

**DEVELOPING PRIMARY MATHEMATICS EDUCATION IN UZBEKISTAN: A  
PERSPECTIVE BASED ON PISA, TIMSS, AND PIRLS ASSESSMENTS**

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**Abstract:** Mathematical literacy is a crucial skill for students to participate successfully in a modern knowledge-based society. In Uzbekistan, various educational reforms have been initiated to improve the quality of primary mathematics education in line with international standards. Large-scale assessments such as PISA, TIMSS, and PIRLS provide valuable insights into students' learning outcomes and inform policy directions. This paper analyzes Uzbekistan's participation in these assessments, identifies key gaps in primary mathematics teaching and learning, and proposes evidence-based strategies to develop students' mathematical thinking and functional literacy. The study emphasizes the importance of curriculum alignment, teacher capacity building, and context-sensitive pedagogical practices to enhance Uzbekistan's position in global education rankings and foster 21st-century skills among young learners.

**Keywords:** Mathematics education, PISA, TIMSS, PIRLS, primary school, functional literacy, Uzbekistan, curriculum reform, teacher training.

In the globalized world, the ability to apply mathematical knowledge to solve real-life problems is considered a fundamental component of functional literacy. International large-scale assessments such as the Programme for International Student Assessment (PISA), the Trends in International Mathematics and Science Study (TIMSS), and the Progress in International Reading Literacy Study (PIRLS) have become benchmarks for comparing students' competencies worldwide.

Uzbekistan has shown commitment to participating in these assessments to diagnose the strengths and weaknesses of its educational system. According to the Ministry of Preschool and School Education (2021), "the insights gained from these studies guide curriculum improvements and teacher training efforts." However, results indicate that while Uzbek students demonstrate strong procedural knowledge, they often struggle with tasks requiring higher-order thinking and problem-solving in unfamiliar contexts.

This paper explores how insights from PISA, TIMSS, and PIRLS can help develop primary mathematics education in Uzbekistan, aligning it with global trends and ensuring that students acquire not only factual knowledge but also critical thinking, reasoning, and the ability to apply mathematics in daily life.

**Understanding International Assessments:** PISA measures 15-year-old students' ability to use their reading, mathematics, and science knowledge to meet real-life challenges (OECD, 2018). TIMSS assesses the mathematics and science achievements of 4th and 8th graders, focusing on curriculum content and cognitive domains (Mullis et al., 2020). PIRLS evaluates reading comprehension among 4th graders and indirectly informs about students' capacity to understand problem statements in mathematics.

Research shows that students with higher reading literacy also perform better in mathematical problem-solving (Mullis et al., 2020). This highlights the interconnection between language and mathematics education in primary schools.

**Uzbekistan's Performance:** Uzbekistan's first participation in PISA revealed gaps in students' functional mathematics literacy (Kurbanova, 2020). In TIMSS 2019, while primary students

performed close to the international average in basic tasks, they faced difficulties in reasoning and applying mathematical concepts creatively.

Pirnazarova (2021) argues that this pattern stems from an overemphasis on rote memorization and insufficient focus on inquiry-based and contextualized learning in the classroom.

**Curriculum Alignment:** To address these gaps, Uzbekistan has initiated curriculum reforms aimed at developing competencies rather than mere factual recall. The new standards emphasize logical thinking, problem-solving, and the use of real-life contexts.

However, as Sabirov (2022) points out, textbooks and classroom practices often lag behind the curriculum goals: “Teachers tend to stick to familiar methods, and new content is sometimes introduced without adequate methodological support.”

It is crucial to ensure that textbooks align with PISA and TIMSS frameworks. This means including open-ended tasks, contextual problems, and activities that foster reasoning and communication.

**Teaching Practices:** Effective mathematics teaching requires moving from teacher-centered instruction to student-centered, inquiry-based learning. According to OECD (2019), classroom discussions, formative assessment, and collaborative problem-solving enhance students’ deeper understanding.

In Uzbekistan, many primary teachers still prefer traditional lecturing due to large class sizes and lack of confidence in managing active learning. Abdullaeva (2020) found that while workshops are organized to train teachers in modern methods, there is a need for continuous support and peer collaboration. Introducing lesson study groups, peer mentoring, and regular professional development can build teacher capacity to implement PISA- and TIMSS-aligned pedagogies.

**Assessment Practices:** Current school assessments in Uzbekistan mainly focus on summative evaluation. To align with international standards, formative assessment practices need to be strengthened.

Black and Wiliam (1998) highlight that formative assessment has a significant impact on learning outcomes. Practical strategies include classroom questioning, feedback, self-assessment, and the use of rubrics that emphasize reasoning and communication.

**Community and Parental Engagement:** Studies show that students’ home learning environment strongly influences their achievement (OECD, 2018). Parents in Uzbekistan often see mathematics as a subject requiring private tutoring and memorization.

Raising awareness among parents about modern mathematics learning goals, encouraging at-home activities like math games, and reducing anxiety about problem-solving can create a supportive learning ecosystem.

Based on the analysis, the following recommendations are proposed:

1. **Curriculum and Textbooks:** Regularly review and revise mathematics textbooks to align with PISA and TIMSS cognitive demands.
2. **Teacher Professional Development:** Expand hands-on training, lesson study, and peer support to build confidence in inquiry-based teaching.
3. **Formative Assessment:** Promote classroom-based assessment methods focusing on students’ reasoning, explanation, and reflection.

4. Parent Education: Develop outreach programs to help parents understand and support modern mathematics learning.
5. Research and Monitoring: Conduct ongoing national studies to evaluate how reforms impact student outcomes.

### **Conclusion**

Uzbekistan's active participation in PISA, TIMSS, and PIRLS provides a roadmap for transforming primary mathematics education. Bridging the gap between curriculum intentions and classroom practice is vital to develop a generation equipped with functional literacy and 21st-century skills.

As educational reforms continue, coordinated efforts among policymakers, textbook developers, teachers, parents, and researchers are essential to sustain progress and ensure that every child in Uzbekistan can think mathematically, reason logically, and solve problems creatively.

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