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Characteristics of Algebraic Material in the Course of Mathematics of Primary School

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Abstract: The algebraic material in the course of mathematics of primary school performs an auxiliary function in the study of the basic (arithmetic) content of the program.

Keywords: Algebraic material, primary school

Introduction. The inclusion in the content of training of elements of algebra, especially exercises with functional content, allows you to see the dynamism of real-world phenomena, mutual conditionality and connection of quantities, and this has a great influence on the formation of the worldview of students. The study of algebraic material contributes to the development in students of such logical techniques as analysis and synthesis, generalization and concretization, induction and deduction.

The introduction of elements of algebra is of great importance for improving the system of primary mathematical education, expanding the arsenal of mathematical tools used by schoolchildren when solving problems. Letter symbolism introduced in primary schools, and the related concept of a variable contribute to the generalization of knowledge about numbers, properties of arithmetic operations. Thus, work is being carried out on the functional propaedeutics of one of the most important concepts of modern mathematics, the concept of correspondence. The use of equations for solving problems can significantly change the entire system of teaching problem solving.

In general, the algebraic material in the course of mathematics of primary school performs an auxiliary function in the study of the basic (arithmetic) content of the program.

Methods. With the first expressions - sum and difference - children get acquainted when studying addition and subtraction in the concentration "Ten". I do not use special terms, first-graders make calculations, write down expressions, read them, replace the number with a sum, based on visual representations. At the same time, they read the expression 4 + 3 as follows: "add three to four" or "increase 4 by 3", and the expression 4 + 3, and the expression 4 + 3 - 3 - "subtract three out of four" or "4 reduce by 3". Finding the values of expressions consisting of three numbers that are connected by signs of addition and subtraction, students actually use the rule of the order of performing actions implicitly and perform the first identical transformations of expressions.

after becoming familiar with expressions of *the form* $a + b$, first-graders first use the term "sum" to refer to the number that results from addition, that is, the sum is interpreted as the meaning of the expression. Then, with the advent of more complex expressions such as the form $(a + b) - c$, there is a need for a different understanding of the term "sum". The expression $a + b$ is called the sum, and its components are called sum. - Terms: When introducing expressions of the form $a - b$, $a \cdot b$, $a : b$ do the same. First, the difference (product, particular) is the meaning of the expression, and then the expression itself. At the same time, students are informed of the names of its components: reducible, subtractable, multipliers, divisible and divisor. For example, in the equality $9 - 4 = 5$ 9 is reducible, 4 is subtractable, 5 is the difference. The entry $9 - 4$ is also called the difference. You can enter these terms in another sequence: invite students to write down example $9 - 4$, explaining that the difference is recorded, and calculate what the recorded difference is. The teacher enters the name of the resulting number: 5 is also a difference. Other numbers are called: 9 - decreasing, 4 - subtracted.

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Memorization of new terms is facilitated by posters of the form

Decreasing Subtractable Difference (difference value)
7 – 3= 5

Difference

To reinforce these terms, exercises such as "Calculate the sum of the numbers; Write down the sum of the numbers. compare the sums of the numbers (insert the > sign, < or = instead of * into the 4 + 3 * 5 + 1 record and read the resulting record); replace the number with the sum of the same (different) numbers; fill out the table; make examples from the table and solve them. It is important that children understand that when calculating the sum, the specified action (addition) is performed, and when writing down the sum, we get two numbers connected by a plus sign.

At the next stage of mastering the concept of expression, students are introduced to expressions that use parentheses: (10 – 3) + 4, (6 – 2) + 5. They can be introduced through text problems. Another approach is possible. The teacher suggests compiling the sum and difference of numbers 10 and 3 on the set canvas using cards on which these numbers and action signs are written. Then the difference 10 compiled by the students – 3 the teacher replaces with a pre-prepared card with this difference. The next task is to compose an expression (at this stage of training it is referred to as an example), using the difference, the number 4 and the + sign. When reading the resulting expression, attention is drawn to the fact that its components are the difference and the number. "To make it noticeable," says the teacher, "that the difference is a term, it is enclosed in brackets."

Results. Independently constructing expressions, children are aware of their structure, master the ability to read, write, calculate their meanings.

The formation of the concept of numerical expression is closely related to the teaching of students to solve text problems.

