

HARMONIZING TIMSS TASKS WITH THE NATIONAL CURRICULUM IN PRIMARY SCHOOL MATHEMATICS LESSONS

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Abstract

This research examines the scientific basis for aligning TIMSS assessment materials with the requirements of the national curriculum in primary school mathematics lessons. The study examines the structure, assessment criteria, and cognitive domains of TIMSS tasks and explores ways of integrating them into the current mathematics teaching process. Furthermore, methodological opportunities for incorporating TIMSS-type problems into lessons based on competency-based requirements of the national curriculum are highlighted. The article presents sample integrative tasks and substantiates their role in developing students' logical thinking, problem-solving skills, and functional literacy. The conducted analysis demonstrates that integrating TIMSS criteria into the national educational content can enhance the mathematical competencies of primary school students.

Keywords

TIMSS, primary education, mathematics lesson, national curriculum, integrative approach, competency, functional literacy, international assessment.

INTRODUCTION

In the modern educational landscape, determining the effectiveness of the learning process in accordance with international standards is one of the most pressing tasks. In particular, the Trends in International Mathematics and Science

Study (TIMSS) is a large-scale comparative international assessment program aimed at evaluating school students' knowledge and practical skills in mathematics and science. This program assesses not only students' theoretical knowledge but also their logical thinking, problem-solving abilities, and competence in applying knowledge to real-life situations [6].

In recent years, the education system of Uzbekistan has been improving its national curriculum based on a competency-based approach. This requires the development of students' functional literacy, the formation of independent thinking skills in primary mathematics classes, and the achievement of results aligned with the requirements of international assessment programs. From this perspective, aligning TIMSS tasks with the content of the national curriculum emerges as a relevant pedagogical issue [1].

Practice shows that the emphasis on predominantly reproductive-type exercises during lessons does not sufficiently develop students' higher-order cognitive skills. In contrast, TIMSS tasks encompass the domains of knowing, applying, and reasoning, thereby requiring students to engage in deep analytical thinking. Therefore, it is necessary to develop a methodology for systematically integrating such tasks into primary school mathematics lessons.

The purpose of this article is to elucidate the theoretical and methodological foundations for aligning TIMSS tasks with the national curriculum in primary mathematics education, as well as to develop practical recommendations. In the course of the study, methods such as the analysis of theoretical sources, comparative analysis, the development of a methodological model, and the generalization of the obtained results were employed.

LITERATURE REVIEW AND METHODOLOGY

Assessing the quality of education based on international standards is one of the priority directions of modern pedagogy. International large-scale assessment studies, particularly TIMSS, promote the idea that students' mathematical achievement is determined not only by factual knowledge but also by their ability to apply and logically justify that knowledge. As emphasized by Mullis and Martin, the leaders of the TIMSS studies, contemporary mathematics education should aim to develop students not as passive recipients of knowledge, but as independent thinkers capable of analysis and problem-solving [7].

According to the theory of the competency-based approach, as stated by A.V. Khutorskoy and I.A. Zimnyaya, the main outcome of the educational process is the learner's readiness for practical activity, that is, the ability to apply knowledge in

real-life situations [5]. From this perspective, the real-life context embedded in TIMSS tasks enhances their didactic significance [8].

In his constructivist approach, J. Bruner substantiated the necessity of active student participation in the learning process and the importance of independent problem analysis. The reasoning-oriented component of TIMSS tasks directly corresponds to this approach [9]. Furthermore, according to L.S. Vygotsky's theory of the "zone of proximal development", complex but methodologically well-structured tasks accelerate students' intellectual development. This highlights the need for the gradual integration of higher cognitive-level TIMSS problems into primary school mathematics lessons [10].

National pedagogical scholars have also examined the issues of developing functional literacy in primary education, strengthening interdisciplinary integration, and adapting to the requirements of international assessment programs. In their view, the primary education stage serves as the foundation for subsequent academic achievement, and it is precisely during this period that logical thinking and decision-making skills in problem-based situations should be formed.

The analysis indicates that although general recommendations exist regarding the alignment of TIMSS tasks with the national curriculum, the issue of implementing them in practice through a systematic methodological mechanism has not been sufficiently developed. This study is specifically aimed at providing a scientific substantiation of this aspect [4].

