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Methodological foundations of the study of mathematical concepts in primary school

Currently, Kazakhstan is reforming the education system, focused on entering the world educational space. This process is accompanied by significant changes, so in secondary education, the transition to updated content is systematically carried out. The development and implementation of new state mandatory standards at all levels of education, methods and training programs, improving the level of teaching, training in popular knowledge, skills and abilities is largely dictated by the conditions of a dynamically changing world.

The main goals and objectives, principles and priorities of the development of Kazakhstan's education are defined in regulatory documents: the Law of the Republic of Kazakhstan "On Education" [1], the State Program for the Development of Education of the Republic of Kazakhstan for 2020-2025 [2], the State Mandatory Standard of Primary Education of the Republic of Kazakhstan [3], etc. The Law “On Education “of the Republic of Kazakhstan states that" general educational programs of primary education are aimed at the formation of the child's personality, the development of his individual abilities, positive motivation and skills in educational activities: strong reading, writing, counting skills, experience of language communication, creative self-realization, culture of behavior for the subsequent development of educational programs of primary school” [1]. In the State Program of Education Development for 2020-2025, one of the goals is to "increase the global competitiveness of Kazakhstan's education and science, education and training of the individual on the basis of universal values” [2].

Primary school is the foundation of education, since it is during this period of training that knowledge and skills are laid that ensure not only the further development of the child, but also active perception and understanding of the surrounding reality, independent planning and building of their actions.

The State compulsory Standard of Primary Education of the Republic of Kazakhstan stipulates that “the content of primary education is oriented towards learning outcomes and is determined ... by the need to develop critical, creative and positive thinking” [3].

Stimulating the growth of mental abilities of younger schoolchildren is carried out in the process of educational activities, by mastering students not only empirical knowledge and practical skills that contribute to the development of theoretical thinking, as a mental neoplasm in children of primary school age, but also the development of one of the forms of social consciousness, which include scientific concepts.

The concepts that are studied in the initial course of mathematics are usually presented in the form of four groups. Number, summand, addition, less, more, i.e. all concepts that are related to numbers and operations on them are included in the first group. The second category includes algebraic concepts: equation, expression, equality. The third is formed by geometric concepts: square, segment, straight line. And the fourth group consists of concepts that are related to quantities and their measurements [4].

In logic, concepts are considered as a form of thought that reflects objects (phenomena or objects) in their essential and general properties. The language form of a concept is a word or group of words. To form a concept of an object means the ability to distinguish it from other similar objects.

Mathematical concepts have a number of features, the main of which is that the mathematical objects that need to be defined do not exist in reality, they are created only by the human mind, they are ideal objects that reflect real phenomena or objects.

The mathematical concepts of "number" and "quantity" are also the result of abstraction.

Mathematical objects exist only in the thinking of man himself in those signs and symbols that form the mathematical language.

Studying quantitative relations and spatial forms of the material world, mathematics uses not only various methods of abstraction, but it itself acts as a multi-

stage process. It is important to remember that this science studies not only the concepts that appeared in the study of real objects, but also the concepts that appeared first.

It is important for teachers to have knowledge of the scope and content of concepts, relations between them, and about the types of definition of order in the initial course of mathematics to possess common approaches to the study of concepts.

Any mathematical object has certain properties. As a rule, there is a distinction between essential and non-essential properties of an object. If a property is inherent in a given object and cannot exist without it, then it is considered essential. Conversely, if an object can exist without a specific property, then it is irrelevant.

When talking about mathematical concepts, as a rule, they mean a set of objects that are denoted by a single term, i.e. a word or a group of words. For example, when we talk about a square in class 1, we mean all geometric shapes that are squares. Therefore, students believe that the set of squares is the concept of "square". From this comes the definition of the scope of the concept – this is the set of all figures that are denoted by one term.

But in addition to the scope of the concept, there is also its content. The content of the concept is the set of all essential properties of the object that are reflected in this concept. There is a certain relationship between the content and the volume of the concept, which is that if the content of the concept increases, then its volume decreases, and vice versa. It is very important to know in what relations different concepts can be, and also to be able to establish connections between them.

The relations between concepts are closely related to the relations between their volumes, i.e. sets.

