

**THE IMPORTANCE OF INNOVATIVE PEDAGOGICAL TECHNOLOGIES IN
TEACHING MEDICAL CHEMISTRY**

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Abstract

This article highlights the significance of using innovative educational technologies in teaching medical chemistry. The role of modern pedagogical approaches, interactive methods, and digital technologies in improving the quality of education and in the development of students' professional competencies is analyzed. The results demonstrated a notable improvement in student engagement and comprehension in the experimental group, where the proportion of "excellent" responses increased compared to the control group. These findings indicate that utilizing pedagogical mastery in lecture organization not only improves knowledge retention but also stimulates critical thinking, active participation, and motivation among students.[2]

Keywords

medical chemistry, innovative education, interactive methods, digital technologies, competence, distance learning.

Introduction

Today, the rapid development of the medical field imposes new requirements on the medical education system, particularly on the teaching of medical chemistry. Alongside traditional teaching methods, the use of innovative educational technologies increases students' interest in learning and contributes to the development of independent thinking and practical skills.

Medical chemistry plays an essential role in the fundamental training of future physicians and pharmacists. Therefore, the introduction of modern pedagogical approaches into the teaching process of this discipline is one of the most pressing issues.

In the modern education system, innovative approaches occupy a significant place. Especially in teaching chemistry, the application of innovative educational technologies contributes to increasing the effectiveness of the learning process. Chemistry is a science rich in complex concepts, formulas, and experiments; therefore, its teaching requires modern pedagogical approaches in addition to traditional methods.

Main Part

The Concept of Innovative Education

Innovative education is a system aimed at improving the effectiveness of the educational process through the introduction of new pedagogical technologies, information and communication tools, and interactive methods. Such education increases students' activity during lessons and places them at the center of the learning process.

Innovative Methods in Teaching Medical Chemistry

The following innovative methods can be effectively used in teaching medical chemistry:

Interactive teaching methods

Interactive methods such as "Cluster," "Brainstorming," "Boomerang," "Case Study," and "Blitz Survey" ensure active participation of students in the learning process. These methods enable students to gain a deeper understanding of chemical processes and to develop skills in analyzing problem situations and making independent decisions.

Problem-based learning technology

Lessons organized on the basis of problem situations foster the development of scientific thinking among students. For example, linking biochemical reactions or mechanisms of action of pharmaceutical substances with real clinical cases enhances the practical significance of acquired knowledge.

Use of Information and Communication Technologies.

Multimedia presentations, virtual laboratories, animations, and simulation programs make it possible to explain complex chemical processes visually. This facilitates faster and more effective comprehension of the subject matter by students.

Distance and Blended Learning Technologies.

Through online platforms, electronic textbooks, and video lectures, students gain the opportunity to acquire knowledge independently. Distance learning is particularly important in developing self-directed learning skills.

The Impact of Innovative Technologies on Educational Effectiveness

Innovative pedagogical technologies in teaching medical chemistry lead to the following positive outcomes:

- increased student interest in the subject;
- integration of theoretical knowledge with practice;
- development of professional competencies;
- enhancement of critical and logical thinking;
- improvement of the overall quality of education.

As a result, students not only acquire knowledge but also develop skills and competencies necessary for their future professional activities.

Conclusion

In conclusion, the use of innovative pedagogical technologies in teaching medical chemistry is a crucial requirement of modern education. Contemporary educational technologies enhance the effectiveness of the learning process and contribute to strengthening students' professional training. Moreover, innovative approaches play an important role in ensuring the competitiveness of future specialists. Therefore, it is advisable to widely implement innovative methods and technologies in teaching medical chemistry in medical educational institutions.

- **Interactive methods** (problem-based learning, case study, brainstorming);
- **Multimedia technologies** (3D models, animations, virtual laboratories);
- **Distance learning platforms** (online lectures, tests, video lessons);
- **Project-based learning**, in which students link chemical processes with medical practice.

In addition, online platforms, which have recently become an integral part of the educational content, play a key role in the teaching process. Such platforms are particularly important in organizing education in disciplines that involve practical and laboratory work, especially in chemistry. They serve as a major supportive tool for visually presenting experiments or practical tasks that are difficult or impossible to perform in real laboratory conditions.

These methods help explain complex chemical processes in a visual manner and strengthen the connection between theory and practice. Through innovative educational technologies, it is possible to significantly enhance students' imaginative and conceptual understanding. In teaching chemistry, these approaches contribute to the development of students' professional capabilities, initiative in innovation, and engagement in innovative activities.

Advantages of Innovative Education

Innovative approaches provide a number of advantages in studying medical chemistry, including:

- deep mastery of chemical knowledge by students;
- formation of independent, creative, and critical thinking skills;
- development of professional competencies;
- readiness to work with modern medical technologies.

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

➤ **Creative and motivational orientation of the individual**, which encompasses curiosity, creative interest, aspiration for creative achievements, striving for leadership, and commitment to self-development;

➤ **Creativity**, which includes imagination (fantasy), hypothesis formation, freedom from rigid patterns, willingness to take risks, critical thinking, the ability to evaluate, independent reasoning, and reflection.

Evaluation of professional activity, which includes the ability to master the methodology of creative activity; the ability to apply pedagogical research methods; the ability to develop an author's conceptual framework and activity technology; the ability to resolve conflicts creatively; the ability to cooperate and provide mutual support in creative activity, and other related competencies.

➤ **Individual abilities of the teacher**, including the pace of creative activity; the individual's capacity for creative work; perseverance and self-confidence; responsibility, integrity, honesty, truthfulness, self-control, and other personal qualities [1].

One of the online platforms used in teaching medical chemistry is the virtual laboratory available at https://expert.itmo.ru/labs_chemistry. This platform enables the performance of experiments that are difficult to conduct under real laboratory conditions. Using this resource, it is possible to carry out virtual experiments not only in medical chemistry but also across all branches of chemistry.

The program includes a database of reactions that can be used in the form of animations, equations, and other visual representations, as well as a collection of laboratory equipment and chemical substances. The virtual laboratory software allows experiments with various substances to be conducted visually, making chemical processes observable.

Different software tools used within virtual laboratories possess additional unique features. To facilitate ease of use, the program includes an "assistant" function, a set of converters based on calculations, and a laboratory journal for recording experiments.

The concept of virtual experiments emerged approximately 20 years ago. With active use of the interface, teachers can manually add a greater number of chemical substances and reactions to the software, thereby enhancing students' experimental experience. In this way, virtual laboratory sessions ensure the implementation of *interactive modeling* [1].

Organizing lessons using innovative interactive methods in addition to traditional approaches contributes to increased instructional effectiveness. Furthermore, web forums organized on Google platforms allow for the exchange of ideas within specific fields, thereby enhancing knowledge acquisition, expanding creative thinking, and developing skills for analyzing information.

Conclusion

In conclusion, the use of innovative educational technologies in teaching medical chemistry makes it possible to improve the quality of education and to develop students' knowledge and skills in accordance with modern requirements. Moreover, this approach creates

a solid foundation for the future professional activities of medical specialists. Therefore, the widespread implementation of innovative education in medical institutions is of great importance.

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