



Eureka Journal of Education & Learning Technologies (EJELT)

ISSN 2760-4918 (Online) Volume 2, Issue 2, February 2026



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DEVELOPING SKILLS TO CREATE TASKS BASED ON TIMSS INTERNATIONAL STUDY

Saidova Mohinur Jonpo'latovna

Doctor of Pedagogical Sciences (DSc), Professor

Bukhara State Pedagogical Institute (BuxDPI)

Sobirova Sabina San'at qizi

Master's Student, Bukhara State Pedagogical Institute (BuxDPI)

Abstract

This article provides a detailed overview of the TIMSS (Trends in International Mathematics and Science Study) international assessment, including its objectives, tasks, framework, classification, and influencing factors. It highlights the types of tasks corresponding to TIMSS, the importance of this study in enhancing the effectiveness of mathematics and science education, and its role in identifying students' knowledge, skills, and problem-solving abilities.

Keywords: International assessment research, mathematics and science, tasks, questionnaires, scales, TIMSS, IEA leadership.

Introduction

In recent years, the educational reforms implemented in Uzbekistan have aimed to achieve significant economic growth and increase the demand for highly qualified specialists. This requires not only raising students' interest in lessons but also strengthening teachers' attention to comprehensive educational processes.

The reforms emphasize the importance of improving the quality of education through assessment and monitoring, drawing on international best practices. In particular, the government focuses on enhancing the teaching efficiency of



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mathematics in schools, preventing potential problems, and enabling students to actively participate in mathematics competitions and Olympiads.

On May 7, 2020, the President of the Republic of Uzbekistan signed a decree on measures to improve the quality of education in mathematics and develop scientific research. These initiatives ensure that students acquire robust knowledge during their school years, enabling them to compete internationally with peers in other countries.

Literature Review and Methodology

In recent years, Uzbekistan has undertaken large-scale reforms to improve educational quality and develop digital education. The PF-5712 decree “Concept for the Development of the Public Education System of Uzbekistan until 2030” (April 29, 2019) outlines Uzbekistan’s participation in international assessments such as:

PIRLS – evaluates reading comprehension skills of 4th-grade students.

TIMSS – assesses 4th and 8th-grade students’ achievement in mathematics and science.

TALIS – examines teaching and learning environments and teachers’ working conditions in general education.

PISA – evaluates 15-year-old students’ literacy in reading, mathematics, and science.

These programs assess students’ creative and critical thinking skills and their ability to apply knowledge in real-life situations.

TIMSS (Trends in International Mathematics and Science Study) is organized by the International Association for the Evaluation of Educational Achievement (IEA). It evaluates students’ mathematics and science literacy, attitudes, and interest in these subjects. In addition, TIMSS collects information on school environments, teachers, students, and their families through questionnaires.



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The study framework is based on the official TIMSS Assessment Frameworks and Specifications, which describe the subjects, learning activities, and types of tasks used in assessments. The study includes:

- Test achievements
- Questionnaires
- Methodological support
- Program provision

International tests are developed considering:

- Alignment of tasks with curriculum and educational levels
- Consistency with other participating countries' tests
- Interconnection of test items
- Appropriateness to students' age
- Compliance with large-scale assessment requirements

TIMSS tasks include various types of questions: multiple-choice, short-answer, constructed-response, and applied tasks. For grades 4 and 8, tasks are carefully designed to assess not only knowledge but also reasoning and problem-solving skills.

TIMSS began in 1995 and is conducted every four years (1999, 2003, 2007, 2011, 2015, 2019). The next 8th cycle is planned for 2023. Participation in TIMSS allows Uzbekistan to adopt international best practices and compare its results with other countries.

For example, in 2019, Singapore's 4th-grade students achieved the highest mathematics score (625 points), followed by 8th graders (616 points). Other high-ranking countries included Hong Kong, South Korea, Chinese Taipei, and Japan. Lower scores were recorded in Morocco, South Africa, Pakistan, and the Philippines.



