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INTEGRATION OF INTERNATIONAL PISA CRITERIA IN ASSESSING MATHEMATICAL LITERACY INTO THE UZBEKISTAN EDUCATION SYSTEM

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Annotatsiya: Ushbu maqolada matematik savodxonlikni baholashda xalqaro PISA mezonlarining O沃bekiston ta厩m tizimiga integratsiyalash jarayoni tahlil qilinadi. Tadqiqot davomida o沃quv dasturlarining mazmuni, baholash tamoyillari va o沃quvchilarning kompetensiya darajasiga ta厩ir qiluvchi omillar o沃ganildi. PISA formatidagi topshiriqlarni qo沃lash tajribasi o沃quvchilarda tahliliy fikrlash, real vaziyatda matematik bilimni qo沃lash va strategik yechim tanlash qobiliyatlari sezilarli darajada rivojlanishini ko沃satdi. Shuningdek, o沃ituvchilarning malakasini oshirish va baholash mezonlarini to沃g沃i talqin qilish PISA yondashuvini samarali joriy etish uchun muhim omil sifatida baholandi.

Kalit so沃lar: PISA, matematik savodxonlik, baholash tizimi, kompetensiya, ta厩m sifati, integratsiya, o沃quv dasturi.

Аннотация: В данной статье рассматривается процесс интеграции международных критериев PISA в систему образования Узбекистана для оценки математической грамотности учащихся. В ходе исследования были изучены особенности учебных программ, подходы к оцениванию и факторы, влияющие на формирование компетенций школьников. Опыт использования заданий формата PISA показал заметное развитие аналитического мышления, способности применять математические знания в жизненных ситуациях и выбирать эффективные стратегии решения. Также установлено, что повышение квалификации учителей и корректное понимание оценочных критериев являются ключевыми условиями успешного внедрения PISA-подхода.
Ключевые слова: PISA, математическая грамотность, оценивание, компетенции, качество образования, интеграция, учебные программы

Abstract: This article examines the integration of international PISA criteria into Uzbekistan’s educational system for assessing students’ mathematical literacy. The study explores curriculum content, assessment principles, and factors influencing the development of students厩 competencies. Experience with PISA-style tasks demonstrates significant improvement in analytical thinking, the ability to apply mathematical concepts in real-life contexts, and the use of effective problem-solving strategies. The findings indicate that teacher training and accurate interpretation of assessment rubrics are essential for the successful implementation of the PISA approach.

Keywords: PISA, mathematical literacy, assessment system, competency, education quality, integration, curriculum design.

Introduction

In today's globalized world, the competitiveness of educational systems is primarily determined by the fact that students have modern knowledge and skills. International systems for

assessing the quality of education, in particular the PISA study, have become one of the most important indicators of this process. The PISA study assesses the real state of the country's education system by determining the level of functional literacy of 15-year-old students in reading literacy, mathematical literacy, and natural sciences. Based on international criteria, the ability to apply knowledge to real-life situations, logical thinking, and the ability to analyze and interpret are considered the main criteria, rather than the knowledge of students. This requires a shift from teaching only theoretical knowledge to teaching principles that are focused on practice. In recent years, Uzbekistan has been implementing consistent reforms to bring its education system in line with international standards, develop students' functional literacy, and achieve decent results in international assessment systems. In particular, methodological manuals are being created on the preparation process for the PISA study, assessment criteria, and question structures, teachers are being trained in modern pedagogical approaches, and curricula are being adapted to a competency-based format. Because PISA not only allows for international comparisons, but also provides clear directions for identifying problems in the education system, identifying existing problems, and eliminating them.

The assessment of mathematical literacy is one of the most important facets of the PISA study, in which it is assessed that the streamer is able to apply mathematical knowledge to situations in everyday life, analyze problem states, draw logical conclusions and use mathematical modeling in the decision-making process. This approach is in stark contrast to the memorization of formulas and rules in traditional education. Therefore, the integration of PISA criteria into the Uzbek education system will serve not only to modernize the assessment process, but also the entire educational process, develop students' independent thinking, and form life competencies. The initial results of Uzbekistan's PISA study have shown the need to improve mathematical literacy in the education system. In this regard, aspects such as the practical orientation of curricula, the application of mathematical methods and concepts in real-life situations, the competencies of teachers, and the compliance of the assessment system with international standards are of particular importance. The process of integrating international criteria into national curricula requires in-depth scientific analysis, a methodological approach, and pedagogical innovations.This article analyzes the essence of the international PISA criteria in mathematics, issues of their application to the education system of Uzbekistan, existing problems and solutions, as well as the role of PISA criteria in improving the quality of education. This approach serves to develop students' mathematical literacy and form them as competitive personnel in line with the requirements of the modern labor market.

