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THE IMPORTANCE OF USING MODERN EDUCATIONAL TECHNOLOGIES IN THE STUDY OF "MEDICAL CHEMISTRY" AND "BIOCHEMISTRY" IN HIGHER EDUCATION INSTITUTIONS

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Abstract: This article highlights the significance of employing innovative educational technologies and artificial intelligence in the teaching of Medical Chemistry and Biochemistry. The role of modern pedagogical approaches, interactive methods, and digital technologies in improving the quality of education and developing students' professional competencies is analyzed.

Keywords: Medical Chemistry, Biochemistry, artificial intelligence, innovative education, interactive methods, digital technologies, competence, distance learning.

INTRODUCTION

Today, the rapid development of the medical field is placing new demands on the system of medical education, particularly on the teaching of Medical Chemistry and Biochemistry. Alongside traditional teaching methods, the use of innovative educational technologies enhances students' interest in learning and contributes to the development of independent thinking and practical skills.

Medical Chemistry occupies an important place in the fundamental training of future physicians and pharmacists. Therefore, the integration of modern pedagogical approaches into the teaching process of this discipline is considered one of the most pressing issues in contemporary higher education.

LITERATURE REVIEW

Innovative approaches play a crucial role in the modern educational system. In particular, the application of innovative educational technologies in chemistry education contributes significantly to improving the effectiveness of the learning process. Chemistry is a discipline rich in complex concepts, formulas, and experimental activities; therefore, in addition to traditional teaching methods, the implementation of modern pedagogical approaches is essential for effective learning.

At present, beyond interactive teaching methods, advanced technological and methodological tools are being widely utilized. These include 3D animations, virtual laboratories, and interactive simulations. Through virtual laboratories, students can perform experiments in a safe environment, make mistakes without fear of negative consequences, and, most importantly, develop independent research and problem-solving skills. Furthermore, such laboratories provide opportunities to study and simulate experiments that may be difficult, expensive, or impossible to conduct under real laboratory conditions. [8]

Concept of Innovative Education

Innovative education is a system aimed at improving the effectiveness of the educational process through the integration of new pedagogical technologies, information and communication tools, and interactive teaching methods. Such an approach increases students' engagement during lessons and places them at the center of the learning process. [4]

RESEARCH METHODOLOGY. Innovative Methods in Teaching Medical Chemistry

The following innovative methods can be effectively employed in teaching Medical Chemistry:

- Interactive teaching methods (problem-based learning, case studies, brainstorming);
- Multimedia technologies (3D models, animations, virtual laboratories);
- Distance learning platforms (online lectures, tests, and video lessons);
- Project-based learning, where students relate chemical processes to medical practice;
- In addition, online educational platforms, which have increasingly become an integral component of modern education, play a crucial role. Such platforms are particularly valuable in organizing education in disciplines that require practical and laboratory work, especially chemistry. They facilitate the visual presentation of information and enable students to perform experiments and practical activities that may be difficult to conduct under real laboratory conditions.

These methods assist in visually explaining complex chemical processes and strengthen the connection between theoretical knowledge and practical application. Innovative educational technologies contribute to the development of students' visualization skills and support the enhancement of professional competencies, creativity, and innovative activities in chemistry education.

Advantages of Innovative Education

Innovative approaches provide several advantages in the study of Medical Chemistry, including:

- Deeper understanding and mastery of chemical knowledge;
- Development of independent, creative, and critical thinking skills;
- Improvement of professional competencies;
- Readiness to work with modern medical technologies.

In the studies conducted by **V.A. Slastenin**, the main characteristics of a teacher's ability to engage in innovative activities were identified. These characteristics include:

➢ **Creative and motivational orientation of the individual**, including curiosity, creative interest, aspiration for creative achievements, striving for leadership, and self-improvement;

➢ **Creativity**, including imagination, hypothesis generation, non-standard thinking, willingness to take risks, critical thinking, evaluative abilities, independent reasoning, and reflection;

➢ **Evaluation of professional activity**, including the ability to master the methodology of creative activity, apply pedagogical research methods, develop authorial concepts and teaching technologies, creatively resolve conflicts, and cooperate effectively with colleagues;

➢ **Individual professional qualities of the teacher**, such as productivity in creative activity, perseverance, self-confidence, responsibility, honesty, integrity, and self-control. [1]

One of the online platforms that can be effectively utilized in teaching Medical Chemistry is the virtual laboratory available at:

ITMO Virtual Chemistry Laboratory

This platform enables users to conduct experiments that may be difficult or impossible to perform under conventional laboratory conditions. The website provides opportunities not only for Medical Chemistry but also for carrying out virtual experiments across various branches of chemistry.

The software contains a database of chemical reactions, animations, equations, laboratory equipment, and chemical substances. It allows users to perform experiments with different substances in a highly visual and interactive environment.

