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SCIENTIFIC METHODOLOGICAL BASES OF INTEGRATED TEACHING OF MATHEMATICS AND NATURAL SCIENCES IN PRIMARY GRADES

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ABCTRACT

The article considers the gradual implementation of the principles of focusing more on practice than theory in organizing mathematics lessons and providing students with ready-made educational materials, thereby qualitatively updating the content of mathematics by forming a certain level of integrated knowledge and skills, as well as improving teaching methodologies and individualizing the educational process.

Keywords. Program, standard, education, education, education, elementary school, mathematics, pedagogy.

Based on the above analysis, it is appropriate that the main areas for the development of mathematics education in the public education system are as follows: - ensuring the quality of education and international requirements for personnel training in accordance with the requirements of the state educational standard in mathematics, primarily based on the needs of the future modern state and society; - forming an integrated system that ensures close cooperation, continuity and coherence between preschool, general secondary, secondary specialized and vocational, higher educational institutions and scientific and methodological research structures;- improving the quality of teaching mathematics in general secondary and secondary specialized, vocational educational institutions, organizing and developing a system of specialized schools for mathematics in the regions; development of a system of training

and retraining of personnel in mathematics, especially in schools in rural areas;- improvement of textbooks and study guides in mathematics; - identification of talented young people and ensuring their successful participation in local and international science olympiads in mathematics and taking prize places;

qualitatively updating the content of mathematics, as well as improving teaching methods, gradually implementing the principles of individualizing the educational process;

improvement, optimization of the content of mathematics and strengthening its integration with other general education subjects;

application of acquired knowledge and skills in students in real life situations, formation of mathematical literacy, critical, creative and inventive competencies;

introduction of modern digital technologies and innovative approaches to ensuring the efficiency and effectiveness of the mathematics teaching process;

based on advanced foreign experiences in assessing student achievements and the results of international research in this area, creating a new assessment system and introducing a national certification system for assessing the level of knowledge of mathematics on its basis[11].;

raising the teaching of mathematics to a new qualitative level, including the introduction of new scientific directions and principles of organizing the educational process using modern information and communication technologies, electronic textbooks and modern laboratory equipment;

harmoniously conducting education and upbringing, forming students not only as knowledgeable, but also as spiritually and morally mature individuals;

creating a healthy creative environment in mathematics lessons, raising the quality of teaching to a new level by introducing advanced innovative modern technologies into the educational and upbringing process, developing students' worldview, thinking, and logical independent thinking skills;

radically updating the content of clubs, optional and elective courses organized outside the classroom and outside the school in mathematics teaching;

developing the scientific methodological support for teaching mathematics; improving the system of encouraging the work of young people who have won international science Olympiads and their mentors;

forming an innovative infrastructure by introducing digital technologies and modern methods into the educational process;

Conducting educational research in the field of mathematics in order to demonstrate the relevance of the acquired knowledge, skills and qualifications of students to everyday life, cultivating creativity aimed at design, and developing their interest in creating innovations[7].

Development of educational and methodological support of mathematics The following activities are being carried out to develop the scientific and methodological support of mathematics:

Development of a national program in mathematics in accordance with advanced foreign experience, international standards and national traditions; Development of requirements for knowledge, skills and competencies of graduates of general secondary educational institutions in mathematics, based on new, modern needs that will be necessary in their future activities;

preparation of proposals on the minimum volume of the mathematics curriculum and their distribution by grade, as established in the basic curriculum of general secondary education;

development of curricula based on the volume, content, sequence of study and competencies to be formed in mathematics by grade and subject in accordance with the basic curriculum;

gradual development and introduction into the educational process of a new generation of educational and methodological complexes (textbook, workbook, teacher’s manual, multimedia applications) in mathematics by grade;

development of a new assessment system based on the content, specific features of mathematics, knowledge, skills to be formed and competencies established in state educational standards[18].

The creation of new educational and methodological complexes in mathematics is determined on the basis of the following principles:

creation of educational and methodological complexes based on the basic principles of state policy in the field of education;

the age, psychophysiological characteristics, level of knowledge, interests, and abilities of students are taken into account;

the focus is on forming a sense of patriotism and national pride in students;

the inclusion of practical tasks in the complexes that meet the requirements of international assessment programs (PISA, TIMSS) aimed at developing students' logical thinking and practical skills;

the establishment of a system of alternative textbooks in mathematics; the development of educational and methodological complexes in accordance with modern didactic, scientific-methodological, pedagogical-psychological, aesthetic, and hygienic requirements.