Example. Let's explain this with a specific example. Students are offered a condition of the problem: "3 boxes of tomatoes of 10 kg each and 6 boxes of cucumbers of 15 kg each were brought to the store." The task condition contains 4 numerical data. First, students choose arbitrary pairs of values and write down the following simple expressions that can be explained based on the condition of the problem: 3 + 6 - the total number of boxes, brought to the store; 10 · 3 is the mass of all tomatoes; 15 · 6 - the mass of all cucumbers; 6 - 3 - so many more boxes of cucumbers than tomatoes; 6 : 3 - so many times more boxes of cucumbers than tomatoes; 15 - 10 - so much more than the mass of one box of cucumbers than a box of tomatoes. Then the teacher invites students to write down complex expressions containing two or more actions, relying on composed simple expressions. Expression 6 · 15 – 3 · 10 corresponds to this condition and allows you to answer the question: "How many more cucumbers than tomatoes were brought to the store?" 6 + 10 · 3 corresponds to the question: "How many vegetables were brought to the store?"

Discussion. The first stage of the formation of ideas about a variable value is implemented in the first grade, when students begin to practice performing tasks with "windows" (omissions). the window is not accidentally used to reveal the concept of a variable, since in the modern interpretation it denotes a sign that plays the role of a "place holder" for the names of a certain given set (the range of values of the variable) - sets of non-negative integers in the initial course of mathematics.

In the textbook of mathematics for the first grade there are entries of the form 3 +□ = 5; □ +□ = 6; 5 > ; 0 > , the tasks for which can be formulated in different forms, for example: "Which of the numbers must be written in the window to get the correct notation? Restore the missing number in the record." Initially, when performing such exercises, visual aids are used. Then, as knowledge accumulates, students abandon it. So, when finding a number that needs to be inserted into the "window" in the record 3□□ +□ = 5, it is proposed to try to substitute the numbers from 0 to 4 in the

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"window" alternately. First, such work is carried out on a set canvas. Substituting cards with the corresponding numbers in the "window", students find out whether the record is correct or incorrect, either with the help of visual aids or relying on knowledge of addition tables. Then examples of this type are solved with oral analysis.

The disclosure of the concept of a variable is also facilitated by the work on filling out tables:

Minuend	1	4	6	7	9
Subtrahend	1		2	3	
Difference		3			6

Such exercises contribute not only to the improvement of computational skills, but also to the development of an idea of a variable and its set of values. After filling out the table, students can be asked the following questions: "To these values take the decreasing; subtrahend; difference? And whether we red uceit; subtractable; difference? How do they change? » In some tables, the values of one of the components may be constant. Thus, children see that a variable can take not only different, but also the same values.

The second stage in the formation of the concept of a variable is the introduction of letters as symbols to denote a variable. At this stage , a combination of inductive and deductive methods is widely used. By making the transition from a numerical expression to a letter expression and from a letter to a numeric one, students thereby generalize the meaning of numerical expressions and concretize it, substituting numerical values instead of letters.

At the last (third) stage, letter symbolism acts as a means of generalizing students' knowledge about the properties of actions, the interrelations of the components of actions. Generalization occurs on the basis of incomplete induction. Students get acquainted with a certain set of homogeneous expressions. With the help of analysis, comparison, synthesis, they establish the general and essential properties of these expressions, i.e. come to generalized theoretical knowledge. Therefore, the use of letter symbolism as a means of generalization The formed knowledge can be carried out only when students repeatedly observed the generalized properties, dependence, formulated them and used them when performing various exercises. Students come to understand that the use of letter symbolism to write certain dependencies, properties, relationships means that the studied dependencies are valid for any values of variables. To this end, it is necessary to provide exercises by which students master the ability to write with letters the properties of arithmetic operations, the interconnection of the components of actions, to read properties and dependencies recorded with the help of letter symbols, to perform identical transformations of expressions with variables based on knowledge of the properties of actions, the meaning of arithmetic operations, to prove the validity of equality or inequality, relying on knowledge of the elements of the theory.

Conclusion. In accordance with the program, equations of the first degree with one unknown of the form are considered in the primary grades: $7 + x = 10$, $x - 3 = 10 + 5$, $x \cdot (17 - 10) = 70$, $x : 2 + 10 = 30$. Equations in the elementary grades are considered as valid equations, the solution of the equation is reduced to finding the meaning of the letter (unknown number) at which this expression has a specified value. Finding an unknown number in such equations is performed on the basis of knowledge of the relationship between the result and the components of arithmetic operations (i.e. knowledge of ways to find unknown components). These requirements of the program determine the methodology for working on equations.

