THEORY OF FORMATION OF GENERAL ACTIVITY METHODS IN THE PROCESS OF TEACHING MATHEMATICS

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Abstract. Various classifications of mental activity methods are reviewed. In the process of learning mathematics, the methods of general logical activity, which are important for their formation and development, and the methods of educational activity corresponding to them are emphasized. In the process of teaching mathematics, the theoretical basis of the formation of general logical activity methods of students is described.

Key words: methods of mental activity, methods of general logical activity, methods of educational activity, teaching mathematics, development of thinking, effective thinking, critical thinking.

Introduction. Thinking is the basis of human conscious activity. It should be an efficient, goal-oriented process. Well-developed thinking allows you to quickly clarify a particular situation, understand its causes and possible development, grasp situations and understand the laws as a whole.

One of the goals of teaching mathematics is the mental development of students, which includes the development of logical thinking, spatial concepts, algorithmic culture as a special aspect of thinking culture, memory, attention, intuition, analysis, classification, generalization, drawing conclusions using analogy. Learning mathematics provides ample opportunities to develop the skills of memory, logical and critical thinking, intuition, imagination, attention, perseverance, control and self-control.

Research analysis. In psychological-pedagogical studies, it was determined that the methods of mental activity are closely related to the methods of educational activity, and the latter includes a set of methods of mental activity that are interconnected and turn into each other. Dissertation research on the problem of influencing the development of students' thinking during the educational process was conducted by M.V. Dekarchuk [7], Yu.V. Litsman [14], D.N. Abduvalieva [2] and others.

The formation of mental activity in the process of teaching mathematics was considered in the researches of Z.I. Kalmykova [13], V.N. Osinskaya [20] and others. The authors classify general methods of mental activity into two groups:

- algorithmic type (algorithm for solving problems, rules for constructing concepts and mathematical sentences), i.e. methods of rational thinking that correspond to the laws of formal logic;

- heuristic methods encourage the search for solutions to new problems, open up new knowledge for the subject. Guides meaningful analysis of problems (comparison, separation of important, generalization, etc.).

According to the research of N.N. Pospelov [21], analytical-synthetic skills, i.e. logical methods of analysis and synthesis, are the leading ones. The authors look at their formation

through the sequence of problem solving. The problem-solving sequence assumes that the subject performs various forms of analysis. The basis of every analysis is the ability to perform "analysis" as a logical activity.

A number of studies [1,3,5,18,24] have been devoted to the formation of logical activity methods in algebra classes. Researchers reveal a number of advantages of algebra course materials in forming students' logical activity methods:

- allows interpretation of many algebraic concepts in terms of logic, using its symbolism. This allows to master logical methods of activity;

- in the course of algebra, it is possible to perform strict, compact and concise proofs based on the rules of deductive reasoning, which have a simple logical structure;

- Algebraic assertions involuntarily create a tendency to deductive reasoning in students compared to geometrical assertions;

- it is an effective tool for developing the ability to simplify complex algebraic expressions, to see, express and "finish" the structure of the whole. It is an important component of mathematical and general intellectual culture.

In her dissertation, I.V. Abdrakhmanova [1] clarifies the definitions of some logical activity methods (the author uses the term "thinking operations"). It offers a method of forming the skill of performing the method.

In the research work of V. N. Moiseva [18], the issue of formation of logical activity methods in the 10th grade students was studied in the process of teaching the subjects of exponential and logarithmic equations and inequalities. The author proposed a four-stage model of formation and developed a methodology.

But in the mentioned work, first of all, it is envisaged to teach students the methods of logical activity separately. The issue of integrating it directly into the content of the teaching process and ensuring its integration with other methods of educational activity has not been considered. Secondly, the change of the mathematics education program in the schools of our Republic, the corresponding educational literature and the change of the method of presentation require a critical study and development of the results of the above-mentioned dissertations.

