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APPLICATION OF ICT LITERACY AND SIMULATION TASKS IN PREPARATION FOR THE INTERNATIONAL ASSESSMENT PROGRAM TIMSS

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Abstract. This article analyzes the significance of ICT literacy and the format of simulation tasks in the international assessment program TIMSS, organized by the International Association for the Evaluation of Educational Achievement. It also reveals the pedagogical effectiveness of applying modern information and communication technologies in the process of preparation for international assessment studies. The results of the study show that the use of virtual laboratories, interactive models, and digital platforms contributes to increasing the functional literacy of students.

Keywords: TIMSS, ICT literacy, simulation tasks, digital competence, international assessment, virtual laboratory.

Introduction. The level of development of society, the beginning of the information age enriched with modern technologies, as well as global competition and scientific-technical progress, have turned the formation of youth as highly qualified specialists into an urgent task. Under modern conditions, sought-after specialists must possess not only theoretical knowledge but also the ability to quickly and adequately assess any situation, make well-founded decisions, and demonstrate logical and creative thinking. In this regard, teaching based exclusively on traditional teaching methods becomes insufficient, which determines the necessity of introducing modern pedagogical approaches. The organization of educational classes based on modern information and communication technologies (ICT) contributes to the intellectual, physical, and spiritual development of students, and to the formation in them of competencies in logical thinking, problem solving, and decision-making. At the same time, the use of ICT tools makes the educational process interactive, more engaging, and effective, forming in students the skills of independent and creative thinking.

At present, practically all general education schools are equipped with modern computers, multimedia tools, and telecommunication technologies. This creates opportunities not only for the modernization of the educational process, but also for the effective preparation of students for international assessment programs. In particular, the international study TIMSS assesses not only knowledge of mathematics and the natural sciences, but also functional literacy, logical thinking, and the ability to analyze information. Therefore, for the performance of simulation tasks and computer tests in the TIMSS format, it is important that the level of ICT literacy of students be sufficient. When organizing lessons using modern ICT tools, the teacher pays attention to the following elements: the goals and objectives of the lesson, strategies for achieving them, the educational material and methods of its presentation,

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teaching methods, types of tasks, questions for discussion and debate, as well as the organization of interaction among students in an interactive form. Such an approach not only increases the effectiveness of the lesson, but also promotes the development in students of skills of independent thinking, decision-making based on experimentation, and analytical abilities. From this point of view, the widespread introduction of modern information and communication technologies in schools has strategic significance for raising the level of student preparation for TIMSS and other international assessment programs. In addition, an important pedagogical task is the continuous professional development of teachers and the enhancement of their competencies in applying interactive and simulation methods.

Methodology. The purpose of the study is to determine the effectiveness of students' ICT literacy and their skills in performing simulation tasks in the process of preparation for the international assessment program TIMSS. The study was conducted on the basis of general education schools among 8th-grade students in the context of preparation in chemistry. In the course of the study, an analysis was carried out of existing scientific sources on international assessment programs, ICT literacy, simulation tasks, and the integration of virtual laboratories into the educational process. The experience of students in using virtual laboratories, their interest in interactive methods, and their level of motivation were also studied.

In the practical part, an experimental group and a control group were organized. Students of the experimental group studied chemistry using ICT and simulation tasks. In this case, classes were conducted using virtual laboratories, interactive models, animations, multimedia presentations, and online platforms for simulations. The simulation tasks allowed students to model various chemical processes, such as electrolysis, reactions of acidic and basic solutions, processes of gas formation, and changes in the concentration of solutions in a virtual environment. In addition, students developed skills in analyzing results, visualizing reaction rates, product yields, and interrelationships using graphs and diagrams. Tasks were performed both individually and in groups, forming in students the skills of independent thinking, experiment design, and collective discussion. The control group was taught by traditional methods, where tasks were limited to paper exercises and standard laboratory work. A comparison of the results of the experimental and control groups made it possible to assess the effectiveness of tasks performed using ICT. The level of students' ICT literacy and their ability to perform simulation tasks were assessed using diagnostic tests, virtual sessions, and questionnaires. Teachers were provided with instructions on working with virtual laboratories and interactive platforms, and conditions were created in the classrooms for the use of computers, projectors, an interactive board, and online modeling tools.

Thus, the presented methodology made it possible to assess the development of students' functional literacy in chemistry, their skills in performing simulation tasks, and their readiness for tasks in the TIMSS format. Practical tests showed the effectiveness of the interactive approach, confirming the importance of ICT tasks for forming logical thinking, experiment design, and the analysis of results among schoolchildren.

Modern information and communication technologies make it possible to provide students with the following types of tasks:

Virtual Laboratories and Simulation Exercises

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- Performing experiments in a virtual environment, such as electrolysis, reactions of acidic and basic solutions, and processes of gas formation.

- Analysis of reaction rates, product yields, and changes in concentration using graphs and diagrams.

- Modeling various scenarios and comparing results by changing the conditions of the experiment.

Interactive Tests and Problem Solving

- Performing electronic tests and simulation tasks in the TIMSS format.

- Interpreting unexpected results, identifying errors, and developing logically substantiated solutions.

- Assessing students' ability for rapid thinking, analysis, and decision-making by means of tests.

Tasks in Graphical and Animation-Based Modeling

- Studying reaction kinetics, metabolism, and atomic-molecular interactions using animated models.

- Visualization and analysis of experimental results.

- Providing students with the opportunity to present their results in graphical form.

The results of the study showed that the use of modern information and communication technologies in chemistry lessons significantly increased the level of students' knowledge and their functional literacy. Students of the experimental group, who studied using virtual laboratories and simulation tasks, demonstrated higher indicators compared to the control group.

The students showed better results in the analysis of chemical processes, the interpretation of experimental results, and work with graphical information. In addition, they effectively demonstrated skills of independent decision-making and the drawing of scientific conclusions in problem situations. ICT-based simulation tasks are an effective tool for developing students' logical thinking, analytical approach, and experimental skills, and also raise the level of their preparation for international assessment programs.

Conclusion. Thus, the use of ICT in the educational process, organized taking into account the above-mentioned requirements, contributes to improving the quality of education and upbringing. The application of the recommendations presented in our pedagogical practice will make it possible to achieve high results and to contribute to the comprehensive development and educational preparation of the younger generation.

In the educational system of our country, the effective use of ICT in the teaching of school subjects is an urgent task. Information technologies serve as a universal instrument of education, providing opportunities not only for the formation of students' knowledge, skills, and abilities, but also for the development of their personal qualities and the satisfaction of their cognitive interests.

Pedagogical and psychological studies emphasize that ICT has a significant influence on the development of theoretical, creative, and reflective thinking in students. The figurative representation of events and processes in the memory of the student enriches the educational material and contributes to its scientific assimilation.

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