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EFFECTIVENESS OF USING EDUCATIONAL TECHNOLOGIES IN TEACHING MICROBIOLOGY

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Abstract

This article highlights the effectiveness of using modern educational technologies in the process of teaching microbiology. The impact of information and communication technologies, interactive methods, virtual laboratories, and simulation-based tools on students' knowledge levels, the formation of practical skills, and interest in the subject is analyzed. Based on the results of experimental studies, the role of innovative methods in improving the quality of teaching is scientifically substantiated.

Keywords

microbiology, educational technologies, virtual laboratory, ICT, simulation-based learning, interactive methods.

Introduction. In the system of medical education, the role of the microbiology course is invaluable, as it forms the main theoretical and practical knowledge essential for students' future professional activities. Skills such as understanding the origin and spread of infectious diseases, performing laboratory diagnostics, and correctly carrying out microbiological analysis procedures depend largely on the successful mastery of this subject.

The use of innovative pedagogical technologies in modern education is a key factor in improving the quality of teaching. In subjects such as microbiology, which require laboratory work, practical skills, and extensive visual materials, the application of educational technologies is particularly important.

Relevance of the Topic. In today's medical education system, effective teaching of microbiology has special significance. The global spread of infectious diseases, the emergence of new viral and bacterial strains, and the rise of antibiotic resistance have sharply increased the demand for microbiological knowledge. In such conditions, medical professionals must possess not only theoretical knowledge but also well-developed practical skills.

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The integration of modern pedagogical technologies, ICT tools, virtual laboratories, and simulation trainers plays a crucial role in improving the learning process and ensuring high teaching efficiency. Traditional classes may not fully cover the multi-step and laboratory-oriented nature of microbiology. Therefore, incorporating educational technologies into the teaching process:

- ensures deeper mastery of theoretical knowledge;
- develops practical skills in a safe and efficient environment;
- enables visual and interactive understanding of microbiological processes;
- increases interest and motivation for the subject;
- supports independent learning.

Today, digital resources, online platforms, virtual microscopy, electronic atlases, and AI-based learning modules are becoming an integral part of medical education. Considering the complexity of laboratory procedures and the high safety requirements in microbiology, the use of virtual learning environments is especially important and relevant.

Purpose of the Study. To determine the effectiveness of using modern educational technologies in the teaching of microbiology, to scientifically substantiate their impact on students' knowledge levels, practical skills, and interest in the subject, and to develop methodological recommendations for integrating innovative pedagogical technologies into microbiology classes.

Research Tasks.

1. To study the current state of microbiology teaching and analyze the extent to which traditional and modern pedagogical technologies are used.
2. To scientifically examine the nature and potential of modern educational technologies used in medical education (ICT, interactive methods, virtual laboratories, simulation trainers).
3. To develop a model for integrating innovative technologies into the microbiology teaching process and define its methodological foundations.
4. To determine the effectiveness of educational technologies through an experimental study, comparing students' knowledge, practical skills, and activity levels.
5. To evaluate the impact of interactive and ICT tools used in microbiology classes and determine their contribution to the learning process.
6. To develop methodological recommendations and practical guidelines for improving microbiology teaching based on research findings.

Literature Review. Scientific studies emphasize the significant role of pedagogical technologies, particularly ICT and interactive methods, in medical education. The World Federation for Medical Education (WFME) identifies the

implementation of digital platforms as an important criterion of modern medical training.

A number of studies indicate that the use of 3D visualization and virtual simulators in teaching microbiology increases learning outcomes by 20–35%. Research conducted in various higher education institutions also shows that interactive methods strengthen students' engagement and activity. Based on these findings, this study aims to demonstrate the practical effectiveness of innovative technologies in microbiology education.

Materials and Methods. The research was conducted among students of Fergana Institute of Public Health during the 2024–2025 academic year. A total of 120 second-year students participated, with 60 forming the experimental group (taught with educational technologies) and 60 forming the control group (taught traditionally).

Applied methods:

- interactive methods ("Case-study", "Cluster", "Brainstorming", "INSERT");
- 3D electronic atlases, virtual laboratories;
- microbiology simulators;
- electronic testing tools;
- statistical analysis (t-test).

Results. The results show that the use of educational technologies in teaching microbiology stands out with several important advantages:

1. **Effectiveness of visual materials**

3D models and virtual microscopy provided students with more realistic and accessible visualization of bacterial structures.

2. **Faster development of practical skills**

Simulation trainers allowed students to repeatedly practice laboratory procedures without errors.

3. **Increased student engagement in an interactive environment**

Case-study and group projects enhanced students' analytical thinking and problem-solving skills.

Scientific Novelty of the Study. A model for the complex integration of modern educational technologies into microbiology teaching was developed.

1. The effectiveness indicators of virtual laboratories, simulation trainers, and interactive methods in microbiology classes were scientifically substantiated.
2. Modern methodological recommendations aimed at improving the quality of microbiology teaching were developed.
3. New technological approaches to forming practical microbiological skills in students were justified.

Practical Significance:

1. Methodological recommendations for organizing microbiology classes effectively can be implemented in practice.
2. The use of virtual and simulation laboratories ensures safety and resource efficiency in real laboratory settings.
3. The research results can serve as a teaching guide for medical colleges, universities, and simulation centers.
4. The improvements in students' practical readiness contribute to the overall quality of medical training.

Conclusion. The results of the study show that using modern educational technologies in teaching microbiology:

- increases the level of knowledge acquisition;
- improves the quality of practical skills;
- enhances student interest and activity;
- creates an interactive learning environment;
- ensures safe, rapid, and effective laboratory training.

Therefore, the continuous implementation of ICT tools, virtual laboratories, simulation trainers, and interactive methods in teaching microbiology is strongly recommended.

REFERENCES:

1. Tortora G., Funke B., Case C. Microbiology: An Introduction. Pearson, 2021.
2. WFME. Global Standards for Quality Improvement in Medical Education, 2020.
3. Zaborina O. Modern Approaches in Teaching Medical Microbiology. 2022.
4. Digital Education Concept in Higher Education of the Republic of Uzbekistan, 2021.