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Study of operations on complex denominated numbers

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Abstract:

In the article, the concept of numbers was created as a result of the measurement of like quantities or the comparison of two like quantities. In order to compare two pieces of straight line, one piece is accepted as a unit of measurement and the number of its position on another piece is defined. The concept indicating the ratio of two like quantities is called numbers and so, the value of quantity is determined.

It is noted that the first insight is created on the quantity and value of it even in the trainings in kindergartens in order to formulate mathematical representations in children and this process is continued since the first class. Complex denominated numbers and the operations on them are featured especially in the fourth classes.

It is noted that the value of quantity can be expressed by basic and derived units of measurement and the number obtained is called complex denominated number.

Methodological suggestions or results related to the subject are given at the end of the article.

Key words: mathematics, quantity, number, straight line, unit of measurement, student

The object of mathematics consists of the quantities and the operations on them. Each quantity is measurable and requires relevant units of measurement for this. Numerical value of quantity is defined as a result of its measurement. The concept of numbers just originated as a result of the measurement of like quantities or comparison of two like quantities. In order to compare two pieces of straight line, we accept one piece as a unit of measurement and define the numbers of its position on other piece. The concept indicating the ratio of two like quantities is called numbers and so we determine the value of quantity. The first insight is created on the quantity and value of it even in the trainings in kindergartens while formulating mathematical representations in children and this process is continued since the first class. Complex denominated numbers and the operations on them are featured especially in the fourth classes. We often meet the expression “denominated number” and when we ask students “to say any denominated number” they say 5,7,12, etc. And in response to the question “Why” they say the name of 5 is five. Certainly, each number represents the number of abstract unities related to it, and this is not a denominated number. Denominated number is the number indicating the numerical value of any quantity (by relevant unit of measurement). For example, 5 m, 6 m 8 dm, 25 kg 500 g etc. So, denominated number may be defined as follows:

The number indicating the value of quantity by relevant unit (units) of measurement is called denominated number. The rest of the numbers are abstract numbers. They are used to indicate the values of quantities.

Depending on the units of measurements of quantities and their system, metric units of measurement (for example, units of time) are divided into two groups.

It is clear that, there are two types of units of quantities:

1. Base units of measurement
2. Derived units of measurement

For example, “Meter” is the base unit of length. The rest of the units of length are derived units of measurement.

In the same order, year and day are base units of time, and the rests are the derived units of measurement.

It is clear that the value of quantity may be indicated by base and derived units of measurement and the number obtained is called complex denominated number.

For example, 2 years 18 days, 6m 3dm 8 cm etc.

As it is seen, units of measurements may not be expressed consistently in the written expression of complex denominated numbers. For example: 5m 2cm. We can also type it as 5m 0dm 2cm. And we will get a number without intermediate stage unit (zero) as a result: 502cm. Here we expressed the unit of quantity by a small unit of measurement. 6km 80m, 5kg 50g, 9m 60cm, 10man 20cop etc. can be indicated in the same way. While performing the operations on complex denominated numbers, the student meets with the numbers the intermediate stage unit of which is zero and he/she makes a mistake in the calculation if he/she is unaware of the quantitative relationship between the units of measurement. The relationship between the units of measurements of quantity is also expressed by numbers, so the student has to perform additional calculations during the process of conversion. As it is seen, performance of operations on complex denominated numbers is based on two grounds:

1) Proper execution of operations on abstract numbers,
2) Proper execution of operations on ordinary denominated numbers.

In addition, the rules for the cross partition and conversion of units of quantity must be also taken into account. So while performing the operations on denominated numbers, both the numbers given and the numbers expressing relationships between the units of measurement must be taking into consideration.

Experience has shown that sometimes teachers don't pay attention to this feature enough and students make gross mistakes as a result. For example, the operation of subtraction 5km 86m – 2km 92m must be performed. After performing 6-2=4, 18-9=9 and 4-2=2 student obtains 4 km 94 m in response.

In fact, it had to be 4km 994m. Teacher must teach the writing procedure as follows, in order to avoid making mistakes. There is no stage of hundred (because the units of measurement such as km and m were given),so the same stage must be indicated by zero: 5km 086 m - 2km 092m or 5086m – 2092m or 4km 1086m – 2km 92m

The student using these three methods or one of them will not make a mistake. We consider that each of these forms has own didactic functions. However the second form of form is more effective. These forms must be applied regularly.

