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METHODOLOGY FOR THE FORMATION OF MATHEMATICAL LITERACY IN PRIMARY SCHOOL STUDENTS (BASED ON TIMSS RESEARCH)

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Abstract: In this article, the issue of forming mathematical literacy in primary school students is covered from a scientific-theoretical and practical point of view based on international TIMSS (Trends in International Mathematics and Science Study) research. The article analyzes the content of the concept of mathematical literacy, its components, and modern approaches to the development of this competence in students. The research results are of practical importance for primary school teachers and play an important role in the formation of students' logical thinking, problem-solving, and mathematical thinking skills.

Key words: Mathematical literacy, primary education, TIMSS research, logical thinking, problem-solving skills, methodological approaches.

Introduction

In the modern educational process, the formation of students' functional literacy, in particular, mathematical literacy, is one of the most pressing issues. Because in today's era of globalization, the training of individuals with digital and logical thinking, capable of solving problems, and applying practical knowledge has become a priority task for every state. In particular, the primary education stage is the foundation of this process, and it is during this period that the foundations of mathematical concepts, practical skills, and logical thinking are formed in students.

TIMSS (Trends in International Mathematics and Science Study) international research plays an important role in assessing and comparing the level of students' knowledge of mathematics on a global scale. These studies are aimed at determining not only students' factual knowledge, but also their level of mathematical literacy, that is, their ability to apply it in solving real-life problems. Through TIMSS research, advanced educational systems at the international level are analyzed, and scientifically based proposals for improving education based on their methodological approaches are developed.

This article analyzes the methodological foundations of the formation of mathematical literacy in primary school students based on the results of TIMSS research. The methodological approaches of teachers, the level of assimilation of students, and the effectiveness of the methods used in the lesson process are also considered. The results of the article will provide practical assistance in improving elementary school mathematics lessons in the Uzbek education system.

Literature review and methodology

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The concept of mathematical literacy is one of the widely discussed issues in the field of education in recent years. Many scholars interpret mathematical literacy not simply as performing calculations, but as the ability to understand mathematical concepts, apply them in practical life, solve problems, and think logically (Kilpatrick, Swafford & Findell, 2001). And at the stage of primary education, the formation of this literacy serves as a solid foundation for the student's future academic success.

TIMSS international research serves as an important source for assessing the quality of mathematical education and the level of literacy of students. These studies help determine the effectiveness of educational programs by testing students' knowledge, skills, and abilities in mathematics and natural sciences in grades 4 and 8 (Mullis et al., 2019). TIMSS reports note the existence of specific methodological approaches aimed at the formation of mathematical literacy in countries that have achieved high results. These approaches are mainly based on the development of logical thinking, mathematical modeling, teaching through life problems, and a differentiated approach.

Uzbek researchers are also conducting scientific research in this area. In particular, Kadyrova (2022) highlighted the advantages of integrated teaching methods for improving mathematical education in primary grades. Bozorov (2020) proposed the role of diagnostic tools in the formation of students' mathematical literacy and methods for their effective use.

Methodology

In this study, methods based on a comprehensive approach were used in the study of the methodology for the formation of mathematical literacy in primary school students. In the course of the study, the concept of mathematical literacy, its components, and methodological approaches put forward on the basis of international TIMSS research were analyzed using the method of theoretical analysis. At the practical stage, data were collected among primary school teachers and students using questionnaires and conversations, and methods in the real educational process were studied through lesson observations. The obtained data were summarized based on qualitative analysis, and effective methodological approaches were developed.

Results and discussion

As a result of the conducted research, it was established that the level of mathematical literacy of primary school students depends on several main factors. The results of questionnaires and lesson observations showed that while most students can perform simple calculations, they have difficulty solving more complex, life-based problems. This indicates the need to develop the ability to apply mathematical knowledge not only at the theoretical level, but also in practical life. During conversations with teachers, many of them admitted that insufficient attention is paid to increasing student activity in the lesson, encouraging independent thinking, and analyzing problems based on real-life examples. In particular, it was noted that test-oriented approaches are more often used in lessons, and there are fewer tasks aimed at forming students' critical and logical thinking.

Comparing the results of the TIMSS study with the situation in Uzbek schools, it can be seen that in countries with high results (for example, Singapore, Japan, South Korea), methodological approaches aimed at developing students' mathematical literacy are systematically implemented. In these countries, special attention is paid to mathematical thinking, consistent analysis, the correct application of mathematical language, and mathematical modeling of real problems in the process of lessons in primary grades. In the education system of Uzbekistan, work in this direction is only gradually developing, which

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requires a review of the existing methodological base in schools, updating curricula, and preparing teachers for modern approaches.

Another important aspect identified in the research process is the insufficient use of interactive methods, group work, tasks based on problem situations, and open-ended questions in lessons for the development of students' mathematical literacy. As a result, students, having mastered knowledge based on memorization, are left out of the opportunity to develop high-level cognitive skills, such as logical consistent analysis, justification of their opinion, and the construction of a mathematical model. This situation leads to difficulties in completing tasks within the framework of TIMSS.

Conclusion

The results of the conducted research showed that the formation of mathematical literacy in primary school students is one of the most important and relevant areas of modern education. Mathematical literacy should be considered not only as the ability to perform calculations, but also as a combination of the skills of using mathematical thinking, problem-solving, and logical thinking in real-life situations. Analysis conducted on the basis of the TIMSS study showed that countries achieving high results oriented students towards independent thinking, analysis of real problems, and application of knowledge through practical approaches. The education system of Uzbekistan should also organize mathematics lessons in primary grades on a new methodological basis, effectively using this experience. In particular, the widespread use of interactive methods, problem situations, group work, open-ended questions, and tasks based on real-life examples in lessons serves the effective formation of students' mathematical literacy. It is also important to improve the professional competence of teachers, to provide them with methodological skills based on TIMSS criteria and modern approaches. The results of this study serve as an important scientific and practical basis for improving the process of teaching mathematics in primary grades, improving the quality of education, and preparing competitive students in international assessment systems.

References:

1. Kilpatrick, J., Swafford, J., & Findell, B. (2001). Adding It Up: Helping Children Learn Mathematics. Washington, DC: National Academy Press.
2. Mullis, I. V. S., Martin, M. O., Foy, P., & Hooper, M. (2019). TIMSS 2019 International Results in Mathematics and Science. Boston College, TIMSS & PIRLS International Study Center.
3. https://timssandpirls.bc.edu/timss2019/international-results/
4. Qodirova, M. (2022). Boshlang‘ich sinflarda matematik ta’limni takomillashtirishda integratsiyalashgan yondashuvlar. O‘zbekistonda pedagogik tadqiqotlar jurnali, №2, 45–50.
5. Bozorov, A. (2020). Boshlang‘ich ta’limda matematik savodxonlikni shakllantirishda diagnostik usullarning o‘rni. Ta’lim va innovatsiyalar, №1, 33–38.