The research methodology was based on the integration of competency-based, systemic, and integrative approaches. The systemic approach requires considering the educational process as a holistic system composed of interrelated elements. On this basis, TIMSS tasks were analyzed in close connection with the content of the national curriculum [11].

In the course of the research, the following methods were employed:

Theoretical analysis and generalization - studying scientific sources related to the conceptual foundations of TIMSS, the competency-based approach, and the methodology of primary mathematics education;

Comparative analysis - comparing TIMSS cognitive domains (knowing, applying, and reasoning) with the competencies defined in the national curriculum;

Modeling - developing a system of integrative tasks for primary school mathematics lessons;

Pedagogical observation - determining the impact of the developed tasks on students' cognitive engagement and problem-solving skills.

The object of the research is the process of primary school mathematics education.

The subject of the research is the mechanism for aligning TIMSS tasks with the national curriculum.

The distinctive feature of this study lies in the fact that tasks developed on the basis of TIMSS cognitive requirements were systematically aligned with the competencies of the national curriculum, and an integrative methodological model was proposed [11].

RESULTS AND DISCUSSION

In the course of the study, the content-related and cognitive requirements of TIMSS tasks were comparatively analyzed in relation to the national curriculum, and a methodological model for their alignment was developed. The findings indicate that the national curriculum is primarily oriented toward providing theoretical knowledge, while tasks aimed at developing higher-order analytical thinking are insufficient. It was determined that integrative tasks designed on the basis of TIMSS cognitive domains contribute to the development of primary school students' skills in problem analysis, mathematical modeling, comparing multiple solution strategies, and providing reasoned conclusions [2].

During the practical implementation phase, TIMSS-type problems based on real-life contexts and requiring the analysis of graphical and tabular data were incorporated into lessons. The results of pedagogical observation demonstrated an increase in students' classroom engagement, a stronger tendency toward independent responses, and improved reasoning abilities in problem situations. In particular, tasks at the "reasoning" level proved effective in fostering students' ability to provide logically justified answers [12].

In the course of the discussion, it was revealed that it is important not to directly replicate TIMSS tasks, but rather to adapt them to the content of the national curriculum and to students' age characteristics. In accordance with Vygotsky's theory of the "zone of proximal development," presenting complex tasks through gradual scaffolding enhances students' intellectual potential. Moreover, in lessons organized on the basis of Bruner's constructivist approach, students participate as active subjects, and the process of independently discovering knowledge takes place [10].

The results indicate that aligning TIMSS requirements with the national curriculum:

1. Contributes to the development of students' practical mathematical thinking;

2. Enhances problem-solving competence;
3. Strengthens interactivity and analytical thinking during lessons;
4. Provides a methodological foundation for improving international assessment outcomes [3].

Overall, the developed methodological model can be applied as a practical mechanism for fostering analytical thinking in primary school mathematics lessons.

CONCLUSION

The empirical and theoretical evidence obtained in the course of the study indicates that the methodological adaptation of TIMSS-type tasks into the structure of the national curriculum has a direct impact on the quality indicators of primary mathematics education. The analysis of theoretical sources and the results of practical implementation confirm that tasks designed in accordance with international assessment frameworks should not be directly transferred, but rather redesigned in alignment with national educational goals, age characteristics, and competency-based requirements.

The findings of the comparative analysis demonstrate that the TIMSS cognitive domains-knowing, applying, and reasoning-are conceptually consistent with the key competencies defined in the national curriculum. Therefore, tasks developed on the basis of the proposed integrative methodological model enable the consistent development of students' logical thinking, mathematical modeling, problem-solving, and justification skills. The experimental results further confirmed that tasks constructed within real-life contexts contribute to the formation of students' ability to apply mathematical knowledge in practical situations.

The pilot implementation showed that increasing the proportion of tasks with higher cognitive demands activates students' independent analytical thinking processes. Such an approach contributes not only to strengthening theoretical knowledge but also to developing the competence to apply it in practical contexts. At the same time, the teacher's methodological preparedness and the gradual increase in task complexity were identified as key factors determining the effectiveness of the process.

Thus, the integrative methodological model based on TIMSS criteria can be regarded as an effective mechanism for developing mathematical competencies at the primary education level. The systematic implementation of this approach in educational practice may serve as a methodological foundation for elevating the quality of primary education to a new level.

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