Observing the process of teaching mathematics at school, conversations with school mathematics teachers allow to emphasize the following. At the moment, teachers do not know the exact methodical technology for developing students' mental activity in the process of teaching mathematics, but there is a spontaneous (spontaneous-dispersed) mastering of thinking operations in schools, which, in our opinion, leads to a low level of qualitative mastering of the content of mathematics programs by superficial students. The purposeful work of the mathematics teacher on the development of students' methods of mental activity leads to a change in the quality of their mental activity, which, in turn, helps to improve the quality of the formation of students' mathematical competences.

The main part. It can be observed that the content of the concept of "method" is interpreted differently in psychological and pedagogical literature. In particular, a method means a set of operations consisting of actions integrated into a certain scheme. The concept of "method of mental activity" is widely used in philosophical, psychological and pedagogical literature.

In philosophical literature, a method of mental activity is understood as a logical operation or a set of logical operations that are subject to the solution of a certain class of

problems. The productive activity of a person is closely related to his thinking work and is carried out through the following methods of mental activity: analysis, synthesis, comparison, classification, analogy, abstraction, generalization, etc.

There are different approaches to classifying the methods of mental activity. S. L. Rubinstein considers the operations of analysis and synthesis, comparison, abstraction and generalization to be methods of mental activity. The scientist considers all these operations to be components of the main operation of thinking - direct expression. A.G. Maklakov considered the main types of mental operations: comparison, assay (analysis) and synthesis, abstraction and concretization, induction and deduction.

In the psychological-pedagogical literature, mental operations are called differently: logical methods of thinking; thinking mechanisms; mental (intellectual) operations; method of mental actions, etc.

L.Rubinstein [22] emphasized that thinking is a process of analysis and synthesis. Moreover, methods of mental activity first arise as practical operations and only then turn into theoretical thinking operations. According to the scientist, in order to solve the problem in the process of thinking, it is necessary to move to more precise knowledge. The mind is able to know this because of the many operations that make up the various interrelated aspects of the thinking process and turn into each other.

We consider the analysis of the theoretical positions of psychologists about the functions and importance of mental activity methods in education. By methods of mental activity in teaching, psychologists often mean operational organizers that ensure the effectiveness of thinking. N.F. Talyzina [26, 27] classified the methods of logical thinking as general types of knowledge (cognitive) activity. Based on their tasks, the scientist identified two types of general methods of cognitive activity: a) methods that allow independent analysis of specific characteristics of a certain field; b) methods that allow you to reproduce the characteristics of this field. N.F. Talizina considered two ways of forming a method of mental activity: a) first, separate actions, components of the method are formed, and then they are combined into a single method; b) from the beginning, the method is formed as a whole. The psychologist explained that the first method is chosen when the actions included in it are complex and new. The actions included in the second method are used when they are relatively simple or their main part is not new. A.N.Kabanova, E.N.Meller [12] stated that the method of mental activity is the method that reflects the psychological stages of cognitive activity and provides the process of solving each educational task. It also emphasizes that the method of mental activity is hidden behind the method of educational activity. In addition, some methods of mental activity are fully compatible with the methods of educational activity. L.V. Zankov emphasizes the need to create conditions for the development of mental operations of analysis, comparison, and proof in order to master reading [6]. N.A. Menchinskaya and D.N. Bogoyavlensky [4] propose a theory of knowledge acquisition that includes the process of perception, test-synthesis, memorization, understanding and application.

Modern psychologists continue research on the place and role of mental activity methods in the learning process. S.D. Maksimenko [16] defines mental operations as the main components of mental actions formed on the basis of external practical actions.

Thus, based on the study of the work of psychologists, the following opinion can be stated: reading is one of the main mechanisms and an important condition of mental

development, and the main characteristic of reading is mastering the method of mental activity.

In pedagogy, mental (thinking) operations are often understood as a method of mental activity, with the help of which mental problems are solved.

S.P. Maksimyuk states: "The task of developing schoolchildren's thinking, will, emotions, educational interests, motives and abilities is to develop thinking on the basis of common mental actions and operations" [17]. In addition, it is emphasized that in order to study the problem situation in the educational process, students should independently use mental operations such as analysis, synthesis, comparison, analogy, and generalization.

