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METHODOLOGY FOR THE USE OF DIGITAL TECHNOLOGIES BY STUDENTS IN THE STUDY OF ANALYTICAL CHEMISTRY

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Annotation. This article analyzes contemporary approaches to integrating digital technologies into chemistry education. It examines significant advancements in the use of virtual laboratories, interactive educational platforms, multimedia tools, and artificial intelligence, all of which contribute to increased student motivation and greater effectiveness in the learning process. Furthermore, the article highlights current challenges—such as the state of technical infrastructure in educational institutions and the professional development of educators—and underscores the need for systemic solutions to achieve a comprehensive digital transformation of the educational process.

Keywords: digitalization of education, digital educational resources, information and communication technologies, Bloom's taxonomy, digital pedagogy wheel, digital lesson builder.

The study employed theoretical and empirical methods to examine the methodology for integrating artificial intelligence (AI) technologies into the teaching of chemistry courses at higher education institutions in Uzbekistan. The theoretical framework was based on the works of both domestic and international researchers in the fields of digital pedagogy, artificial intelligence, and chemistry teaching methodology.

The Analytical Chemistry course requires students not only to master theoretical foundations thoroughly but also to develop abstract and algorithmic thinking skills. Traditional teaching methods often emphasize the lower levels of Bloom’s Taxonomy (remembering and understanding), leaving fewer opportunities for the development of higher-order cognitive skills (applying, analyzing, evaluating, and creating). Digital technologies serve as a catalyst for transforming the educational environment and provide opportunities to connect theoretical concepts with practical activities.

The key aspects of modern digital didactics that are particularly important in the teaching of Analytical Chemistry and in the professional training of students and teachers are outlined below:

a contradiction between the requirements of modern digital didactics and the insufficient level of teachers’ professional competence in using existing digital environments, as well as their reluctance to devote additional personal time to self-directed learning in this field;

a contradiction between the rapid development of digital technologies and the development of methodological frameworks necessary for their effective integration into the school educational process;

a contradiction between teachers’ readiness to use digital technologies recommended by the Ministry of Education and the actual technical capabilities available in schools for implementing digital educational tools;

a contradiction between the variety of professional development courses aimed at teaching educators how to use digital educational tools and the difficulties teachers face in mastering these tools independently.

The identified contradictions made it possible to formulate the following research problem: What should the methodological framework for designing and conducting modern lessons using digital educational tools look like in order to ensure high quality and accessibility of education at all levels and

in all types of educational institutions, while contributing to the development of a safe digital learning environment in schools?

The development of a digital lesson constructor was identified as a means of providing methodological support for lessons. The purpose of this article is to present the scientific and methodological foundations for developing the structure, content, implementation algorithm, and methods for evaluating the effectiveness of a digital lesson constructor based on Bloom's Taxonomy as a tool for providing methodological support for modern lessons.

The objectives of this article are as follows:

To analyze existing lesson constructors used in national and international didactic practices;

To describe Benjamin Bloom's Digital Taxonomy model and to develop and present an adaptation of Allan Carrington's Pedagogical Wheel model based on Bloom's Taxonomy, taking into account the specific characteristics of the Russian educational system;

To describe the features and functionalities of a digital lesson constructor website based on Bloom's Digital Taxonomy;

To analyze the results of the pilot implementation of the digital lesson constructor developed on the basis of the adapted Pedagogical Wheel model.

The idea of developing a lesson constructor is not new in national and international didactics. Various researchers have proposed their own models of lesson constructors and methodological support systems as didactic tools designed to provide methodological assistance for teaching activities.

In general, existing lesson constructors are based on several different versions of taxonomies.

In school education practice, Bloom's Taxonomy is one of the most widely used frameworks. It identifies six levels of cognitive activity: knowledge, comprehension, application, analysis, synthesis, and evaluation. Based on Bloom's Taxonomy, L. S. Ilyushina developed a constructor of learning tasks.

Bloom's Taxonomy is a system for classifying educational objectives developed in 1956 by a group of educators led by Benjamin Bloom. This framework was initially presented in the publication Taxonomy of Educational Objectives: The Classification of Educational Goals.

The taxonomy divides educational objectives into three broad domains: cognitive (knowledge-based), affective (emotion- and attitude-based), and psychomotor (action- and skill-based). Each of these domains, in turn, comprises a hierarchy of skills and abilities. Educators use these domains to design curricula, assessment methods, and instructional strategies aimed at developing different types of learning.

Conclusions

The integration of digital technologies into the teaching of Analytical Chemistry plays an essential role in improving the quality and effectiveness of the educational process. The use of modern digital tools, interactive platforms, virtual laboratories, and specialized software enables students to develop not only theoretical knowledge but also practical skills, analytical thinking, and the ability to solve complex chemical problems.

The application of digital technologies based on Bloom's Taxonomy creates opportunities for developing students' higher-order cognitive skills, including application, analysis, evaluation, and creation. In particular, digital learning resources help students visualize complex chemical processes, perform virtual experiments, analyze experimental results, and independently evaluate their acquired knowledge.

Furthermore, the effective implementation of digital technologies promotes student engagement, independent learning, creative thinking, and professional competencies. It also provides

opportunities for individualizing the learning process and creating an interactive educational environment.

Thus, the methodology for using digital technologies in the study of Analytical Chemistry should be considered an important component of modern chemical education. Its systematic implementation contributes to improving students' academic performance, strengthening their theoretical and practical knowledge, and preparing highly qualified specialists capable of meeting the demands of modern science and technological development.

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