

DETERMINING THE LEVEL OF BIOLOGICAL SUBJECT ASSIMILATION BY SECONDARY SCHOOL STUDENTS BASED ON INTERNATIONAL ASSESSMENT STUDIES.

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Abstract. This article extensively covers the issues of developing and substantiating a network model for determining the level of mastery of biology by students of general education schools based on international assessment studies. As the theoretical and methodological basis of the study, the PISA international assessment program implemented by the OECD and the competence-based approaches to scientific literacy and natural sciences of TIMSS international assessment programs conducted by the IEA organization were studied.

Keywords: biology education, PISA international assessment program, natural science literacy, competency-based approach, international assessment research, student mastery level, cognitive levels, scientific thinking, 21st-century skills, education quality, innovative education, environmental culture, OECD, biological literacy, educational monitoring.

Introduction. In the current era of globalization and informatization, improving the quality of the education system and evaluating students' knowledge and skills at the international level is of great importance. One of the most pressing issues is determining the effectiveness of teaching biology in general education schools, developing students' scientific literacy, and assessing their level of knowledge utilization in practical life. Biology plays an important role in shaping students' scientific worldview about living nature, developing ecological culture, and strengthening knowledge regarding a healthy lifestyle. Therefore, alongside traditional assessment methods, there is a growing need to determine mastery levels in this discipline based on international assessment studies.

PISA (Program for International Student Assessment) is an international program for assessing student literacy. Literacy in the natural sciences requires providing the necessary information in a short period of time and creating the necessary conditions for young people to thoroughly master the basics of various sciences. PISA is a program that assesses the literacy (reading, mathematics, natural sciences) and the ability to apply knowledge in practice of 15-year-old students in

different countries. The proposed program will be conducted every 3 years. It was first developed in 1997 and used for the first time in 2000. Under this program, tests are conducted every three years to evaluate students' knowledge. To date, PISA 2025 test tasks have been conducted a total of 9 times (2000, 2003, 2006, 2009, 2012, 2015, 2018, 2022, and 2025), and the research results are expected to be released. Preparations for the international assessment studies to be conducted in 2028 have also begun in our country. Let us consider these competencies using the example of competencies used to determine students' natural science literacy:

- 1. Competence in explaining phenomena from a scientific perspective.*
- 2. Competence in designing and evaluating scientific research.*
- 3. Competence in the scientific interpretation of data and evidence.*

Based on the intellectual and thinking ability required to complete the PISA task, they are divided into three cognitive levels:

- 1. Lower level - single-step operations.*
- 2. Medium level - description of phenomena.*
- 3. High level - analysis of complex data.*

However, the purpose of participating in this program is not to conduct tests or prepare students for testing, but to form 21st-century skills in our students and create a solid foundation for creating competitive personnel. In the 20th century and earlier, specialists who possessed a strong memory, knowledge, and as much information as possible in their field were highly valued, but now this knowledge no longer holds decisive importance. Search engines, online encyclopedias, and comprehensive online databases have been created, and the need to memorize this information has been pushed into the background. In today's specialist, the competence to analyze this knowledge and derive new information from it is coming to the fore. PISA tests reflect the same changes in the education system and improve schoolchildren's skills in analyzing, drawing conclusions from, and communicating with those who need them in real life. The PISA program tests are conducted to reflect these changes in the education system, to analyze the events that schoolchildren need in real life, to determine the extent to which they have mastered the skills of drawing conclusions and communicating, and to determine how well the education system is adapting to these changes.

The essence of the international assessment program is that in recent years, as a result of the reforms carried out in our country, a huge indicator of economic growth has been achieved, which further increases the demand for qualified personnel and advanced specialists in all areas. This, in itself, requires increasing students' interest in lessons and increasing attention to the comprehensive education and upbringing of students. The fact that the above requirements are very important for the education system means that, as in most foreign countries, it is necessary to attract best practices aimed at improving the quality of education by assessing and monitoring the development of education and science.

Natural science literacy increases the competence to identify problems that can be solved scientifically in life events, and to draw conclusions based on observations and experiments. The main goal of these conclusions is to develop the ability to understand and comprehend the world around us and the changes occurring within it as a result of human activity, and to make the necessary decisions accordingly. In 2025, Uzbekistan will participate in the International Student Assessment Program (PISA) for the second time. The project is also supported by the World Bank. PISA-2025 tests were conducted in May of last year.

