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ENHANCING THE TEACHING OF INFORMATION TECHNOLOGIES IN MEDICAL EDUCATION THROUGH DIGITAL PEDAGOGICAL INNOVATIONS

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Abstract: The rapid digitalization of healthcare and education has increased the importance of information technology competence among future healthcare professionals. Medical students are expected not only to acquire professional medical knowledge but also to develop the ability to use digital technologies, electronic health information systems, medical databases, data analysis tools, and online educational resources. Therefore, improving the teaching of Information Technologies (IT) in medical education has become an important pedagogical objective. This study aims to examine pedagogical approaches to enhancing the teaching of information technologies in medical education and to identify effective digital innovations that can improve students' learning outcomes and digital competence. The study employed a descriptive and analytical research design based on the analysis of pedagogical approaches, digital learning technologies, and contemporary educational practices. The findings demonstrate that the integration of interactive learning methods, simulation technologies, project-based learning, adaptive learning platforms, and learning management systems can increase student engagement and support the development of practical digital competencies.

Keywords: information technologies, medical education, digital competence, pedagogical innovation, digital learning, healthcare education, competence-based approach.

Introduction. The development of information and communication technologies has significantly transformed modern society, including the fields of education and healthcare. Digital technologies are increasingly used in hospitals, clinics, research institutions, and medical universities. Electronic health records, telemedicine, artificial intelligence, medical information systems, mobile health applications, and digital diagnostic technologies have become important components of contemporary healthcare systems. These developments have created new requirements for healthcare professionals. Modern physicians and medical specialists are expected to possess not only clinical knowledge and practical skills but also sufficient digital competence to work effectively in technology-rich healthcare environments. Consequently, medical universities have an important responsibility to prepare future healthcare professionals for the digital transformation of medicine.

Information Technologies is an important academic discipline in medical education because it provides students with fundamental knowledge and skills related to computer technologies, digital information management, databases, communication technologies, and medical information systems. However, the traditional teaching of Information Technologies often focuses primarily on general computer literacy and theoretical knowledge. Such an approach may not adequately prepare medical students to apply information technologies in professional healthcare contexts. The effectiveness of IT education depends not only on the content of the curriculum but also on the pedagogical methods used during the teaching and learning process. Traditional lecture-based instruction may provide theoretical information, but it may be insufficient for developing practical digital competence. Therefore, the

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teaching of Information Technologies in medical education requires innovative pedagogical approaches that encourage active learning, problem-solving, practical application, and independent learning.

Digital pedagogical innovations provide new opportunities for improving IT education. Interactive learning platforms, virtual simulations, project-based learning, case-based learning, online laboratories, learning management systems, and adaptive learning technologies can create more engaging and practice-oriented learning environments. For example, medical students can learn to work with healthcare information systems through simulated clinical scenarios. They can analyze medical data, use electronic databases, explore digital diagnostic tools, and develop simple digital projects related to healthcare. Such activities can help students understand the relationship between information technologies and their future professional activities.

Another important issue is the development of digital competence. Digital competence includes the ability to search for, evaluate, process, manage, and communicate information using digital technologies. In the context of medical education, digital competence also involves understanding data security, patient confidentiality, ethical principles, and responsible use of medical information. The integration of information technologies into medical education should therefore follow a competence-oriented approach. Students should not simply learn how to use specific software programs; they should develop the ability to apply digital technologies to solve professional problems.

Despite the increasing importance of digital technologies, several challenges remain in the teaching of Information Technologies in medical universities. Students may have different levels of prior digital knowledge. Some students may have advanced computer skills, while others may have limited experience with digital technologies. Teachers may also experience difficulties in integrating innovative educational technologies into the learning process.

Furthermore, IT curricula may not always reflect the rapidly changing technological environment of modern healthcare. Therefore, continuous improvement of educational content and teaching methods is necessary.

The purpose of this study is to examine pedagogical approaches to enhancing the teaching of Information Technologies in medical education and to identify digital innovations that can contribute to the development of students' professional digital competence.

The objectives of the study are:

1. To analyze the role of Information Technologies in modern medical education.
2. To identify effective pedagogical approaches to teaching Information Technologies to medical students.
3. To examine the potential of digital educational innovations in improving student learning.
4. To identify challenges associated with the teaching of Information Technologies in medical universities.
5. To develop recommendations for improving IT education in medical institutions.

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Methods. This study employed a descriptive and analytical research design. The research focused on the pedagogical development of Information Technology education in medical universities. The study examined contemporary educational approaches, digital learning technologies, and pedagogical strategies relevant to the development of students' digital competence.

