SCIENTIFIC STAGES - THE SUBJECT "METHODS OF TEACHING MATHEMATICS"

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Annotation: There are different points of view on the content of the concept of "methodology". Some, recognizing the methodology as a pedagogical science, considered it as a private didactics with principles of teaching common to all subjects. Others considered the methodology to be a special pedagogical science that solves all the problems of learning and personal development through the content of the subject.

Key words: methodology, mathematics, teaching, students, teaching, functioning, science, humanization.

Аннотация: Существуют разные точки зрения на содержание понятия "метолика". Одни. признавая методику наукой педагогической, рассматривали ее как частную дидактику с общими для всех предметов принципами обучения. Другие считали методику специальной педагогической наукой, решающей все задачи обучения и развития личности через содержание предмета.

Ключевые слова: методика, математика, обучения, учащихся, преподавать, функционирование, наука, гуманизация.

Introduction: There are various perspectives on the content of the concept of "methodology." Let us provide several definitions:

The methodology of teaching mathematics is the science of mathematics as an academic subject and the patterns of the process of teaching mathematics to students of various age groups and abilities.

The methodology of teaching mathematics is a pedagogical science about the tasks, content, and methods of teaching mathematics. It studies and investigates the process of teaching mathematics in order to improve its effectiveness and quality. The methodology of teaching mathematics addresses the question of how to teach mathematics.

The methodology of teaching mathematics is a branch of pedagogy that investigates the patterns of teaching mathematics at a certain stage of its development in accordance with the goals of educating the younger generation set by society. The methodology of teaching mathematics aims to research the problems of mathematics education, teaching mathematics, and mathematical upbringing.

The methodology of teaching mathematics in secondary school emerged with the goal of finding pedagogically appropriate ways and methods of presenting educational material. The methodology of teaching mathematics began to be developed by the Czech scientist J.A. Comenius. The methodology of teaching mathematics was first distinguished as a separate discipline in the book by the Swiss scientist I.G. Pestalozzi "Visual Learning about Numbers" (1803, Russian translation 1806). The first manual on the methodology of mathematics in Russia was the book by F.I. Busse "Guide to Teaching Arithmetic for Teachers" (1831). The creator of the Russian methodology of arithmetic for public schools is considered to be P.S. Guryev, who recognized experience and practice as the criterion for solving methodological problems.

The goal of the methodology of teaching mathematics is to research the main components of the system of teaching mathematics in schools and the relationships between them. The main components are understood as: goals, content, methods, forms, and means of teaching mathematics.

The subject of the methodology of teaching mathematics is exceptionally complex. The subject of the methodology of teaching mathematics includes the teaching of mathematics, consisting of the goals and content of mathematical education, methods, means, and forms of teaching mathematics.

A number of factors influence the functioning of the system of teaching mathematics: general educational goals, humanization and humanitarianization of education, the development of mathematics as a science, the applied and practical orientation of mathematics, new educational ideas and technologies, research results in psychology, didactics, logic, etc. This combination of factors forms the external environment that directly influences the system of teaching mathematics. Many components of the external environment affect it through the goals of teaching mathematics.

The methodology of teaching mathematics faces significant challenges in its development, primarily due to the difficulty of overcoming the gap between school mathematics and mathematical science, as well as because it is an interdisciplinary branch of pedagogy at the intersection of philosophy, mathematics, logic, psychology, biology, cybernetics, and even art.

The methodology of teaching mathematics reflects the features of the millennia-long history of mathematics development, from ancient times to the present. To deeply understand methodological patterns, students need to know the history of the development of the methodology of teaching mathematics.

Main tasks of the methodology of teaching mathematics

• Define the specific goals of studying mathematics by grade, topic, and lesson.

• Select the content of the academic subject in accordance with the goals and cognitive abilities of students.

• Develop the most rational methods and organizational forms of teaching aimed at achieving the set goals.

• Consider the necessary teaching tools and develop recommendations for their use in the practice of a teacher's work.

The methodology of teaching mathematics is intended to answer the following three questions:

- Why do we need to teach mathematics?
- What needs to be studied?
- How should mathematics be taught?

The content of school mathematics education, despite changes over time, retains its core. This stability of the fundamental content of the program is explained by the fact that as mathematics develops, while acquiring many new aspects, it preserves all previously accumulated scientific knowledge, not discarding it as outdated and unnecessary. Each section that has become part of this "core» has its own history of development as a subject of study in secondary school. Questions about their study are examined in detail in the special methodology of teaching mathematics.

The designated core of the school mathematics course forms the basis of its fundamental program, which serves as the initial document for the development of thematic programs. In the thematic program for secondary schools, besides the distribution of educational material by grades, the requirements for students' knowledge, skills, and competencies are outlined, interdisciplinary connections are revealed, and approximate grading standards are provided.

Abroad, in the schools of developed countries, a significant place in mathematics programs is given to probability theory and statistics. In Japan's school programs, the "Statistics" section is already a major subject in the first grade of elementary school. Elements of probability theory, on a strict mathematical basis, are introduced in the senior classes of schools in Belgium and France. Geometry, as an independent academic subject, is not studied in many schools, and its individual questions are included in the course of arithmetic, algebra, and the fundamentals of mathematical analysis. In most developed countries, mathematical education at the senior level of general education is differentiated in accordance with a specific profile of specialization. At all levels of education, great importance is given to the development of functional thinking, mastering mathematical methods, and forming research skills.

Some of the disadvantages of traditional teaching include:

• The predominance of verbal methods of presentation, which contribute to dispersing attention and the inability to focus on the essence of the educational material.

• An average pace of studying mathematical material.

- A large volume of material requiring memorization.
- A lack of differentiated tasks in mathematics, and more.

