How many times longer is a day than 6 hours?

In order to broaden students' understanding of motion in these classes, observing various motions (people, cars, bicycles, etc.) is very useful in terms of teaching theoretical material. In this regard, we can consider the following complex issues related to motion:

1. Issues related to oncoming traffic: cars start moving from two points at the same time and stop at the same time.

2. Cars start moving from two points at different times and stop at the same time.

3. Issues related to the movement of vehicles from the same point in different directions at the same time.

4. Issues related to movement from the same point in one direction.

As is known, solving problems of the first and second types is usually preferred in the school course. Also, problems of the first type are important in that they serve as preparation for problems of the second type.

By the way, let's consider a problem of the first type: Two trains from cities A and B start moving towards each other at the same time. The first train is moving at a speed of 40 km per hour, and the other at a speed of 50 km per hour. The trains meet after 4 hours. Find the distance between the cities.

In order to solve this problem, a drawing related to the problem is drawn and, after analysis, mathematical operations are performed.

Consider this problem: 3 hours after a train leaves a station at a speed of 40 km/h, a second train leaves in the same direction at a speed of 60 km/h. After how many hours will the second train reach the first train?

It is considered appropriate to visualize these types of problems. It is also necessary to write the solution to the problem with an explanation.

1)- the distance traveled by the first train in 3 hours,

2)- the distance traveled by the second train in one hour more than the first train,

3)- the first train will catch up with the second train.

Experience and observations show that students usually face certain difficulties in solving complex problems. Therefore, in order to overcome these difficulties, it is necessary to teach students the dependencies between quantities, arithmetic operations, and dependencies between components and results in the process of solving problems. That is, the dependencies between these quantities must be expressed in a general way and must be understood by students.

Based on the specific data about these three quantities we discussed above, it is advisable to teach students the following rules:

1) To find the distance traveled, you need to multiply the object's velocity by time.

2) To find the speed of movement, you need to divide the distance by the time.

3) To find the time spent on the movement, you need to divide the distance by the speed.

After all these studies, it is possible to conclude that problem solving plays an important role in the acquisition of abstract theoretical knowledge in elementary grades.

Mechanism for assessing students' mathematical knowledge and skills and mathematical problems

As is known, taking into account and evaluating student success plays an important role in the pedagogical process.

An essential component of the learning process is verification, evaluation, and assessment. Assessment is characterized by an increase in the speed and accuracy of recalling facts, key concepts, and ideas, as well as their relationships. The information obtained at this stage informs the teacher about the progress and results of the learning process, and reflects the dynamic development of students and their ability to grasp concepts.

Assessment data should objectively reflect students' knowledge and play a key role in improving the organization of teaching and learning processes.

It should be borne in mind that the verification process during the problem-solving training process should guide the students' activities in the training, the development of their creative skills and abilities, and also have the function of controlling this development. Therefore, verification is considered a process that occurs alongside all types of training work.

It is worth recalling that teacher-student feedback is called external feedback, and student self-assessment is called internal feedback. It is also well known that there is a close relationship between assessment and self-assessment. Observations have shown that advanced teachers pay great attention to teaching self-assessment methods, because these methods help to increase students' awareness and activity, a sense of responsibility, and stimulate their independent work.

In the process of testing students' knowledge, a constant comparison of the given program of educational activities with the work done in reality is carried out. This comparison, first of all, aims to answer the following question: is the educational task being performed correctly, are there any inaccuracies in the formation of students' ideas and concepts, their skills and habits?

The nature of the assessment requires the teacher to be skillful, pedagogically polite, and to approach each student's work objectively and carefully.

It is known that the testing and evaluation of the knowledge of primary school students is mainly determined based on how they solve problems and examples. In addition, the student's quarterly grade is also determined by his problem solving. The student's quarterly and annual grade is determined based on his problem solving skills.

In the process of problem-solving training, the assessment of student knowledge has a psychological-pedagogical nature and mainly consists of providing assistance to students. Here, the issues of showing confidence in the creative forces and abilities of students, mobilizing all their knowledge and skills to fulfill the task set, and arousing and strengthening their cognitive interest come to the fore.

It should be noted that when applying methods for testing students' knowledge through problem solving in primary schools, the characteristics of the subject of mathematics and the age of the students should be taken into account. The purpose of testing methods is to encourage students to independently complete the task, apply their knowledge and skills in practice, and engage in creative activity.

As is known, the form of evaluating and recording students' achievements is expressed in the form of displaying these grades in points.