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Sample TIMSS Problems for 4th-Grade Students

Problem	Skill Focus	Explanation
Jack ate $\frac{1}{2}$ of a bread, Anna ate $\frac{1}{4}$. What fraction of the bread did they eat together?	Fractions	Requires understanding and combining fractions. Visual aids or manipulatives can be used.
Madina showed her friend a paper with the number 68. She asked: "Can you increase it by 21 without using arithmetic?"	Logical thinking	Encourages alternative problem-solving strategies.
Two fathers and two sons picked 3 apples. How did each person get one apple?	Logical reasoning	Requires understanding of relationships (grandfather, father, son).
Ahmad was climbing a 30-meter ladder when it suddenly fell, but he was unharmed. Why?	Critical thinking	Requires analysis of situational context, fostering reasoning skills.

These tasks enhance students' critical thinking, visualization, and problem-solving abilities.

In April–May 2023, Uzbekistan participated in the **TIMSS (Trends in International Mathematics and Science Study) 2023** international assessment for the first time. A total of **8,800 students** from **166 schools** across the country took part in the study, including **4,450 fourth-grade** and **4,350 eighth-grade** students. In addition, school principals and over 1,000 mathematics and science teachers completed questionnaires that accompanied the tests.

4th Grade Results

Mathematics: The average score was **443 points**, placing Uzbekistan **50th out of 58 participating countries**.

Science: The average score was **412 points**, resulting in **54th place out of 58 countries**.

Gender Variation: In mathematics, **girls scored 446** and **boys scored 440**; in science, **girls scored 414** compared to **409 for boys**.

8th Grade Results

Mathematics: The average score for eighth-grade students was **421 points**, placing Uzbekistan **32nd out of 44 participating countries**.



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Science: The average score was **396 points**, ranking **39th out of 44 countries**.

Gender Variation: In mathematics, **boys scored 426** and **girls scored 416**; in science, scores were nearly equal (**396 boys, 395 girls**).

Interpretation

Theoretical Perspective: The TIMSS 2023 results indicate that Uzbek students have established foundational knowledge in both mathematics and science. However, the relatively lower scores compared to top-ranking countries show gaps in **higher-order thinking, applied reasoning, and problem solving**—core skills emphasized by TIMSS tasks.

Practical Implications: These findings suggest a need for instructional strategies that promote **critical thinking and real-world application** in mathematics and science classrooms. Integrating TIMSS-style tasks (complex word problems, data interpretation, conceptual reasoning) into the primary and middle school curricula can help improve student achievement.

 Uzbekistan's TIMSS 2023 Results — Table

Grade	Subject	Average Score	International Ranking	Key Observation
4th	Mathematics	443	50th / 58	Foundational skills okay; more focus needed on reasoning and application.
4th	Science	412	54th / 58	Basic science understanding present; conceptual depth needs improvement.
8th	Mathematics	421	32nd / 44	Moderate performance; suggests strengthening algebra and geometry reasoning.
8th	Science	396	39th / 44	Scores highlight need for enhancing experimental and inquiry-based learning.

Uzbekistan's first participation in TIMSS 2023 shows that students are building core competencies in mathematics and science, but improvements in higher-order thinking and application skills are needed. These insights can guide curriculum



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development, teacher training, and classroom practices to better align with international standards.

Discussion and Conclusion

Mathematics is integral to daily life and essential for developing logical thinking. Solving TIMSS-style tasks allows students to deepen their understanding and apply knowledge creatively.

To ensure students' success, teachers must provide clear instruction and use diverse methods, including visual aids and practical demonstrations. Integration of mathematics with other subjects strengthens students' overall knowledge.

Participation in TIMSS allows students to evaluate their knowledge, gain experience in applying it, and adopt international best practices. Overall, the TIMSS study plays a critical role in improving mathematics and science education and fostering independent, analytical thinkers among students.

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