FEATURES OF MATHEMATICAL THINKING OF STUDENTS, APPLICATION OF OBSERVATION, EXPERIENCE AND MEASUREMENT

Kuchkarov M.U.
Kuchkarov Mukhiddin Umaraliyevich
Associate professor of the department of specialty sciences, Andijan faculty Tashkent Institute of Finance
Andijan. Uzbekistan
https://doi.org/10.5281/zenodo.13990817

ABSTRACT

The aim of the study is to study and generalize the methodology of using empirical methods in teaching mathematics to students. Teaching methods are both a historical and a social category, as they change depending on historical and social conditions. Educational institutions are reformed, the content of education changes, and as a result, the methods of activity of teachers and students change. Educational institutions face new challenges, the content of education changes, and therefore teaching methods change. New means are used or traditional ones are improved. All this greatly complicates the interpretation of the essence of teaching methods.

Key words: Pedagogical environment, communication, development of personality, effectiveness of modern methods, interactive teaching, communication, process of teaching, interactive methods.

INTRODUCTION

Many mathematics teachers have seen from personal experience that it is possible to interest students in their subject by combining and combining various teaching methods. Any head of a methodological association will tell you that in education under his or her jurisdiction, every teacher uses modern technologies when conducting a combined lesson. And although the use of modern technologies in the lesson sometimes takes up most of the time (accordingly, there is no time left for consolidation and summing up, the most important components of the lesson), the teacher sacrifices this time for the sake of modernizing the lesson. A modern student is interested in visual knowledge of the world. When studying such a science as mathematics, experimentation and observation play a major role. After all, learning something new begins with perception, experience. Including learning mathematics as a subject. The introduction of empirical methods of cognition in the process of teaching mathematics allows the teacher to show the ways of the origin of mathematical knowledge, involve students in active heuristic activity, and justify the need to study the components of mathematical content.

RESEARCH METHODOLOGY

The effectiveness of the learning process depends primarily on the organization of students' activities. Therefore, the teacher strives to activate this activity with a variety of techniques, and therefore, along with the concept of teaching methods, we also use the concept of teaching techniques. A technique is an action of the teacher that evokes a response from students that corresponds to the goals of this action. A technique is a more specific concept in relation to the concept of a teaching method, it is a detail of the method.

Techniques can be determined by the characteristics of the learning system; in problem-based learning, this is the formulation of problem situations, in explanatory-illustrative learning, this is a detailed planning of students' actions to achieve specific goals, etc. Having a variety of techniques and differently organizing the nature of the activities of students and teachers, we, nevertheless, cannot unambiguously define the essence of teaching methods.

If the learning process is mainly characterized by the inclusion of students in direct practical activity (the learning process, as such, was of the nature of imitative activity in the early stages of its emergence), then teaching methods can be defined as ways of including students in practical activity with the aim of developing the appropriate skills and abilities in them.

Recently, we have been paying more and more attention to the development of the motivational side of learning, so teaching methods can be considered as ways to stimulate students' cognitive activity.

Thus, teaching methods are ways of transmitting knowledge to students in a finished form, and ways of joint activity of the teacher and students in learning the essence of individual phenomena, and ways of organizing independent practical and cognitive activity of students and, at the same time, ways of stimulating this activity.

Different textbooks provide different definitions of teaching methods, but they all reflect only individual aspects of this pedagogical phenomenon. It is practically impossible to give an unambiguous definition of a teaching method, or to name their exact number. Everything depends on which aspects of the learning process, which classical teaching systems are considered a priority and what is taken as the basis for the classification of teaching methods.

Empirical methods include the following types of methods:

- Observation - purposeful perception of phenomena of objective reality.
- Measurement - comparison of objects by some similar properties or sides.
- Experience (experiment) - observation in specially created and controlled conditions, it allows to reconstruct the course of the phenomenon when repeating the conditions.

These methods are not characteristic for mathematics, since mathematics is not an experimental science, and, therefore, experimental confirmation cannot serve as a sufficient basis for the truth of its propositions. This is undoubtedly true if mathematics is understood as a set of ready-made, already constructed deductive theories, but this is incorrect if mathematics is understood as mental activity, the result of which are such theories. In the latter case, deductive theory is only one phase of mathematics. But it has two more phases - the phase of accumulation of facts (experimental, intuitive) preceding the deductive theory and the phase of applications following it. These two phases, regardless of whether they are considered mathematical or quasi-mathematical, are no less important in teaching than the deductive theory itself: the first - for understanding this theory, the second - for its justification.