It would be appropriate to touch on an important point here. In our opinion, it is not at all correct to consider any mistakes made by students as equally valuable when checking and evaluating a student's knowledge through problem solving. In this case, one should be careful and distinguish between gross mistakes that prove that the student's knowledge is deficient and minor (in some cases, purely mechanical) errors.

Problem-solving lessons are of great importance in testing and assessing students' knowledge.

This type of lesson has been called " *verification-accounting lesson* " (Golant), " *verification lesson"* (Ivanov, M.Muradkhanov, etc.), " *verifying and calculating lesson* " (Kazanoev), " *lesson that checks and corrects knowledge, skills and habits* " (Onishshuk), etc. The point is that regardless of how it is called, the main goal and task of that lesson is to check the success of children, assess their knowledge and skills, and, if necessary, carry out correction operations.

In primary grades, testing and evaluation are mainly conducted in the form of oral, written, or practical testing exercises.

The structure of the problem-solving assessment and evaluation lesson can also be structured as follows:

1. Inform students of the purpose of the lesson and the requirements of the work to be done.
2. Performing writing tasks in a frontal or individual way.
3. If necessary, provide a collective explanation of questions that arise and cause difficulties in solving the problem, or common errors that are observed.
4. Give assignments to evaluate the work overall and correct errors.

The purpose of the test can also be different: to determine how well students understand what was taught in the previous lesson (or in the current problem-solving lesson), to motivate students to learn, to systematize and correct the knowledge gained by students, to get acquainted with the results of the teacher's work, etc.

A lesson type that aims to test and evaluate can also have the following structure:

1. Motivating students' learning activities and stating the topic, goals and objectives of the lesson (showing the importance of knowledge, skills and habits acquired at school in life in a wide variety of situations). Providing information about the nature of the problem given in the lesson, the sequence, ways and rules for solving it, and summarizing the results of independent work.

2. Checking students' knowledge of practical material.

3. Checking the depth of students' understanding of knowledge and the degree to which they can generalize it (by having them independently compile written questionnaires or summary tables or diagrams appropriate to the issue).

4. Testing students' acquired knowledge of basic concepts (rules). Testing their ability to independently clarify the essence of these concepts and provide questions (or examples) to justify their judgments with evidence.

5. Students' application of knowledge in standard conditions (independent work on written problem solving)

6. Application of knowledge in a modified (non-standard) way (implementation of complex creative tasks or practical tasks that require application in new conditions).

7. Collection, verification, analysis and evaluation of solved problems.

8. Summarizing the lesson and assigning homework.

It should be noted that despite the fact that this structure of the lesson is considered more perfect in terms of checking, correcting and evaluating the knowledge, skills and habits acquired by students, unfortunately, this structure has not yet been able to take its proper place in the school practice of our republic and has not been massified. Although the time has long come to eliminate this defect, there are no practically significant measures in this regard yet.

In primary grades, students lack knowledge, skills and habits in mathematics.

There have been various approaches to its development and evaluation:

I 1. Evaluation of oral responses.

2. Written test of knowledge, skills and habits.

3. Evaluation of combined works.

assessment of knowledge, skills and habits .

II Another group of experts viewed *“Taking into account and assessing students' knowledge, skills, and habits in mathematics ”* as follows:

1. Oral testing and assessment of knowledge, skills and habits.

2. Written testing and evaluation of knowledge, skills and habits.

III The following proposals made in recent years also attract attention :

a) Evaluation of oral responses.

b) Written test of knowledge, skills and habits.

c) Final assessment of knowledge, skills and habits.

From the analysis of what has been said , we can conclude that the testing and evaluation of students' knowledge through problem solving can be carried out in the following manner :

1. Evaluation of oral responses.

Grade “5”. If the student is able to independently solve the problem, draw up a plan, explain the course of the solution, accurately formulate answers to questions about the problem, and complete the practical task, he is given a grade of “5”. Also, if he proves the correctness of the course by solving the problem in an efficient way, if he can distinguish similar and different aspects of geometric figures by drawing them correctly, if he is able to correctly use formulas to calculate the perimeter and area of figures , these cases are also taken into account. A grade of “4” is given if the student’s solution of the problem is generally consistent with the students determined for grade “5”, but he:

a) does not always use efficient methods in calculations and makes some minor errors ,

if he/she cannot explain the solution to the problem sufficiently correctly ,

If the student makes certain mistakes in the measurement and drawing process while performing practical work , but can easily correct these mistakes with a little help from the teacher, he/she may be given a grade of "4".

Grade “3”. If a student is able to correct the mistakes he made in solving the problem with the help of the teacher, it is considered appropriate to give him a grade of “3” .

Grade “2”. If the student is unable to solve the problem even with the help of the teacher, a grade of “2” is given.