METHODS

This study used a comprehensive methodological approach to comprehensively analyze the integration of international PISA criteria into the Uzbek education system in assessing mathematical literacy. In order to ensure the scientific justification of the study, the reliability and practical significance of its results, several scientific and methodological techniques were left to be domesticated. They include pedagogical analysis, comparison, diagnostics, content analysis, statistical generalization, experimental observation, and expert survey methods, each of which was selected in accordance with the goals and objectives of the research. At the first stage, the conceptual framework of the PISA study, international requirements for mathematical literacy, assessment criteria, and question structures were studied using the theoretical-pedagogical analysis method. Official reports on the PISA 2022 and 2025 cycles, methodological manuals published by the OECD, and conceptual documents on the assessment of mathematical literacy were analyzed. In addition, regulatory and legal documents on state standards, curricula, pedagogical technologies, and assessment systems related to the education system of Uzbekistan were compared, and their

compliance with PISA criteria was determined. This stage created the theoretical foundation of the research.

In the second stage, the methods of comparison and content analysis were used, and meaningful, structural, and cognitive differences were identified between the mathematical tasks developed based on PISA requirements and the tasks found in the current mathematics textbooks of Uzbekistan. In particular, the level of complexity of the questions, their connection to real-life situations, the mathematical models used, the thinking operations required of the student, and the skills required to achieve PISA levels were analyzed. As a result of the content analysis, it was clarified which sections of the National flow program correspond to the competencies of PISA and where there are bosses.

In the third stage, expert surveys and diagnostic methods were used to form the practical direction of the study. Surveys were conducted among mathematics teachers, methodologists, specialists from the education quality assessment agency, as well as professors and teachers of higher education institutions specializing in mathematics. Their knowledge of PISA requirements, the methods they use to develop functional literacy in students, and their experience and problems in creating PISA-type tasks were studied. Experts also gathered opinions on the advantages, challenges, and practical mechanisms for integrating PISA criteria into the national education process.

In the next stage, empirical-experimental methods were used, and trial lessons based on PISA-type tasks were conducted in selected schools. The students' approach to the question, their understanding of the problem situation, their ability to mathematically model, their logical consistency, and the validity of their answers were observed. These observations served to determine the students' overall level of preparation and the effectiveness of the implementation of the PISA criteria. As a result of experimental work, it was determined which skills the tasks adapted to the PISA criteria develop in students and in which aspects they cause difficulties.Statistical generalization and analysis methods were also widely used to systematically process the collected data. Statistical methods such as frequency analysis, classification of student responses, identification of typical errors, and assessment of the level of skill development were used based on expert opinions. The results were processed in the form of charts, tables, and comparative indicators, and conclusions were drawn.

An interdisciplinary approach as a set of methods also played an important role. Because mathematical literacy is not limited to mathematical knowledge alone, it includes many competencies such as logic, critical thinking, problem solving, understanding real-world situations, and information processing. Therefore, scientific sources on pedagogy, psychology, didactics, assessment system methodology, and international educational standards were used in the research process. At the final stage, all the results obtained were summarized based on a systematic analysis, and practical proposals were developed for integrating PISA criteria into the Uzbek education system. The proposals include such areas as modernizing the curriculum, improving teacher qualifications, reforming the assessment system, creating a bank of PISA-type tasks, and organizing the educational process based on competency-based methods.

Results

Theoretical analyses, content analysis, expert surveys, diagnostics, and empirical observations conducted during the study identified a number of important results in the process of integrating the PISA mathematical literacy criteria into the Uzbek education system. The results obtained comprehensively illuminated the current state of the education system, the level of student

preparation, the competence of teachers, and the level of compliance of curricula with PISA requirements.

As a first result, it was found that the conceptual model of PISA mathematical literacy partially coincides with the current mathematics curriculum of Uzbekistan. In particular, although the basic mathematical content sections required - algebra, geometry, statistics and probability - are present in the national program, it has been confirmed that their content does not adequately cover components such as real-life context, problem situations, modeling, functional thinking based on PISA requirements. As a result of the content analysis, it was found that 70-75% of the tasks in the textbooks are traditional, algorithmic, and oriented towards solutions, and only 20-25% are compatible with real-life situations and PISA-type problems.

The second important result is that students' mathematical literacy levels, in particular their modeling, logical analysis, data processing, and interpretation skills, are not sufficiently developed. According to empirical observations, approximately 35-40% of students had difficulty fully understanding the PISA-type tasks used in the pilot lessons; 50% needed additional explanations to solve the tasks. Students' mistakes were observed more often in the processes of transforming a situation into a mathematical model, interpreting graphs and diagrams, justifying an idea, and logically explaining a solution.

