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METHODOLOGY FOR ORGANIZING AN INTEGRATIVE APPROACH AND AN BINARY LESSONS IN BIOLOGY CLASSES AT AN ACADEMIC LYCEUM

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Abstract: The article analyzes the theoretical and methodological foundations of the integrative approach and binary lessons in biology education, their didactic potential, as well as the mechanisms for their implementation in the educational process. It is scientifically substantiated that integrated education contributes to improving learning effectiveness by ensuring close interconnection between biology and other academic disciplines. In addition, the results of experimental research conducted in academic lyceums aimed at determining the effectiveness of applying the integrative approach and binary lessons in biology teaching are analyzed.

Keywords: integrative approach, binary lessons, biology education, interdisciplinary integration, competency-based approach.

Introduction In the modern education system, teaching subjects separately leads to the fragmentation of students' knowledge. Therefore, ensuring interdisciplinary integration and forming knowledge as a holistic system is considered one of the most important tasks of contemporary education [1]. Especially in biology education, revealing the interrelationships among natural sciences plays a significant role in developing students' scientific worldview [2]. An integrative approach and binary lessons enable the harmonization of theory and practice in teaching biology and contribute to the development of students' competencies [3]. Thus, this section provides a scientific justification for the methodology of organizing an integrative approach and binary lessons in biology education.

Theoretical Foundations of the Integrative Approach in Biology Education The integrative approach is aimed at organizing educational content based on interdisciplinary connections, ensuring the systematic and logical acquisition of knowledge [1]. In biology, integration makes it possible to explain biological processes in harmony with chemical, physical, and geographical laws. According to V.V. Kraevskiy and I.Ya. Lerner, integrated educational content forms not only theoretical knowledge in students but also practical and analytical skills [2].The integrative approach in biology education is based on the following didactic principles:

- scientific validity and systematicity;
- continuity and consistency;
- practical orientation;
- competency-based approach [4].

The integrative approach facilitates the mastery of complex concepts in biology education, increases students' interest in the subject, and contributes to the formation of ecological culture [6].

The Concept of Binary Lessons and Their Pedagogical Significance A binary lesson is an integrated form of instruction organized collaboratively by two or more subject teachers [3]. In

biology education, binary lessons are most often conducted through the integration of biology with chemistry, physics, geography, and informatics.

According to Yu.K. Babanskiy, binary lessons contribute to optimizing the educational process and increasing students' cognitive activity [3]. Through such lessons, students gain a deeper understanding of biological processes and acquire skills for applying knowledge in practice [7].

Methodology for Organizing Binary Lessons in Biology To organize binary lessons effectively, topics suitable for integration should first be selected. For example, topics such as "Chemical Foundations of the Photosynthesis Process" or "Physical Mechanisms of Nerve Impulses" can be studied through the integration of biology with other subjects [6].

During the planning stage of binary lessons:

- general didactic objectives are defined;
- interdisciplinary content is determined;
- responsibilities are distributed among teachers [5].

Implementation of Binary Lessons When conducting binary lessons, it is recommended to use problem-based learning, project methods, interactive methods, and digital technologies [4]. During the lesson process, teachers present biological processes from the perspectives of different disciplines, which enhances students' analytical thinking skills [8].

Assessment of Results In the assessment process, attention is paid to students' ability to apply interdisciplinary knowledge, their problem-solving skills, and creative approaches [9]. Rating systems, portfolios, and project work are considered effective assessment tools [5].

The Impact of Integrative Approaches and Binary Lessons on Educational Effectiveness Research shows that binary lessons organized based on an integrative approach increase the level of students' knowledge acquisition and contribute to the development of independent thinking and research competencies [6; 10]. Moreover, such lessons help reveal the real-life significance of biology as a science.

Results of Experimental Studies on the Effectiveness of Integrative Approaches and Binary Lessons To determine the effectiveness of integrative approaches and binary lessons in biology education, experimental research was conducted in several academic lyceums during the 2020–2025 academic years. The experimental work focused on introducing integrated lessons in biology teaching, organizing binary lessons, and identifying their impact on educational outcomes [6].

Objects and Participants of the Experiment A total of 580 students from academic lyceums affiliated with Navoi State University, Tashkent State Pediatric Medical Institute, Tashkent Pharmaceutical Institute, and Kokand State Pedagogical Institute participated in the study. Among them, 282 were first-year students and 298 were second-year students. Selecting participants from academic lyceums in different regions contributed to ensuring the reliability of the research results [1].

Organization of Experimental Work During the experimental process, students were divided into experimental and control groups. In the experimental groups, the teaching of biology involved:

- an integrative approach;
- binary lessons based on biology–chemistry and biology–physics integration;
- extensive use of problem-based learning and project methods [3; 4].

In the control groups, traditional biology teaching methods were maintained. Analysis of Experimental Results At the end of the experiment, students' levels of mastering biological knowledge, their ability to apply interdisciplinary concepts, and their analytical and logical thinking skills were determined through special diagnostic tasks [5].

The analysis showed that in the experimental groups:

- achievement levels in biology increased significantly;
- students demonstrated a higher level of understanding interdisciplinary connections;
- independent and creative thinking skills were formed [6].

In particular, binary lessons conducted at the academic lyceum of the Tashkent Pharmaceutical Institute were notable for significantly improving students' understanding of biological processes from a chemical perspective.

Pedagogical Significance of the Experimental Results The obtained results confirmed that the application of integrative approaches and binary lessons in biology education:

- increases educational effectiveness;
- develops students' competencies;
- reveals the practical and real-life significance of biology as a subject [7; 10].

This demonstrates that the implementation of this methodology in biology education practice is scientifically and pedagogically well grounded.

Conclusion In conclusion, the methodology for organizing integrative approaches and binary lessons in biology education is one of the key directions in modernizing the educational process. This approach enhances educational effectiveness by integrating biology with other disciplines and contributes to the formation of students' scientific worldview and competencies. The widespread implementation of this methodology in practice will significantly improve the quality of biology education.

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