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IMPROVEMENT OF METHODOLOGY OF TEACHING ANALYTICAL CHEMISTRY BASED ON MODERN INFORMATION AND PEDAGOGICAL TECHNOLOGIES

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Abstract
Learning is carried out at different stages, at which the student understands the content of education and understands what his cognitive tasks are. Processes such as intuition, perception and imagination take an active part in this. At the next stage, they understand the educational material, understand its essence and generalize it. As a result, they gain new knowledge. To do this, they use analysis, synthesis, comparison, and conclusion. At the last stage, new knowledge is consolidated through exercises, independent work, and additional comments from the teacher.

Keywords: Teacher, analysis, synthesis, comparison, conclusion, technology, multimedia, education, computer, innovation, methodology.

Introduction

According to international experience, cooperative learning in the process of training, retraining, and advanced professional development of pedagogical personnel, the organization of education based on a systemic approach, the expansion of modern technological knowledge among teaching staff, the formation of project-based activities using information technologies (optical effects, 3D educational rooms), and the application of pedagogical design technologies in the development of distance education (online and offline) are

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considered urgent issues. Therefore, an important problem is initiating the training of qualified personnel among students of general secondary and vocational education.

For the years 2017–2021, the Action Strategy on five priority areas of development of the Republic of Uzbekistan was adopted—"Continuing the path of further improving the system of lifelong education in the development of education and science in priority areas of social development." This strategy increases the opportunities for educational services by improving the quality of education; taking concrete measures aimed at improving the material and technical base of educational institutions by equipping them with modern educational and laboratory equipment, computer technologies, and teaching aids. As a result of efforts directed at radically improving the quality of general secondary education, the in-depth teaching of foreign languages, computer science, mathematics, physics, chemistry, biology, and other important and in-demand subjects, and expanding the capacity of higher education institutions, the topic of this scientific research becomes important. The use of new information technologies in the educational process is a relevant requirement for increasing the effectiveness of learning through the complete provision of information technology tools. This research is being conducted within the framework of the priority direction: "spiritual-ethical and cultural development of a democratic and legal society, the formation of an innovative economy."

This study contributes to the improvement of the content and form of teaching methodology in analytical chemistry under conditions of integrating information-communication and pedagogical technologies in higher educational institutions with in-depth study of chemistry.

Expected scientific novelty of the research:

- analysis of analytical chemistry courses in higher educational institutions, educational programs, textbooks, and scientific-methodical literature related to the dissertation topic;
- development of computer animations illustrating reaction mechanisms in analytical chemistry, and enhancing students' knowledge through their explanation;
- development of computer animations of laboratory processes in analytical chemistry and training students in animation-based laboratory technologies;

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- development of interesting examples, exercises, and control questions that ensure students' independent work and allow continuous self-monitoring of their activities and knowledge.

The analytical chemistry program in higher education institutions with advanced chemistry instruction includes 350 hours of coursework. Based on one year of teaching experience, several difficulties encountered by first-year university students in mastering analytical chemistry have been identified:

- analytical chemistry includes deep theoretical concepts;
- the teaching methodology is not designed considering students' knowledge levels and age characteristics;
- there is a lack of electronic teaching aids for studying analytical chemistry;
- no simplified analytical chemistry textbooks for university students have been prepared;
- modern pedagogical and information-communication technologies for enhancing students' independent work, self-assessment, thinking skills, and knowledge levels have not been developed or integrated into the study of analytical chemistry.

Results of pedagogical experiments on the application of advanced pedagogical technologies in the learning process show that students can retain up to 80% of experiments they conduct, the reaction equations they record, and other practical information studied. However, a methodology for fully teaching laboratory training, mechanisms, and spatial structures of analytical chemical reactions in educational institutions using information-communication and pedagogical technologies has not yet been developed.

At present, it is difficult to explain the spatial structures of analytical compounds, reaction mechanisms, and laboratory exercises using traditional methods. Dynamic models of such processes can be developed on the basis of electronic documents prepared using computer visualization, and the development of computer-based lessons for teaching the subject and implementing them in student learning makes it possible to master analytical chemistry more deeply.

Research is needed to develop a methodology for using animation based on modern information technologies to explain certain laboratory processes in analytical chemistry.

An important task is to explain topics in analytical chemistry to students by creating lesson plans, videos, animations, teaching materials, and electronic

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manuals using the integration of modern information-communication and pedagogical technologies.

Using information technologies, when the mechanisms of chemical reactions in analytical chemistry can be demonstrated live, if the teacher creates and implements a computer program related to the subject, this can greatly enhance the effectiveness of the lesson.

Therefore, it is impossible to explain the topics of the analytical chemistry curriculum for higher educational institutions by traditional means and increase students' comprehension. To solve this problem, in our opinion, it is necessary to create a methodology for presenting selected subject material using information and pedagogical technologies. These considerations formed the basis for choosing the research topic: "Improving the methodology of teaching analytical chemistry under conditions of integrating information-communication and pedagogical technologies."

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