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SCIENTIFIC AND METHODOLOGICAL ASPECTS OF THE DEVELOPMENT OF MATHEMATICAL LITERACY OF STUDENTS BASED ON INTERNATIONAL RESEARCH

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ABSTRACT:

This article represents the scientific and methodological basis of the international PISA survey to determine the mathematical literacy of students. The structure (model) of a special PISA test, aimed at assessing mathematical literacy, and the context of the PISA task are described in detail.

KEYWORDS: international studies, mathematical literacy, mathematical modeling, logical thinking, content, abilities, quantities, space and form, change and relationship, uncertainty.

INTRODUCTION:

Today, one of the most important requirements for the organization of modern education is to achieve high results in a short time, without spending too much mental and physical effort. To do this, the teacher must design the educational process based on modern pedagogical technologies and international experience that increase the effectiveness of teaching. It is necessary to take into account the specifics of the subject, the place and conditions of education, and most importantly, the opportunities, needs and joint activities of students. These assignments require the teacher to be well prepared for the learning process. With a comprehensive preparation, the educational process is integrated into a single system, the sequence of topics, the form and type of lessons, the purpose of the topic, the expected results of educational activities, the literature and teaching aids used, didactic materials, and teaching methods. methods, criteria for assessing knowledge and skills will be determined. Indeed, one of the main tasks at the present stage of reforming the education system is the development of students' ability to think independently, creatively and critically, to organize their constant research and independent learning, to create their own methodological system.

To this end, in accordance with the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan dated December 8, 2018 No. 997 "On measures for organizing international research in the field of assessing the quality of public education", the development and implementation of innovative methods for the development of mathematical and natural science literacy of students, the study and implementation of international research in the field of assessment the quality of education is one of the most important tasks today. Therefore, below is a detailed description of the aspects of the international PISA survey to determine the mathematical literacy of students, the structure (model) of a special PISA test task aimed at assessing mathematical literacy.

MATERIALS AND METHODS:

PISA is an international program that assesses the literacy and competence of 15-year-olds and is administered by the Organization for Economic Co-operation and

Development every three years. It tracks the quality of students' knowledge in reading, math and science and assesses them on a 1,000-point scale. This international program was developed in 1997 and was first implemented in 2000. With the help of the program, changes in the education system of different countries are identified, compared and evaluated. The results of this study are being followed with great interest around the world. Therefore, its importance and coverage are growing every year. For example, although 265,000 students from 32 countries took part in the program's tests in 2000, this figure is expected to double in 2018 to more than 540,000 students from 78 countries. The number of students from each country is about 2% of the total number of 15 year olds in the country. The PISA tests are organized by the Organization for Economic Cooperation and Development with the participation of leading international organizations and national consortium centers.
In 1999, the authors of the PISA study set the task of determining the readiness of 15-year-old schoolchildren to adapt to modern society. The changes that have taken place in our life in recent years have shown that mathematics is an important tool for successfully solving many problems encountered in everyday life, education, profession, social and scientific activities. This is one of the directions of the PISA study - an assessment of the level of readiness of 15-year-old schoolchildren to use mathematics to solve problems in everyday life. The main task of PISA is to provide member countries with information on education policies and support them in their decision making. The survey, conducted every three years, allows countries to provide timely information, including data and analysis, to take into account the impact of policy decisions and related programs.

At the same time, it allows countries to define the future goals of their education systems during this period. The main reason for the survey of 15-year-old students is the end of the 15-year period of compulsory education in most member countries of the Organization for Economic Co-operation and Development (OECD).

Based on the foregoing, it is important to constantly participate in international assessment studies, effectively prepare for this process, develop assignments based on the requirements of international studies and improve the system of practical application. Therefore, below we discuss the scientific and methodological foundations of the international PISA assessment survey to determine the mathematical literacy of students.

RESULTS:

The PISA International Assessment Program now measures students' reading (comprehension), math and science skills, and the knowledge and skills they acquired in school. PISA is an international assessment program that assesses students' reading, math and science skills, and communication skills. The content of the math assessment for 15 year olds is based on the concept of math literacy.
Mathematical literacy is described by foreign experts as follows:

Mathematical literacy is a person's ability to think mathematically about various life situations (contexts) and problems, express a given problem using mathematics, apply mathematics to solve a problem, and use the results to interpret and evaluate a problem. It includes concepts, algorithms, facts, and tools to describe, explain, and predict events. It helps people understand the place of mathematics in the universe and make the informed judgments and decisions that creative, curious, and introspective citizens of the 21st century need. [2]

Mathematical literacy refers to the following student skills:

- Identify problems in real life and solve them using mathematics;
- Express these problems in mathematical language;
- Solve these problems using mathematical facts and methods;
- Analysis of the methods used;
- Explain and interpret the results obtained taking into account the problem;
- Formulation, expression and recording of results, decisions.

Thus, PISA assignments offer students unusual math learning assignments. These tasks are close to real problem situations associated with various aspects of the surrounding life, and provide information about school life, society, students' personal lives, professional activities, sports, etc. To solve these problems, more or less mathematics is required. According to the research concept, each task corresponds to one of four contents, selected by agreement of the participating countries to compare the mathematical training of students in different countries:

- Quantity;
- Space and form;
- Changes and relationships;
- Uncertainty.