Grade “1”. If the student does not know the program material at all , then he is given a grade of “1”.

2. Testing knowledge, skills, and habits through problem solving.

Written assignments in mathematics can consist of a problem, an example, or both (combined). The volume of the test work is quite important here. Thus, the volume of the work should be such that it takes students up to 20 minutes to complete it in the second half of the school year in grade I, up to 35 minutes in grade II, and up to 35-40 minutes in grades III and IV.

Distinguishing between gross and non-gross errors is also a fairly important issue when checking written work in mathematics. In fact, this in itself means an objective assessment of students' knowledge through problem solving.

Gross errors include the following:

- errors made in the calculation process in the matter,

- the issue was not resolved correctly (omission of the action, its incorrect selection, failure to provide additional actions) or was not resolved at all, the question for the action was not posed correctly.

The following can be attributed to non-gross errors:

- inefficient way of calculation,
- incorrect choice of question when solving the problem,
- the question is not answered correctly,
- incorrect transcription of writings (numbers, signs).

At this time, the following should be taken into account when evaluating the issues resolved:

Grade “5” – if the tasks are completed without errors,

Grade “4” – if there are 1-2 minor errors in the question,

Grade “3” – if there is one gross error in the question,

Grade “2” – if there are two or more gross errors,

“1” rating – if the issues are not resolved.

3. Evaluation of combined works.

As indicated above, these lessons are structurally divided into different stages. It should be noted that there is no absolute rule regarding the sequence and quantity of these stages. It is recommended to be very careful in checking and assessing students' knowledge through such work.

Based on our observations in primary schools, answers from conversations with leading methodologists and teachers, and analysis of the pedagogical literature we have read, we come to the conclusion that in terms of the structure of a combined lesson, these works are multivariate. A. Hashimov showed 7 variants of this lesson in his article.

(Combined) assessment of a written assignment consisting of problems (if both problems are of the same difficulty).

If both problems are solved correctly, a grade of “5” is given. If the solution of both problems is correct, but 1 error is made in the calculation, a grade of “4” is given.

A grade of “3” is given in the following cases:

a) the solution of both problems is correct, but 2 errors are made in the calculation,

b) one problem is solved correctly, while the other is solved incorrectly,

c) the solution process should be correct in both problems, but 2-3 errors should be made in one (or both) of the problem solutions.

If the solution is incorrect in both problems, a grade of "2" is given.

If the written assignment is not completed, a grade of “1” is given.

If, in the teacher's opinion, one of the given problems is the main one and the others are additional ones, then if the additional problem is not solved or a mistake is made, the student's knowledge of mathematics (only for these problems) can be given a grade of "3". However, if the main problem is not solved, a grade of "2" is given.

We can look at the following example to analyze the testing and evaluation of a student's knowledge using a three-question writing task:

1. The students collected 336 kg of apples and half as many pears. They collected half of the pears into 7 boxes. How many kg of pears did they collect in each box?

2. The fishing crew caught 410 kg of carp, 450 kg more of pike-perch than carp, and 2 times less of pike-perch. How many fish did they catch in total?

3. The perimeter of a square is 44 cm. What is the area of this square?

The following evaluation standard can be used to solve these issues:

If all three problems are solved correctly, a grade of "5" is given. If two of the problems are solved correctly (but one of the problems solved must be the first problem), a grade of "4" is given.

If the first or last two problems are solved correctly, then the student's knowledge is evaluated as "3".

If the first or last two problems are not solved correctly, the student's knowledge is evaluated as "2".

If the written assignment is not completed, a grade of “1” is given.

4. Final assessment of knowledge, skills and habits.

1) In grades I-IV, quarterly and annual assessments of children's knowledge, skills, and habits in mathematics are evaluated with the same score (mainly based on problem and example solving).

2) The final grade is based on the teacher's observation of the student's daily work, oral questioning, and the results of the current and final tests. However, more attention should be paid to the latter.

3) The final grade is based on the student's level of both theoretical knowledge and practical skills and habits. If half or more of the current and final written tests are unsuccessful , the student cannot be given a positive final grade in mathematics.

According to VMBradis, solving a problem means that the solution found:

1) the solution should not be wrong,

2) the solution should be justified,

3) be exhaustive. ... Therefore, verification of the problem solution and the correctness of the result should be the stages of problem solving.

After all this analysis and research, we come to the conclusion that problem solving is the main criterion in testing and evaluating student knowledge.

Conclusion

As can be seen from the conducted studies, methodological training should be organized more efficiently, and serious work should be done to prepare students for independent living and labor activity. From this point of view, in our time, when the tasks facing schools are expanding and becoming more complex, the problem of optimal organization of the educational process attracts attention as it is increasingly relevant.