Taking into account the results of the above-mentioned researches and the system of basic educational and cognitive activity methods necessary for students to acquire mathematical knowledge, developed in the researches of O.B.Episheva [8], analysis, synthesis, generalization, abstraction and concretization are the main activity methods for performing mental operations and we consider them as general methods of operation. Because these methods of activity form the basis of other logical thinking methods (working with concepts, working with reasoning, working with conclusions, searching for a solution to a problem, etc.). Below we present the descriptions of each of the main general logical activity methods and their corresponding educational activity methods.

Analysis – is a way of thinking that moves from effect to cause; with its help, the equation or inequality is mentally divided into meaningful parts of a certain order, each part is studied separately (a method of solving the problem is sought).

Implementation scheme of the educational method:

1) dividing the equation or inequality into meaningful parts (determining the composition of the equation or inequality; determining what algebraic operations are performed in the equation or inequality; determining the level of the equation or inequality or the level of the unknown involved in them; determining the logical structure in the equation or inequality);

2) separate research of each meaningful part (under what conditions the expression included in the equation or inequality has meaning, what results can be obtained from the given equation or inequality;

3) if necessary, to introduce the equation or inequality into communication and relationships with other, that is, previously worked out equation or inequalities or certain theorems (equal strength, equation-result);

Synthesis – is a method of thinking, in which it goes from the cause to the result caused by this cause; It is characterized by combining the meaningful parts of the equation or inequality into a whole, the solution of the equation or inequality.

Scheme of educational activities:

1) solving an equation or inequality based on a plan created as a result of analysis, or performing actions, solving an equation or inequality based on certain algorithms;

2) checking that the estimated roots belong to the field of determination of the equation or inequality;

3) write the answer.

Generalization – is a way of thinking that mentally separates a property common to several equations or inequalities and includes equations or inequalities with this property in a single class.

Scheme of educational activities:

1) to research, compare, solve several equations or inequalities to have a common property;

2) choosing a property;

3) inclusion of equations or inequalities with a selected property into one class;

4) to present the general formula of an equation or a class of inequalities or a general method of solving an equation or a class of inequalities.

Abstraction – is a way of thinking in which a single sign in an equation or inequality, or group of equations or inequalities, is isolated.

Scheme of educational activities:

1) selecting some (important) sign in an equation or inequality;

2) solving equations or inequalities, dividing equations or inequalities into meaningful parts, taking into account the isolated sign, ignoring other signs in the problem;

Concretization – is a way of thinking, in which a group of equations or inequalities that can be solved in the same way is separated, or it is carried out by reducing from a more general class of equations (inequalities) to a less general class, into a single equation (For example, partial quadratic equations consist of a concretization of the general form of complete quadratic equations).

Scheme of educational activities:

1) from a group of equations or inequalities, distinguish those that have a common class or a common solution method;

2) choosing one general property as the basis of concretization;

3) separate equations or inequalities with this property as a separate class;

4) research as a separate class with private solution methods.

General methods of operation are used at every stage of teaching mathematics and therefore play an important role in ensuring its effectiveness.

Summary.

The main thing is to activate the thinking process of students, first of all, to activate their thinking. In their mental activity, students often face various difficulties, which is mainly explained by the fact that in school practice there is still a spontaneous (impulsive) acquisition of thinking mechanisms, and there is no clear, consistent, structure for the formation and development of mental activity. Therefore, the teacher should build an educational system based on the consistent, logical and purposeful development of students' thinking, distinguish and focus on each of its methods. The development of general logical methods of teaching mathematics is relevant at every stage of the lesson, when solving every problem. In order to clearly visualize the goal set by the teacher and its final result, it is appropriate to see an ideal model of a student mastering mathematics. Our ideal student is a logical and independent thinker, can easily move from direct actions to inverse actions, and can find solutions independently. Our ideal student in teaching mathematics is characterized by considerable flexibility, mobility in thought processes and ease of transition from one mental operation to another. This model can serve as a kind of standard to which we should strive in the process of teaching mathematics to students.

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