Empirical methods serve as means of collecting empirical material and as means of creating empirical knowledge. The plurality of empirical material and knowledge is determined by:

Firstly, in the empirical reality surrounding the researcher, he directly deals only with a multitude of diverse individual phenomena, the perception of which constitutes the initial

material of empirical knowledge. That is, the object of scientific research can be various phenomena or sets of phenomena.

Secondly, the diversity is determined by the fact that the object of research itself can be different for different researchers. The same is true for the subject of research: the phenomenon being studied (empirical object) is directly revealed to the researcher only in the multitude of its individual aspects and properties, which allows one or another researcher to choose one or another aspect of the phenomenon as an object, which again determines the diversity of the content of empirical knowledge even if the same object is available.

Thirdly, when creating and inventing empirical methods, many academic educators emphasize the need for a creative approach and imagination, which also contributes to diversity.

So, the diversity of empirical material, the diversity of the empirical aspects identified for research, and the diversity in the creative creation of a method - all this determines the diversity of content obtained by empirical methods.

ANALYSIS AND RESULTS

The possibility of using empirical methods in mathematics lessons often depends on the age characteristics of the students. We have already said earlier that the use of the method of observation, measurement and experience can arouse great interest in the study of mathematics among students, as well as show the connection of this discipline with other sciences. But not always in each class will this or that method be appropriate, for example, in the younger classes, more interest will be aroused by observation of this or that object, but, for example, in older classes, an experiment (experience) plays a greater role.

Knowledge and experience of a person are not stored in memory in isolation from each other, but in the form of certain complexes of thoughts or ideas. In the process of reproducing them in memory, a person usually recalls not only the required object, but also its background, which forms a certain complex with this object. The process of separating the background from the object is very complex and requires a high culture of thinking. It is clear that pupils who do not have a high culture of mathematical thinking usually remember many of the object's inessential properties along with the essential properties, often unable to separate one from the other. Often the background of an object forms interfering associations, due to which some useless provisions in a given situation, remembered in combination with the necessary ones, are restored in memory along with them and obscure them. In addition, knowledge and experience are very often reproduced by consciousness along certain beaten paths that are habitual for a given individual, expressed in following a certain system of rules, in applying the same method of solving a problem. Thus, standardization of thinking often appears. Standardization of thinking and its indivisibility are especially characteristic of schoolchildren, therefore, it would be more appropriate to conduct various experiments and tests in older classes, for example, in laboratory and practical classes.

Let's move on to the characteristics of the mathematical thinking of pupils in more detail.

In the process of evolution of the science of mathematics and the methodology of mathematics, the content that was put into the concept of "mathematical thinking" has naturally changed, the role of the problem of the development of thinking in the process of teaching mathematics has significantly increased.

It is known that between the system of education and the course of mental development of students there is a close relationship, subject to certain patterns, the search for which is currently one of the central problems of educational psychology.

It is also important to pay attention to some qualities of students' thinking, for example, purposefulness of thinking. Purposefulness of thinking is characterized by the desire to make a reasonable choice of actions when solving a problem, constantly focusing on the goal set by this problem, as well as the desire to find the shortest ways to solve it; the development of this quality of thinking can be observed already in students in grades 5-6. The presence of this quality of thinking in pupils is especially important when searching for a plan to solve mathematical problems, when studying new material, etc. This is facilitated by specially selected tasks by the teacher, through which the expediency of studying a new topic and the sequence of consideration of issues related to it are revealed to students.

Critical thinking is characterized by the ability to evaluate the correctness of the chosen ways to solve a problem and the results obtained in terms of their reliability, significance, etc. In the process of teaching mathematics, the development of this quality of thinking in students is facilitated by constant reference to various types of checks, rough estimates of the found (sought) result, as well as checking conclusions made using induction, analogy and intuition.

The development of mathematical thinking presupposes not so much the development of students' ability to master fixed operations and techniques, as the ability to discover new connections, master general techniques for solving new problems. Simply put, students should develop general techniques of thinking, and not techniques of thinking in a specific situation.

Students need to be taught the techniques of freely using the tools and methods of empirical research used in the school mathematics course, on the basis of which the corresponding skills are developed, allowing them to independently draw certain conclusions. All this can be achieved by performing practical and laboratory work.