Two main criteria have been identified for the optimality of mathematics teaching:

- achieving the highest possible results (level of education, upbringing and development) for the class or student;
- achieving these results with little time, effort, and resources [38, p.19].

The main condition is that both signs are taken together. If additional effort and time are spent, such training cannot be considered optimal. In order to achieve effective results, one of the tasks of training in primary schools is to create the skills and habits of solving mathematical problems in students. Because problem solving has both general educational and educational significance.

Problem solving gives a great impetus to the development of students' thinking skills and logical thinking, and trains them in practical skills such as reasoning, justifying the solution of the problem, and checking the correctness of the answer. For this, students should be taught and shown ways to formulate their own independent problems. Thus, the forms of the student's own independent problem formulation shown in the dissertation contribute to the conscious application of mathematical knowledge. “Psychological research shows that in the independent formulation and solution of the problem, mathematical rules are remembered more fully and firmly than in those that are simply solved” [5; 12].

In elementary grades, methods and techniques should be used to solve problems that are aimed at forming students' abilities to make independent judgments, examine similarities and differences, draw conclusions from what is known by making generalizations, and at least partially develop their search and research abilities when solving not very difficult problems. Pedagogical research shows that the purposeful use of the problem in teaching is divided into specific complex problems. These problems, having their own characteristics, are organically interconnected. The global setting of this problem consists of teaching the solution of mathematical problems or teaching mathematics through problem solving. In both cases, the content of the problems is preserved, which reveals the main tasks of the problem.

One of the main issues facing schools is the improvement of the content of mathematical education. The issue of the content of mathematical education in primary grades has been seriously discussed in the pedagogical press since the end of the 20th century. Thus, students are not able to see all the practical applications of mathematics. One of the main forms of application of the mathematical knowledge and skills acquired by students is problem solving. In order to overcome the difficulties encountered by students and increase the efficiency and quality of mathematics education, it is important to find effective ways of solving problems.

We can say the following about the important benefits of problem solving:

- Elementary school students witness the process of independent work and become accustomed to it when solving problems independently.
- The habits of independent work and achieving one's desires learned in elementary school help them to make independent and decisive decisions in the future and to develop their personality .
- Brain functions develop, mental and intellectual abilities increase.
- They develop the ability to help and assist among elementary school children in a properly structured creative lesson process.
- It helps instill in them self-confidence, trust in comrades, friends, and other abilities.

As noted, in the subject curricula applied in mathematics in primary schools, teaching children theoretical knowledge is considered very important and creates the basis for the implementation of some didactic functions in the teaching process. In particular, it should not be forgotten that the main important issue that determines the relevance of the issue is the establishment of an educational process that will serve to increase the knowledge and skills of primary school children and develop their mental abilities, which is one of the most important issues facing modern Azerbaijani education, and in this case, innovative and interactive teaching methods and the advantages of modern education can be used.

Suggestions.

Based on the results of research and experiments conducted on optimizing mathematics teaching in elementary grades through problem solving, the following suggestions can be made.

1. The functions of the problem in teaching mathematics in grades I-IV, their place and role in teaching, and ways to improve the system of mathematical problems in elementary grades were shown, a coherent explanation of the main functions of problem solving (instructional, educational and developmental) and their subordination to the main methodological function were justified.

2. By studying the specific system that characterizes the content of the problem in a narrow context, but has broader possibilities, we have determined that the system of problem-solving methods should include, along with known mathematical methods, general methods of problem-solving based on the method of scientific cognition.

3. The requirements related to the system of problems of the mathematics course for primary grades have been methodologically developed, and as a result, it has been shown, based on the teaching of individual topics, that through problem solving, it is possible to achieve the unity of

the educational, educational and developmental functions of students directly in the lesson and in the implementation of independent work.

4. In the mathematics course of primary grades, solving the given problems as a means of developing the learning capabilities of students serves as a way to develop their logical thinking, creative working ability and cognitive interest. By observing this principle, the correct organization of teaching the solution of mathematical problems in all our secondary schools can be directed to this format. Developing cognitive ability and increasing desire is a very important factor.

5. The psychological and pedagogical characteristics of problem-solving training, methodological principles, and especially the leading role of vital issues in optimizing learning through problem solving have been substantiated in optimizing the teaching of elementary mathematics. The study also showed that the formation of students' mathematical thinking in the process of problem solving is a psychological process that contributes to the optimization of learning.