The virtual laboratory software also incorporates additional features, including an assistant system, calculation-based converters, and an electronic laboratory journal for recording experimental results.

The concept of virtual experimentation emerged approximately twenty years ago. With active use of the interface, instructors can expand the software by adding new chemical substances and reactions, thereby enriching students' practical experience. Consequently, virtual laboratories provide an environment for interactive simulation of laboratory activities and chemical processes. [1]

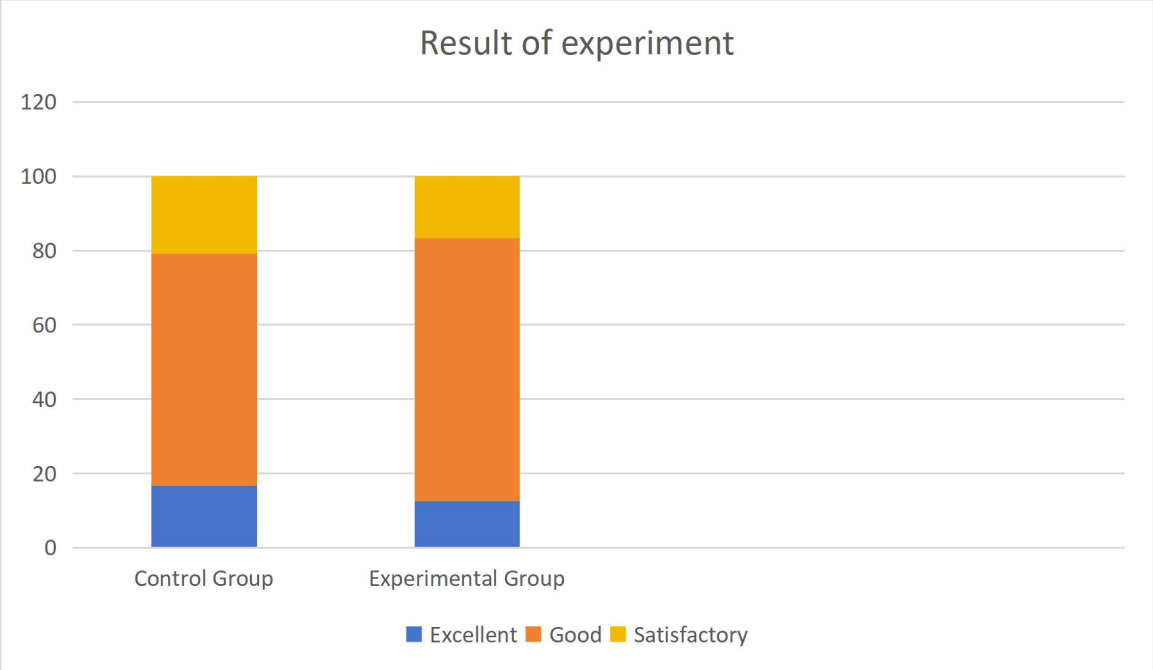
The use of innovative interactive teaching methods alongside traditional approaches contributes significantly to increasing lesson effectiveness. Furthermore, web forums available through Google platforms facilitate the exchange of ideas within specific fields of study, thereby enhancing knowledge acquisition, expanding creative thinking, and developing students' analytical skills.

DISCUSSION AND RESULTS

The integration of innovative educational technologies into the teaching of Medical Chemistry has demonstrated positive outcomes in improving the quality of education and students' academic performance. Interactive methods, virtual laboratories, and online learning platforms enhance students' motivation, increase participation in the learning process, and strengthen the connection between theoretical concepts and practical applications. As a result, students develop professional competencies more effectively and become better prepared to utilize modern medical and chemical technologies in their future careers.

Assessment Levels	Number of Students	Control Group (n)	Control Group (%)	Experimental Group (n)	Experimental Group (%)
Excellent	24	4	16.67	3	12.50
Good	24	15	62.50	17	70.80
Satisfactory	24	5	20.83	4	16.70
Total	**24**	**24**	**100.0**	**24**	**100.0**

The results presented in Table 1 indicate that the proportion of students who achieved a **"Good"** grade was higher in the experimental group (70.8%) than in the control group (62.5%). At the same time, the percentage of students who received a **"Satisfactory"** grade was lower in the experimental group (16.7%) compared to the control group (20.83%). These findings suggest that the implementation of innovative educational technologies had a positive impact on students' academic performance and learning outcomes in Medical Chemistry and Biochemistry courses.



Conclusion

In conclusion, the use of innovative educational technologies in the teaching of Medical Chemistry and Biochemistry significantly enhances the quality of education and enables students to acquire knowledge and skills in accordance with modern educational requirements. Furthermore, this approach creates a solid foundation for the future professional activities of medical specialists. Therefore, the widespread implementation of innovative educational technologies in medical education institutions is of great importance for improving the effectiveness of the teaching and learning process.

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