The results of the study showed that the methodological training of teachers is also an important factor. During the expert survey, 68% of teachers expressed that they had a general understanding of the PISA criteria, but lacked experience in systematically applying them in the classroom. 54% of respondents said they had difficulty creating PISA-type tasks, and 72% said that the problems in textbooks were not sufficiently integrated with PISA requirements. This confirmed that the development of modern assessment methods for teachers is also a pressing issue. Another result of the study is that the environment for developing mathematical literacy for students is not sufficiently developed. It was found that the methods used in schools are mainly based on traditional memorization and algorithmic thinking, and that methods aimed at developing competencies such as independent research, analysis of problem situations, and working on practical examples are not widely used. During the pilot lessons, it was observed that PISA-type tasks aroused great interest among students, but they required more time to develop appropriate thinking strategies. The statistical processing of the collected data revealed another important conclusion: the use of tasks that meet PISA criteria significantly enhances students' ability to think independently, analyze, and consider various solution options. During empirical experiments, students' analytical thinking, logical reasoning, and decision-making skills significantly improved as a result of repeatedly completing PISA-type tasks. In general, the results of the study showed that the mathematical training of Uzbekistan has the necessary potential to introduce the criteria of PISA, but the need to improve the flow programs, retrain the streamers, create modern methodological supports and adapt the assessment system to international standards in order to reduce this potential. It was found that the correct integration of PISA criteria creates ample opportunities for improving the quality of the country's education system, developing students' functional literacy, and achieving decent results in international assessments.

DISCUSSION

The results obtained showed that the work on applying the PISA criteria to the Uzbek education system is still at an initial stage. First of all, it became clear that the current learning process, which is dominated by algorithmic problem-solving tasks, does not sufficiently develop functional thinking in students, as the PISA approach requires the development of these

competencies. This situation was evident not only in the content of the textbooks, but also in the behavior of the students during the test lessons: the lack of skills in understanding the situation, creating a model, and interpreting the results indicates that the complex thinking strategies required by PISA have not yet been formed. The evidence gathered during the study also showed that the penetration of PISA assignments into school practice increases motivation in leaks. Issues based on Real-life situations have been observed to generate more interest in them. However, it has been found that time and a special methodological approach are needed to prepare students to independently complete such tasks. Therefore, it is necessary to make this process a component of the teaching strategy, not a one-time initiative.

Feedback from teachers also showed that the lack of methodological manuals and a database of practical examples is one of the biggest obstacles to the integration process. Although teachers have a general understanding of the PISA criteria, they need clear guidelines, a professional development system, and practical methods for developing PISA-type tasks to apply them to the classroom. To support this process, special methodological materials, trainings and seminars are needed. The results also revealed the characteristics of the talim system itself. Since more memorization, exercise based on replayability prevails in schools, the analytical thinking that PISA requires seems complex. Although this is the case, the ability of the streamers to adapt to PISA-type questions in the test lessons has shown their high potential. With the right learning strategy, they can achieve significant short-term gains.

From a technical and organizational perspective, adapting the assessment system to the PISA format requires a number of modernizations, from the content of education to digital monitoring systems. In order to adopt an international approach, it is necessary to revise the discharge process, the structure of textbooks, the assessment criteria, the requirements that admire the activities of the streamers in stages. Otherwise, the introduction of the PISA criteria will be limited only to a change in External coring.

Overall, the evidence from the study confirms that PISA integration is an effective and promising direction for the Uzbek education system. However, for the successful implementation of this process, the methodological training of educators, the domestication of the content of flow programs with modern competencies and the modernization of the assessment system occupy an important orin. The success of integration depends precisely on the suitability of these factors.

Conclusion

Studies have shown that applying PISA criteria to the Uzbek education system will expand the assessment of mathematical literacy to meet modern requirements. This approach helps to identify students' skills not only in traditional knowledge, but also in finding solutions in real situations, analyzing information, comparing different mathematical models, and drawing independent conclusions. The results observed during the testing process confirmed that students had increased flexibility in thinking, decision-making based on evidence, and a desire to try different strategies.

To fully integrate the PISA approach into curricula, it is important to improve teacher training, correctly interpret assessment criteria, and increase the proportion of complex, context-based problems in the learning process. It is expected that as this process is implemented step by step, mathematical literacy in Uzbekistan's schools will approach international standards, students' global competitiveness will increase, and their readiness to succeed in a digital society will increase.

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