6. Ways to effectively use problem solving in testing and assessing students' knowledge in primary grades, to ensure that the educational, training, and developmental functions of problem solving training are easily fulfilled, and to increase and strengthen the opportunities for applying knowledge have been explored.

7. It is explained that solving mathematical problems in primary grades generally contributes to the study of mathematical expressions, a deep understanding of their essence, and that these solutions contribute to the optimization of the teaching of theoretical material in mathematics. It is also justified that problem solving plays a role in the foundation for acquiring new knowledge, develops the creative activity of students, and gradually leads them to independently carry out the solution process.

8. The development and education of elementary school students' mathematical knowledge through problem solving and ensuring the uniformity of teaching were shown as a result of the research.

The following suggestions can be made in accordance with the results of the study:

1. It should be the duty of every teacher to make optimal use of problem solving and its functions in the study and understanding of any topic in the elementary mathematics course.

Problem-solving training should create a foundation for the student's comprehensive development and the formation of mathematical worldviews.

2. Problem solving should be used both as a goal and as a means of learning in primary grades. For this, optimal problem solving options, the necessary knowledge on which students are based, problems taken from life, and solving these problems in various ways should be effectively used.

3. In order to implement problem-solving training as a complete system of activities, the process of students' assimilation should be optimally organized. For this, favorable conditions should be created for the interaction and dependence of the general logic of the mathematics being taught and the student's mental activity, including theoretical thinking.

4. In order to ensure effective comprehension of theoretical material, it is necessary to select optimal methods, tools, and forms of problem solving, and to achieve an organic connection between theoretical materials and problem solving in the study of each topic.

5. In order to optimally organize the learning activities of students, conditions should be created for them to solve problems independently and use optimal ways of formulating problems. Also, continuity should be ensured between the problems solved in independent and additional work and the solutions to problems covering the program material.

6. By systematically working on the application of the main methods of problem solving and the formation of the ability of students to find ways to find solutions, a system of well-thought-out problems that meet methodological requirements (in accordance with the topic) should be selected. It should be borne in mind that problem-solving training should activate and develop such thinking operations in students as thinking, reasoning, comparing, concretizing and generalizing.

7. Problem-solving training should be organized in such a way that it prepares students not only for the learning process, but also for full training, education, and development, forming in them a system of mathematical knowledge, skills, and habits, as well as independent knowledge.

8. The methodological structure of problem solving should serve the systematic development of students' real learning opportunities, corresponding to all their main components.

The main components include the following:

a) Psychological (analysis, synthesis, generalization, independence, rationality of thinking, etc.)

b) Teaching work habits (self-control, ability to plan one's own activities, etc.)

c) Educational character (worldview, interest, principledness, etc.)

In the teaching of the elementary course of mathematics, the mathematics teacher must know the necessary economic and applied, mathematical and scientific materials in the educational process and take them into account when selecting problems. When using productive teaching methods in the process of solving mathematical problems, the following specific features should be taken into account:

- taking into account teacher-student equality when solving problems;
-taking into account students' mathematical abilities, cognitive independence and freedom;
-Arousing interest in the issues being solved and ensuring student activity;
- using various methods to focus students' attention on problem solving;
-increasing students' cognitive activity through thought-provoking and guiding questions.

It should be noted that solving problems using different methods not only conveys different facts to students, but also teaches them mathematical methods, and at the same time strengthens their thinking abilities. Various methods of solving problems are mastered primarily as a result of solving a large number of both mathematical and non-standard problems. Based on a pedagogical experiment conducted to solve the problem of increasing students' cognitive activity through problem solving in primary grades and to determine its theoretical and methodological effectiveness, it was determined that the learning results achieved in experimental classes based on the proposed methodological system were 11%-13% higher than in control classes. During the observations conducted, it was determined that students in experimental classes also differ in the formation of problem-solving skills and cognitive activity. The pedagogical experiment showed that as a result of increasing students' cognitive activity through solving mathematical problems, students - develop the ability to independently acquire knowledge, - develop logical, critical and creative thinking, and also acquire the skills to solve problems and make decisions.

The results obtained in the study can be widely used in the development and upbringing of spiritual and moral qualities in secondary school students. The emergence of new creative options in the spiritual development and improvement of young people will create a basis for the development of their personal qualities. By knowing the direction of the development dynamics of intellectual abilities and moral and cultural qualities in our secondary schools, it is possible to become more familiar with their ideas about themselves and to eliminate a number of shortcomings in this age period. At the same time, the results of the research work can be used in the preparation of scientific and methodological recommendations for teachers, in the research work of specialists of scientific and research institutions engaged in studying the socio-psychological aspects of pedagogical activity, school and educational issues.

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