The disadvantages of traditional teaching can be eliminated by improving the teaching process.

Method of teaching is an organized set of didactic techniques and tools through which the goals of teaching and education are realized. Teaching methods are interconnected ways of purposeful activity between the teacher and students. A method of teaching implies a system of actions, means of teaching, and an intended result. The object and subject of the method of teaching are the student.

Very rarely is a single method of teaching used in its pure form. Usually, the teacher combines different teaching methods. Methods in their pure form are applied only for specially planned academic or research purposes.

Method of teaching is a historical category. Throughout the history of pedagogy, the problem of teaching methods has been resolved from different points of view: through forms of activity, through logical structures and functions of activity forms, and through the nature of cognitive activity. Today, there are various approaches to modern teaching theory.

Classification of teaching methods is carried out based on various grounds:

By the nature of cognitive activity (M.N. Skatkin, M.I. Makhmutov, I.Ya. Lerner):

• Explanatory and illustrative (story, lecture, conversation, demonstration, etc.).

• Reproductive (problem-solving, repetition of experiments, etc.).

• Problem-solving (problem tasks, cognitive problems, etc.).

• Partially-searching – heuristic.

• Research.

By components of activity (Y.K. Babansky):

• Organizational-action – methods of organizing and conducting academic and cognitive activities.

• Stimulating – methods of motivating and stimulating academic and cognitive activities.

• Control-evaluative – methods of control and self-control of the effectiveness of academic and cognitive activities.

By didactic goals (methods of studying new knowledge, methods of consolidating knowledge, methods of control).

By methods of presenting educational material:

• Monological - information-communicative (story, lecture, explanation).

• Dialogical (problem presentation, conversation, discussion).

By forms of organizing academic activities.

By levels of students' independent activity.

By sources of knowledge transmission (A.A. Vagin, P.V. Gora):

• Verbal: story, lecture, conversation, instruction, discussion.

• Visual: demonstration, illustration, diagram, material presentation, graph.

• Practical: exercise, laboratory work, practicum.

By considering the structure of personality (consciousness, behavior, emotions):

• Consciousness (story, conversation, instruction, illustration, etc.).

- Behavior (exercise, training, etc.).
- Emotions stimulation (approval, praise, reproach, control, etc.).

All of these classifications are considered in the didactic aspect, but the subject matter of mathematics is not sufficiently accounted for, making it impossible to fully reflect the entire range of teaching methods for mathematics. The choice of teaching methods is a creative endeavor; however, it is based on knowledge of the theory of teaching. Teaching methods cannot be universalized or viewed in isolation. Moreover, the same teaching method can be effective or ineffective depending on the conditions of its application.

New educational content generates new teaching methods in mathematics. A comprehensive approach is necessary when applying teaching methods, ensuring flexibility and dynamism. The pedagogical classification of teaching methods distinguishes between methods of teaching and methods of learning, which are in turn represented by scientific and academic methods of studying mathematics.

Teaching methods are the tools, techniques, and approaches for conveying information, managing, and controlling students' cognitive activities.

Learning methods are the tools, techniques, and approaches for acquiring academic material, including reproductive and productive methods of learning and self-control.

The primary methods of mathematical research are: Observation and experimentation; Comparison; Analysis and synthesis; Generalization and specialization; Abstraction and concretization.

Modern methods of teaching mathematics include: The problem-solving (prospective) method; The laboratory method; The method of programmed learning; The heuristic method; The method of constructing mathematical models; The axiomatic method, and others.

Information-based developmental teaching methods are divided into two classes:

a) Transfer of information in a ready-made form (lecture, explanation, demonstration of educational films and videos, listening to audio recordings, etc.);

b) Independent acquisition of knowledge (independent work with a book, independent work with a teaching program, independent work with information databases, including the use of information technologies).

Problem-solving methods include: Problem-based presentation of educational material (heuristic conversation); Educational discussion; Laboratory research work (preceding the study of the material); Organization of collective intellectual activity (CII) in small group work; Organizational and activity games; Research work.

Reproductive methods: Repetition of academic material; Performing exercises based on samples; Laboratory work following instructions; Exercises on simulators.

Creatively-reproductive methods: Creative writing; Variable exercises; Analysis of practical situations; Business games and other types of professional activity simulations.

A component of teaching methods consists of techniques of academic activity for both teachers and students (M.I. Makhmutov).

Methodological techniques are actions and approaches aimed at solving specific problems. Hidden behind these academic techniques are mental activity techniques such as analysis and synthesis, comparison and generalization, proof, abstraction, concretization, identifying the essential, formulating conclusions, and techniques of imagination and memory.

Teaching methods are constantly being supplemented by modern methods, primarily aimed at teaching not ready-made knowledge but activities for independently acquiring new knowledge, i.e., cognitive activity.

Special teaching methods are adapted for teaching core methods of cognition used in mathematics itself. These include methods characteristic of

mathematics for studying reality (constructing mathematical models, methods of abstraction used in building such models, the axiomatic method).

References:

 Epishova O.B. General Methods of Teaching Mathematics in Secondary Schools / Tobolsk, Publishing House of TGPU named after D.I. Mendeleev, 1997

2. Novoseltseva Z.I. Expanded Lecture Plans and Academic Assignments for Students in the Course "Theoretical Foundations of Teaching Mathematics" / St. Petersburg, Publishing House "Obrazovaniye" RGPU, 1997.

3. Imomberdiev, S. S. (2024). Mathematics In Ecology. *Pedagogical Cluster-Journal of Pedagogical Developments*, 2(1), 130-138.

4. Imomberdiyev, S. S. (2023). Use of Problems with Ecological Content in Mathematics Lessons in Primary Grades. *Web of Teachers: Inderscience Research*, 1(7), 36-39.