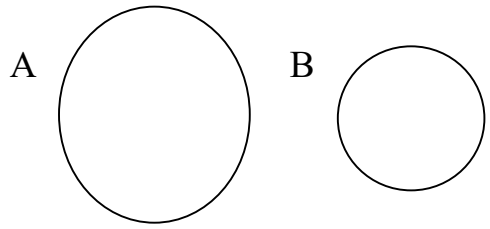
Relation of species and genus between concepts:

1) the concept of species and genus are relative, i.e. the same concept can be generic in relation to another concept. For example, the concept of " rectangle "is generic in relation to the concept of" square "and specific in relation to the concept of"quadrilateral".

2) for any concept, quite often you can specify several generic concepts.

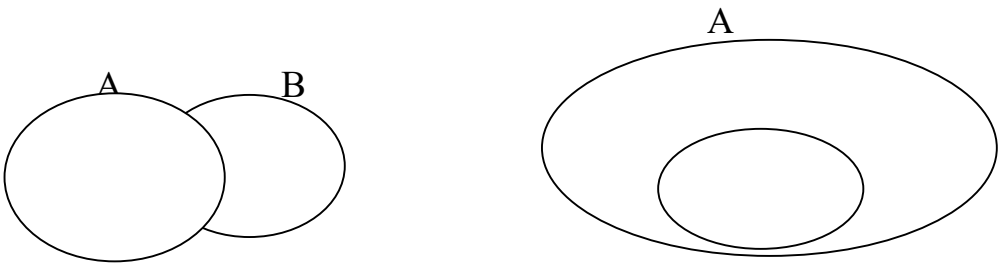
3) the specific concept has all the properties that the generic concept has [5].

Due to the fact that the volume of a concept is a set, it is convenient, when establishing relations between the volumes of concepts, to depict them using Euler circles:



1. The volumes of these concepts do not overlap, because no segment can be called a straight line, and no straight line can be called a segment.

2. The volumes of concepts are in relation to inclusion, but they do not coincide.



3. The volumes of these concepts overlap, but no set is a subset of another.

Speaking of such terms as "direct" and "cut" in class 1 we can say that they are in a relationship of whole and part. I.e. cut is part straight, not her appearance, so often (in our case the segment) do not necessarily have the properties of the whole, as it would be between the properties of species and genus concepts.

Due to the fact that new concepts appear in mathematics, and therefore new terms that denote these concepts, their definitions also appear. A definition is a sentence that explains the essence of the term itself, most often this is done on the basis of previously introduced concepts. The definition consists of two parts: the defined concept and the defining concept [6].

A species difference is a property (or properties) that allows you to distinguish certain objects from the set of objects of a generic concept.

Given that definition by genus and specific difference is that a conditional agreement on the introduction of a new term to replace a certain set of previously entered terms, then the definition is not saying true or false, because it does not disprove and not prove. But when formulating a definition, it is important to adhere to a number of rules.

1. The definition must be proportionate. Proportionality means that the volumes of the defined and defining concepts must be the same. This is based on the fact that the defined and defining concepts are interchangeable.

2. There should be no vicious circle in the definition (or their system). This rule is that you can not define a concept through itself or define it through another concept, which, in turn, is defined through it.

3. The definition should be clear. This means that the terms that are included in the defining concept should be already known to everyone by the time the definition of the new concept is introduced.

In order to ensure the brightness of the definition, the presence of a generic concept in relation to the defined is also very important. Its absence makes the definition disproportionate.

4. Through the genus and species difference, you can formulate the definition of the same concept in different ways. This is possible because of the large number of properties of the concept, because the definition includes only a few of them, on the basis of which it will be easier to build a theory.

In the study of mathematics is rarely used definition by genus and specific difference. This is due to the peculiarities of the course, as well as the capabilities of the students themselves. But despite this, there are many concepts in mathematics, so implicit definitions are often used for this. An implicit definition is a definition in which the definable and the determinant cannot be distinguished. Among them, contextual and ostensive definitions are also distinguished.

In contextual definitions, the content of a new concept is revealed through a context, a passage of text, or an analysis of a specific situation that describes the meaning of the introduced concept. Here, a connection is established between the defined concept and others that indirectly reveal the content of this concept.

Ostensive definitions are definitions by showing. The content of the concept is revealed by demonstrating the objects by which they are designated [7].

Before studying such a large number of concepts, it is important to have an understanding of the concept as a logical category and the features of mathematical concepts. It is important for the teacher himself to know and understand the relationships between concepts, as well as to be able to establish connections between them.

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