These are exercises with graphs, measuring work on the ground, modeling, working with computers, etc. In accordance with the above, depending on the purpose of training, such work is divided into two types: cognitive (research), used at the stage of learning something new, and applied, used at the stage of applying knowledge. The first aims to introduce students to a mathematical fact that is new to them, the second - to teach them to apply mathematical knowledge to specific problems, for example, with measurements on models of geometric bodies and calculating their surface areas, volumes, or with measurements on a map and calculating real distances.

The use of symbolic visual aids in drawings, diagrams, charts, symbols, etc., teaching students the techniques of construction, reading graphic visual aids, and writing mathematical sentences helps students better assimilate new material.

The integration of mathematics lessons with history, astronomy, geography, economics, music, biology, physics and other subjects allows us to consider many important phenomena in a multifaceted way, connect mathematics lessons with life, show the richness and complexity of the world around us, and give children a boost of curiosity and creative energy. Children have the opportunity to create not only their own model of the world, but also to develop their own way of interacting with it. The integration of subjects allows the teacher to cultivate in children the desire to purposefully overcome difficulties on the path to

knowledge. The new functions of the teacher are mainly determined by the need to clearly imagine the structure of educational activities and their actions at each stage from the emergence of an idea to its full implementation. In this regard, three main tasks of the teacher are distinguished:

1. inclusion of students in independent cognitive activity (organization of educational activities of pupils);
2. provision of emotional support, creation of a situation of success for each student based on the use of individual assessment standards;
3. conducting an examination of the result obtained by both the teacher and the student.

CONCLUSION

The main task is to reveal the features of the methodology for applying empirical methods. This task is analyzed, and it considers the methodological techniques of using empirical methods, stages of using the method of observation, measurement and experience.

References:

1. Babansky Yu.K. Methods and means of teaching. Application of computers in the educational process // Pedagogy / Ed. Yu.K. Babansky. - M.: Education, 1988.
2. Babansky Yu.K. Methods of teaching in a modern comprehensive school. - M.: Education, 1985.
3. Golant E.Ya. Methods of teaching in the Soviet school. - M.: Education, 1957.
4. Danilov M.A. The learning process in the Soviet school. - M.: Education, 1960.
5. Dorofeev G.V., Bunimovich E.A., Krasnyanskaya K.A., Kuznetsova L.V., Minaeva S.S., Roslova L.O., Suvorova S.B., Sharygin I.F. Mathematics 5th grade. Textbook for 5th grade. general educational institutions. - M.: Education, 2010.
6. Episheva O.B. General methods of teaching mathematics in secondary school. - Tobolsk.: TGPI named after D.I. Mendelev, 1997.
7. Lemberg R.G. Didactic essays. - Alma-Ata.: Education, 1960.
8. Lerner I.Ya. Didactic foundations of teaching methods. - M.: Education, 1981.
9. Methods of teaching mathematics in secondary school. Oganesyan V.A., Kolyagin Yu.M., Lukankin G.L., Sannin V.Ya. - M.: Education, 1980.
10. Orekhov F.A. Graphic laboratory works on geometry. - M.: Education, 1967.
11. Voloshinov A.V. Union of mathematics and aesthetics // Mathematics at school. -2006. - №7. P. 62.
12. Problems of teaching methods in a modern comprehensive school / Ed. Yu.K. Babansky, I.D. Zverev. - M.: Education, 1980.
13. Prochukhaev V.G. The connection of theory with practice in teaching mathematics. - M.: uchpedgiz, 1958.
14. Sarancev G.I. Exercises in teaching mathematics. - M.: Education, 1995.
15. Slastenin V.A., Isaev I.F., Shiyanov E.N. General pedagogy / Ed. V.A. Sweet tooth: In 2 parts. - M:. Education, 2002. Part 1. P. 274-275
16. Roslova L.O. Geometric line of the new textbook for grades 5-6. // Mathematics at school. - 1999. - No. 5, P. 15 - 22.
17. Geometry grades 7-9. Textbook for general educational institutions. Atanasian V.G., Butuzov V.F., Kadomtsev S.B., Poznyak E.G., Yudina I.I. - M .: Education, 2001.

18. Algebra grade 8. Textbook for general educational institutions. Makarychev Yu.N., Mindyuk N.G. - M .: Education, 2001
19. Kononova E.S., Novokreshchenova T.E., Integrated lesson of mathematics and geography in the 5th grade. school №897, Moscow
20. Chukantzov S.M. Laboratory works in mathematics. - M.: Education, 1961.
21. Kolyagin Yu.M. Tasks in teaching mathematics. - M.: Education 1997.