Uzbekistan first joined the PISA study conducted by the Organization for Economic Cooperation and Development (OECD) in 2022. The study assessed the ability of 15-year-old students from more than 80 countries to use their skills and knowledge in three areas of literacy: reading, mathematics, and science. The Ministry of Preschool and School Education ensured the participation of more than 7,200 students from more than 200 schools in Uzbekistan in the PISA-2022 test. Despite the low results of the assessment of Uzbekistan, this experience made it possible to identify existing problems in the school education system and start working to eliminate these problems in order to improve the quality of education and improve the level of student performance.

According to the 2022 results of PISA, an international program for assessing student performance in education by the Organization for Economic Co-operation and Development (OECD), Uzbekistan ranked in the bottom ten in all three areas: mathematical literacy - 364 points (the average score for the countries participating in the study was 472 points), reading literacy - 336 points (476 points), and science literacy - 355 points (485 points). In international assessment studies conducted in 2022, Singaporean students showed the best results in all areas: 575 points in mathematical literacy, 543 points in reading literacy, and 561 points in science literacy. Overall, students from the Southeast Asian and Chinese regions led the

study. Estonia and Canada also entered the top ten in all categories.

Table 1.

Top 10 performing countries

	Math literacy	Reading literacy	Science literacy
1	Singapore	Singapore	Singapore
2	Macau (China)	Irish	Japan
3	Taipei (China)	Japan	Macau (China)
4	Hong Kong (China)	South Korea	Taipei (China)
5	Japan	Taipei (China)	South Korea
6	South Korea	Estonia	Estonia
7	Estonia	Macau (China)	Hong Kong (China)
8	Switzerland	Canada	Canada
9	Canada	USA	Finland
10	Netherlands	New Zealand	Australia

Table 2.

Top 10 lowest performing countries

	Mathematical literacy	Reading literacy	Science literacy
72	Uzbekistan	North Macedonia	El Salvador
73	Jordan	Albania	Guatemala
74	Panama	Dominican Republic	Palestine
75	Kosovo	Palestine	Paraguay
76	Philippines	Philippines	Morocco
77	Guatemala	Kosovo	Dominican Republic
78	El Salvador	Jordan	Kosovo
79	Dominican Republic	Morocco	Philippines
80	Paraguay	Uzbekistan	Uzbekistan
81	Cambodia	Cambodia	Cambodia

Table 3.

Results among CIS countries

	Mathematical literacy	Reading literacy	Science literacy
	21. Latvia (483 points);	27. Latvia (475 points)	19. Latvia (494 points)
	24. Lithuania (475)	32. Lithuania (472)	29. Lithuania (484)
	41. Ukraine (441)	46. Ukraine (428)	39. Ukraine (450)

46. Kazakhstan (425)	51. Moldova (411)	49. Kazakhstan (423)
50. Moldova (414)	61. Kazakhstan (386)	51. Moldova (417)
56. Azerbaijan (397)	67. Georgia (374)	66. Georgia (384)
60. Georgia (390)	69. Azerbaijan (365)	68. Azerbaijan (380)

In accordance with the Concept for the Development of the Public Education System of the Republic of Uzbekistan until 2030, Uzbekistan plans to enter the top 30 countries in terms of PISA results by 2030. Based on this, it was instructed to update school curricula and programs in mathematics, physics, chemistry, biology, and foreign languages based on international standards, and to develop teaching methods aimed at forming students' knowledge, analytical, critical, and creative thinking skills, and the ability to find solutions to problems and apply them in practice.

Conclusion. The tasks of modernizing biology education based on international standards, systematically forming students' research competencies, and achieving high results in international assessment programs by 2030, particularly in the PISA ranking, require a comprehensive approach. In this process, the network model is of particular importance as an effective mechanism for organizing the content, methods, and assessment system of education in a mutually integrated manner. Biology education, organized on the basis of the network model, serves to harmonize students' theoretical knowledge with practical activity, develop independent decision-making in problem situations, and develop critical and creative thinking skills. At the same time, this model ensures the continuity and consistency of the educational process and creates an opportunity to form students' scientific literacy at the level of international standards. Natijada, biologiya ta'limi tarmoq modeli asosida tashkil etish o'quvchilarning raqobatbardoshligini oshirish, ularning zamonaviy ilmiy tafakkurini rivojlantirish hamda global muammolarga ilmiy asoslangan yondashuvni qaror toptirishning muhim omili sifatida namoyon bo'ladi.

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