The state of students' mathematical literacy is characterized not only by the availability of materials in the chosen area of content, but also by the level of development of "mathematical competence". Students' mathematical competence is assessed as "a set of knowledge, skills, experience and abilities in mathematics", which allows them to successfully solve various problems that require the use of mathematics.

The study identified three levels of mathematical competence: recovery level, communication level, and reasoning level. The study identifies the following activities to determine the level of mathematical competence:

a) Recovery (repeat), definitions and calculations;
b) Connections and integration needed to solve the problem;
c) Mathematical modeling, logical thinking, generalization and intuition.

These actions are listed in ascending order. However, this does not mean that you need to master the next type of activity. For example, you don't need to study math to start thinking mathematically.

The PISA study focuses on three aspects of student mathematics:

- Assignments correspond to the interests and needs of students in everyday life;
- Persistence of the problem context;
- The fact that not only some, but all stages of the application of mathematics are completely covered, that is, not only part of the process (for example, solving equations, simplifying algebraic expressions), but also from the stage of understanding the problem, its expression in mathematical language and all the stages preceding interpretation solutions.

The structure (model) of a special PISA test for assessing mathematical literacy is based on the following 3 aspects:

- The content of the subject, i.e. sections of mathematics;
- Content or context of the problem;
- The type of mental activity that students are required to demonstrate in completing the assignment.

Mathematical literacy refers to solving problems using mathematics on the one hand and mathematical reasoning on the other. PISA 2021 highlights mathematical rationale as an important aspect of the problem-solving cycle.

Mathematical reasoning, deductive or inductive, is related to some of the basic concepts that form the basis of school mathematics. These basic concepts include:

- Understand quantity, number systems and their algebraic properties;
- Understand the importance of abstraction and symbolism;
- To see mathematical constructions and their laws;
- Recognize functional relationships between quantities;
- Use mathematical modeling as a means of studying various phenomena of the real world (for example, in physical, biological, social, economic and humanitarian sciences);
- Understand that volatility is based on statistics.

According to international experts, the tasks of pisa-2021 are divided into the following four areas of content (sections) of mathematics:

- Quantity;
- Changes and relationships;
- Space and form;
- Data and inaccuracies.

They are divided into three cognitive levels according to the intellectual and thinking skills required to complete a task:

1. Lower level - one-step actions.
2. Intermediate - description of events.
3. High level - complex data analysis.

Each type of mental activity based on the above reasoning requires students to determine the following skills in determining mathematical literacy:

- Expression of situations in mathematical language;
- Apply mathematics;
- Interpretation of the decision.

The context of a PISA assignment is a description of real life situations in various forms. The context can be divided into 4 sets of tasks, depending on what kind of life situation they represent. These are personal, professional, social and scientific.

The context is the part of the human world where these problems arise. The choice of appropriate mathematical strategies and expressions often depends on the context of the problem, so knowledge of the real-world context should be used to develop the model. It should be noted that successful demonstration of mathematical literacy depends on the development of universal cognitive competencies in teaching mathematics. Thus, in addition to the math competencies mentioned in the upcoming 2021 PISA study, the aforementioned competencies called "21st Century Skills" will be assessed:

- Critical Thinking;
- Creativity;
- Research And Analysis;
- Independence, Initiative And Decisiveness;
- Use Of Information;
- Systems Thinking;
- Communication;
- Meditation.

DISCUSSION:

Based on the results and analysis of international studies presented in the previous paragraphs, the following requirements can be imposed on the knowledge and skills of students to improve their mathematical literacy:

- Search and use of mathematical definitions, formulas and other facts from textbooks and reference books;
- Apply knowledge, skills and graphic skills in algebra in various life situations;
- Collection, analysis, processing, synthesis of data;
- Use mathematical formulas, independently formulate formulas representing the relationship between quantities, based on generalization of certain special cases;
- To use the obtained algebraic substitutions and functional graphical representations and representations in the expression and analysis

of the corresponding objects in the environment or in other disciplines;

- Be able to substantiate your point of view, participate in its discussion and draw logically correct conclusions;

- Be able to work with mathematical texts (analyze and extract the necessary information), clearly and correctly write your ideas using mathematical terms, symbols and symbols, as well as express yourself orally and in writing;

- To solve the practical problems of life, if necessary, use the necessary reference materials and computing tools to solve them;

- Analysis of tables, diagrams, real digital data in graphical form, as well as statistical data;

- The use of modern information technologies as a means of solving practical mathematical problems.

In preparing for the pisa international assessment survey, math teachers are encouraged to consider the following to improve student math literacy:

- Correct and accurate formation of mathematical speech;

- To highlight and apply mathematical content and methods for solving word problems;

- Translate the terms of the problem from the text into mathematical language and reveal the content and essence of these substitutions;

- Create problematic situations for students to develop skills in creative work and active thinking.

- Creation of differentiated trajectories of students in the educational process;

- Effective use of interactive and active learning technologies in the classroom.

CONCLUSION:

Based on the above, we conclude that the formation of positive qualities in students, teaching them independent, logical and cognitive thinking, the formation of mathematical literacy, along with mathematics, preparation for PISA - international assessment studies and regular participation have great potential.

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