In *the preparatory stage* for the introduction of the first equations in the study of addition and subtraction within 10, students learn the relationship between, the sum and the terms. In addition, by this time the children have mastered the ability to compare the expression and the number and get the first ideas about numerical equalities of the form: 6 + 4 = 10, 8 = 5 + 3. Of great importance in terms of preparing for the introduction of equations are exercises for the selection of the missed number in equalities of the form 4 + □ = 6, 5 - □ = 2, □ - 3 = 7 (II class). subtracted).

At the *first stage* (iii class) there is a studentin with the equation in the course of solvingthe problem with abstract numbers, for example: "To an unknown number 3 were added and 8 were obtained. Find an unknown number." For this problem, an example with an unknown number is drawn up, which can be written as follows: □ + 3 = 8. Then the teacher explains that in mathematics it is customary to denote an unknown number in Latin letters. One of the letters is written and read - x (x). It is proposed to designate an unknown number with a letter and read the example.

For a long period, students have been practicing reading, writing, solving and testing such equations, with the simplest expressions of all kinds in various combinations included in the left and right parts of them.

Then equations are included in which one of the components is specified in the form of a numerical expression, for example: $x + (60 – 48) = 20$, $(35 + 8) – x = 30$. It is useful to learn to read these equations with the naming of components (for example: "The first term is unknown, the second is expressed by the difference in numbers 60 and 48, the sum is equal to 20"). To read the equation, you should establish the order of actions in the expression, Highlight the last action, recall, call numbers when you perform this action, and read with the name of the components and result. As you can see, such reading requires analysis of the expression, while immediately isolating an unknown component and specifying which expression is specified by the known component.

As in the previous case, first simplify the given expression, and then solve the simplest equation. For example, in the equation (35 + 8) – x = 30, they calculate what is equal to the reducible and get an equation equivalent to the first: $43 – x = 30$, which children are able to solve. When practicing the skills to solve the equations of the structure under consideration, use equations whose solution is based on knowledge of the relationship between the results and components of only the actions of addition and subtraction; in I V class - all four actions.

At the *third stage* (III class) the methods of solving themost complex x equations are studied, in which one component is an expression containing an unknown number, for example: $(x + 8) - 13 = 15$, $70 + (40 - x) = 96$, etc., since when solving the equations of a given structure, it is necessary to apply the rules for finding unknown components twice. For example, the lesson considers the equation $(12 – x) + 10 = 18$.

Acknowledgement. The program does not set the task of teaching students how to solve inequalities. However, very often in practice, for example, when studying the relationship of order on a set of natural chivillages, exercises of the following type are used: < 4; > 7; 3 >□□□ .

Students are asked to find a number that needs to be inserted into the "window" to get a correct notation (true inequalityo). In the future, the inequalities become more diverse, the structure of the compared expressions becomes more complicated. An unknown number is compared with the expression (24 – 6 <), it can also be one of the components of the expression (15 <□ 15 +□, 10 – 3 <).□

After introducing letters as symbols to denotea variable , the inequality takes the form: $2 \cdot a < 8$. Such inequalities are also solved by selection. To facilitate the solution of inequalities, the tasks are formulated as follows: "From the series of numbers 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, select those values of the letter a at which the inequality a is true · 2 < 12". Then the exercises become more complicated. Students must independently choose the values of the variable at which this inequality will be truem: "Choose such numbers so that the inequalities are correct: $12 + x < 15$; $a : 5 < 4$".

Although the main method of solving inequalities with a variable is the selection method, in some cases, for example, when solving an inequality of 5 + c > 5 + 2, the student can, using the dependence between the components and the result of addition, immediately name 1-2 numbers that satisfy the inequality. However, in this case, he must prove that he found the numbers correctly, that is, substitute these numbers in the inequality instead of the letter.

Students are then taught the following, rational way of solving inequalities: first, they compile and solve the corresponding inequality, for example, for inequality $x \cdot 5 < 40$ solve the equation

$x \cdot 5 = 40$
$x = 40 : 5$
$x = 8$.

Therefore, the values *of* $x < 8$, i.e. 0, 1, 2, 3, 4, 5, 6, 7, are suitable for inequality.

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