While defining quantitative relationships between the units of quantities, students make mistakes. For example: they can't find the proper relationships between the units of weight. They make mistakes in the problems on cross partition and conversion between tonne and centner, tonne and kg, etc. units of money. For example, in the problem 38 man 9 cop · 26, 389 copeck is obtained instead of 3809 copeck as a result of cross partition.

In general, the operations of crosspartition and conversion of denominated numbers play an important role to perform the operations on the same numbers properly. At the same time we meet the cases when the one or two of intermediate stage of number are zero in the process of cross partition. For example,

15man 7cop = 1507cop:

4t 64kg = 4064 kg;

8c 5kg=805kg;

24m 8cm = 24 · 100cm + 8cm = 2408cm etc.

During the process of operations on denominated numbers, the mistakes mostly arise from the improper form of components.

For example, two methods can be used while solving the problem 18km 85m - 9km 96m:

1) By the cross partition in columns,
2) By the cross partition firstly.

Students make a mistake in both methods.

We think that the cross partition methods must be taught to students in the first stage to avoid making mistakes. After that operations on denominated numbers must be taught without cross partition. In particular, students mostly make a mistake during the multiplication of complex denominated numbers.
For example:

1) in the problem 24man 8cop·23, cross partition must be performed firstly and multiplication must be performed after that. Reconversion must be used in sum:

2408cop × 23 = 55384cop=553man 84cop

2) While solving the problem 15km 85m - 8km 98m, some of the students get the following answer: 6km 87m. In fact, the answer must be 6km 987 m.

As it is seen, student makes certain mistakes during the multiplication of denominated numbers.

On the basis of all these, we can come to the following conclusion:

In the multiplication of complex denominated numbers, the most effective form of writing operation of multiplication after the numerical cross partition, knowledge on cross partition and conversion are repeated.

It is clear that the measurement of areas and volumes and the calculation of values are reviewed in the fourth class and the relationships between the relevant units of them are found.

However, the students often forget that proportionality factor in the crosspartition and conversion of units of area is 100 and they equate with the units of length. The most important issue in the calculation of areas is the correct spelling of operation. Because they mostly don't consider the possibility of arithmetic operations in the calculation of areas and volumes on quantities and make a mistake as a result.

As is known, axioms of operations must be guided on the quantities:

1. Like quantities can be added and subtracted.
2. Like quantities must be divided.

3. Quantity can be multiplied and divided by unknown (abstract) number.
4. Quantities can't be multiplied. In this case, the definition of the operation of multiplication is important.

Exercise. The length of reservoir is 12m, and the width is 8m. Find the area of the reservoir.
As it is known that quantities given are homogeneous. So, m^2- must be used to measure the area:

$S=(1m^2 \cdot 12) \cdot 8$ or,

$S=12m^2 \cdot 8 = 96m^2$

Other forms of spelling of problem solving can be applied:

$12m \cdot 8m=96m^2$

$12 \cdot 8=96(m^2)$

The first of the last two forms is grossly wrong. Because, based on the definition of multiplication, 12m can't be added 8m times. And even if the second form is abstract, it is considered correct.

The students come to a conclusion that the area of reservoir is measured by m^2. If the dimensions of object given were expressed with the different units of measurement, then they must be typed in the same unit of measurement. For example, if the sides of the rectangle are 8dm and 14cm, then cross partition must be used to calculate the area. You need to know quantitative relationship between the units of measurement in the calculation of areas:

$1m^2=100dm^2$, because $1m=10dm$, then $1m^2=10^2\ dm^2$ or $1m^2=10 \cdot 10dm^2=100dm^2$

In the primary schools the students study the concept of capacity and the concept of liter since the first class. In the fourth class the volumes are calculated in the similar way and cubic meters, liter and barrel are used as the units of measurement.

Quantitative relationships between the units of volume are based on the laws of the metric measurement system:

$1m^3=1000dm^3$

$1dm^3=1000cm^3$

$1km^3=10^9m^3$

Teaching of operations on denominated numbers is directly related to the quantities and both verbal and written calculations are used here as well.

We can get the following methodological suggestions and results on the subject under discussion:

1. Knowledge and skills related to the performance of four calculation operations on denominated numbers and their writing forms must be strengthened.
2. The cases when there is zero in intermediate stages of number must be paid attention in the studies related to the operations on denominated numbers.
3. Attention should be paid to the use of known properties, efficient calculation methods in the process of the performance of operations on denominated numbers.
4. Various forms must be used in the writing of operations on denominated numbers while solving textual problems.

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