The following activities are carried out to introduce digital technologies into the teaching of mathematics:

ensuring a strong integration of modern digital technologies and educational technologies;

individualization of educational processes based on digital technologies;

connecting all educational institutions to a fast and stable Internet network;

providing educational institutions with digital technologies, electronic, multimedia resources and relevant software;

creating educational platforms that allow students to learn independently and providing them with an electronic library in mathematics, all electronic resources related to the educational and methodological support of lessons, video lessons, multimedia interactive animation applications;

creating and posting on the platform a full version of the mathematics lessons of the "Online School" and "Professional Development" courses broadcast on television[13].;

preparing and posting on the platform offline versions of lessons and lessons held at school, creating opportunities for online conferences, and organizing various distance learning programs in mathematics outside the classroom and outside the school, and elective courses aimed at deeper study of mathematics;

Recommendations for the development of basic competencies in students through mathematics:

In the general secondary education system, it is stipulated that students should form basic competencies along with subject-specific competencies. It is appropriate to focus the formation of basic competencies in students through subjects in the block of exact sciences on the basis of their acquired knowledge and skills in various situations.

In particular, in the formation of communicative competencies, it is necessary to teach independent, creative thinking, fluent written and oral expression, correct pronunciation, interpretation, and free communication in the state language and foreign languages. In particular, mathematics has its own scientific language, its own concepts, symbols and symbols, and communication in this language should be considered as a factor in the formation of communicative competencies.

In teaching subjects, it is necessary to regularly use modern information and telecommunication tools that expand the possibilities of effectively developing competence in working with information. In this regard, it is recommended to use various practical software packages and equipment, mobile devices (phones, tablets and other gadgets) to form students' skills in working with textbooks and various educational resources, searching for and analyzing information on mathematics from various sources, and working with information media while observing information security[8]. In the formation of self-development competence, it is necessary to teach students to have qualities based on universal human values, to love their homeland, to have knowledge about society and nature, to strive for innovation and to make independent decisions based on the theoretical knowledge they have acquired, to be aware of and involved in progressive and innovative changes taking place in society, to constantly strive to acquire modern knowledge and skills, and to use them in

everyday life. At the same time, through thorough study of mathematics, students learn discipline, approach each problem as a mathematical problem and become determined in solving it.

The formation of socio-emotional and civic competence includes acquiring knowledge about civic duty, social and political development, emergencies, environmental problems, as well as understanding and developing organizational skills in preserving works of art and art. Mathematics also educates them in the spirit of justice, indifference to injustice, and loyalty to the homeland. Through thorough teaching of mathematics, the foundation is laid for the development of students as active citizens of society.

Understanding the essence of basic mathematical concepts and relationships and using them in completing typical educational tasks:

These standards define what students should understand and be able to do through learning mathematics. One of the hallmarks of understanding in mathematics is the ability to justify the correctness or incorrectness of a particular mathematical expression or the origin of a particular mathematical rule, based on the student's level of mathematical mastery. Understanding the essence of mathematical concepts and the ability to perform typical operations are equally important, and they are assessed using standard tasks of a certain level of complexity[15].

The mathematical content standards are expressed in the form of generalized requirements and cover the following sections of mathematics (for ease of use in the future, the names of the sections are coded with two initial letters):

Numbers and operations: 1. Understanding numbers and quantities (quantities), knowing how to represent them, and number systems,

2. Establishing and understanding relationships between numbers and quantities, and using them to solve word problems;

3. Know the essence of mathematical operations and understand the relationships between them;

4. Perform calculations on numbers and quantities without difficulty, evaluate the results appropriately, and approximate them.

Geometric knowledge: 1. Basic concepts of flat and spatial geometric shapes, the ability to apply their main properties in solving practical problems, recognize geometric shapes in drawings, models and the real world;

2. Develop mathematical and logical thinking about geometric relationships;

3. Describe spatial relationships in coordinate systems and other representation systems and determine their geometric location, perform simple geometric constructions;

4. Use symmetry and geometric shape transformations in analyzing mathematical situations;

5. Use proof methods and problem-solving algorithms, make sound mathematical judgments in the process of solving problems;

6. Use geometric modeling, spatial observation and visualization methods in solving problems;

7. Know the measurable elements of various objects, units of measurement, understand the essence of measurement systems and processes;

8. Use appropriate measurement methods, formulas, teaching aids, multimedia interactive applications, calculators, and measuring instruments in the measurement process.

Reflection: 1. Logical thinking based on mental activity, guessing, drawing conclusions, providing evidence, substantiating, inferring, reasoning about principles and reasons;

2. Thinking about the definitions, rules, concepts, algorithms and methods used, mathematical solutions and errors;

3. Recognizing and using relationships between mathematical concepts;

4. Combining mathematical concepts or building one on top of another to form a holistic mathematical concept.

Modeling:

1. Reading and understanding the essence of problem situations, analyzing them, and

identifying the problem presented in them;

2. Using various mathematical interpretation methods to explain and

model phenomena and processes in nature and society;

3. Expressing the problem in the form of a mathematical problem, building a mathematical model.

Problem solving:

1. Using mathematical concepts, facts, ideas, laws, algorithms and methods to solve real-life problems and practical mathematical problems;

2. Using logical, creative thinking, mathematical observation and scientific research methods in solving a problem (issue): observation, measurement, experimentation, analysis and synthesis, induction and deduction, comparison and analogy;

3. Analyzing, selecting and justifying alternative methods and algorithms for solving a problem (issue);

4. Creating and mastering new mathematical knowledge in the process of solving a problem (issue);

5. Expressing and investigating mathematical assumptions, mathematical justification, comparison and evaluation;

6. Transferring a mathematical solution to the content of a real problem and interpreting it in relation to the real problem described in the mathematical problem and assessing the correspondence and proximity of the solution found to the real solution to the problem;

7. Demonstrate problem-solving algorithms in the process of completing a small research project based on real-life situations, whether independently or collectively.

Communication:

1. Use mathematical language, symbols, and images to communicate with others;

2. Understand, analyze, evaluate, and respond to the mathematical ideas of others.

Working with data:

1. Represent statements, sentences, and data in various forms and formats, convert from one format to another, analyze, interpret, and use mathematically;

2. Use mathematical language, symbols, and images, as well as computer and information and communication technologies, to express mathematical ideas clearly, verbally, in writing, and visually;

3. Identify, collect, and process the information necessary to solve a problem;

4. Select and apply appropriate statistical methods for analyzing data;

5. Develop appropriate conclusions and predictions based on the data and evaluate them;

6. Understand and use the basic concepts of probability theory.

Mathematical literacy competence:

draws up personal, family, and economic plans based on accurate calculations;

reads information in the form of various diagrams, drawings, and models in everyday activities;

uses formulas in simple calculations, solving equations, describing flat and spatial geometric shapes, computing tools, and ready-made computer programs;

knows the units of measurement of various quantities (length, area, volume, mass, time, speed, and others) encountered in everyday life, and performs calculations on them;

is economical in using various utilities such as water, gas, electricity, and heat supply, and calculates the corresponding payments;

solves problems with four operations on natural numbers, finds the value of a numerical expression (with and without brackets) according to the calculation algorithm;

reads and writes a simple fraction and a decimal fraction, converts a simple fraction to a decimal fraction and a decimal fraction to a simple fraction; depicts a decimal fraction in terms of its distribution over rooms in the light of coordinates;

performs arithmetic operations on decimal fractions, compares them;

finds the percentage of a number, a number according to its percentage.

Expected results from the implementation of mathematics. By fulfilling the tasks set within the framework of the mathematics concept, it is intended to achieve the following indicators:

To prepare highly capable, competitive, competent personnel who are knowledgeable, experienced and modern in thinking in order to take their place among developed countries;

The concept will serve as the basis for the requirements set out in the state educational standards of general secondary education;

The widespread implementation of the goals and objectives set out in the concept will effectively affect the intellectual development of students;

The stages of teaching mathematics, the content of education in the subject, and the standards of requirements for students' knowledge, skills and competencies will be clarified[12].;

The introduction of STEAM education will increase the literacy level of students based on the integration of subjects;

A system will be created to gradually increase the share of electronic resources in the educational process, create electronic educational literature and complexes and place them on a single information and educational platform;

In accordance with the basic curriculum, curricula will be developed based on the volume of mathematical subjects by grade and topic, updated content, sequence of learning, and the knowledge, skills and competencies to be formed;

A new assessment system will be developed based on the content, specific features, and requirements of state educational standards of mathematics, and a national certification system for assessing the level of knowledge of mathematics will be introduced on its basis;

A base of practical tasks that meet the requirements of international assessment programs (PISA, TIMSS) aimed at developing mathematical literacy, logical thinking, and practical skills of students will be created, and the equal participation of our

students in these international assessment programs will be ensured;

A new generation of educational and methodological complexes (textbooks, teacher's manuals, electronic textbooks) will be developed and introduced into the educational process in mathematics classes;

Innovative methodologies for using modern pedagogical technologies in teaching mathematics will be created;

In the international context of STEAM education, attention is paid to interdisciplinary connections and a practical approach to general education subjects;

students will be developed in terms of educational projects and research;

students will be guided to a professional career through mutual integration with general secondary education subjects[13];

in order to continuously update the knowledge, skills and competences of mathematics teachers in the subject, a personal and professional information space for teachers will be created and the professional development system will be radically updated based on modern digital technologies;

digital technologies will be introduced into the educational process, a single virtual environment - an information and educational platform will be launched, and an electronic library in mathematics, all electronic resources related to the educational and methodological support of lessons, video lessons, a virtual laboratory, and multimedia interactive animation applications will be placed on it;

Schools will be equipped with modern classrooms and laboratories, new types of educational furniture, equipment and tools, visual aids, computer equipment and other teaching aids, and within the framework of the state program "Modern School", general secondary schools will gradually introduce a network of SMART classes, classrooms and workshops designed to conduct STEAM classes[11].

Mathematical practice standards are inextricably linked to content standards in each grade level and are reflected in the relevant content standards. Practice standards are instilled in accordance with the content of the content standards, taking into account the physiological capabilities of the relevant age and areas of mental activity.

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