A qualitative research approach was used to analyze theoretical and methodological aspects of teaching Information Technologies in medical education.

The study was based on the analysis of scientific literature, educational research, methodological publications, and international reports related to digital education, medical education, and information technology competence.

Relevant academic materials were selected according to their relevance to the following areas:

information technology education;

medical education;

digital competence;

competence-based learning;

digital pedagogy;

educational innovation;

simulation-based learning;

online learning.

The literature was analyzed to identify effective pedagogical strategies and innovative approaches to teaching Information Technologies.

The pedagogical framework of the study was based on three major approaches:

The competence-based approach focuses on the development of practical knowledge, skills, and professional competencies. Students are expected to apply theoretical knowledge in practical situations.

In IT education, students should develop the ability to use digital technologies to solve professional problems related to healthcare.

Student-centered learning emphasizes the active role of students in the educational process. Instead of receiving information passively, students participate in discussions, practical activities, projects, and problem-solving tasks.

This approach allows students to develop independent learning skills and digital competence.

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Practice-oriented learning connects theoretical knowledge with professional activities. Medical students can learn information technologies through practical tasks related to healthcare.

For example, students can work with medical databases, analyze healthcare data, create digital presentations, or participate in simulated clinical information management activities.

The collected information was analyzed using thematic analysis. The major themes identified included:

development of digital competence;

interactive learning;

project-based learning;

simulation technologies;

adaptive learning;

online learning platforms;

teacher digital competence;

technological infrastructure;

professional relevance of IT education.

The results were organized according to the potential benefits and challenges of implementing digital pedagogical innovations.

Results. The analysis demonstrated that the modernization of Information Technology education can contribute significantly to improving the quality of medical education.

One of the most important outcomes of improved IT education is the development of digital competence among medical students.

Digital competence involves more than basic computer literacy. It includes the ability to use digital technologies effectively, critically, and responsibly.

Medical students should develop competencies in several areas:

digital information management;

healthcare databases;

electronic health records;

medical information systems;

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data analysis;

digital communication;

cybersecurity;

protection of patient information.

The integration of these competencies into IT courses can improve the professional relevance of education.

Interactive teaching methods can improve student engagement and participation.

Traditional lectures may provide theoretical information, but practical IT skills require active participation. Interactive methods such as discussions, quizzes, problem-solving tasks, and digital exercises can encourage students to actively participate in the learning process.

Online learning platforms can also provide students with immediate feedback. This allows students to identify mistakes and improve their performance.

Project-based learning represents an effective approach to teaching Information Technologies in medical education.

Students can work individually or in groups to develop projects related to healthcare.

Examples include:

developing a digital health education project;

analyzing medical data;

creating a patient information database;

designing a health-related website;

developing educational multimedia materials;

preparing digital presentations on medical topics.

Project-based learning allows students to apply theoretical knowledge to practical problems.

The results of the analysis indicate that project-based learning can improve creativity, collaboration, problem-solving, and independent learning.

Simulation technologies can improve the professional relevance of Information Technology education.

Medical students can participate in simulated situations involving electronic health records, patient information systems, and digital healthcare environments.

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Simulation-based learning allows students to practice using digital technologies without creating risks for real patients.

For example, students can learn how to enter and manage patient information, analyze medical data, and protect confidential information.

Such activities can help students understand the importance of digital competence in future professional practice.

Learning Management Systems (LMS) can support the organization and management of the educational process.

LMS platforms can provide access to:

learning materials;

video lectures;

practical exercises;

online assessments;

discussion forums;

student progress reports.

The use of learning management systems can support flexible learning and independent study.

Students can access educational materials outside the classroom and review difficult topics at their own pace.

Adaptive learning technologies represent another promising approach to improving IT education.

Students have different levels of digital knowledge and experience. Adaptive learning systems can identify individual learning needs and provide personalized educational content.

For example, students with limited computer skills can receive additional learning materials and practical exercises. More advanced students can complete more complex tasks.

This approach may improve learning efficiency and reduce differences in students' initial levels of preparation.

The findings demonstrate that Information Technology education becomes more effective when learning activities are connected with medical practice.

Students may have greater motivation when they understand the professional relevance of digital technologies.

Therefore, IT courses should include examples related to healthcare.

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These may include:

electronic medical records;

telemedicine;

medical databases;

artificial intelligence in medicine;

health information systems;

mobile health technologies.

The integration of medical contexts can help students understand how information technologies are used in healthcare.

Several challenges were identified during the analysis.

The first challenge is technological infrastructure. Medical universities require appropriate computer laboratories, reliable internet access, educational software, and digital platforms.

The second challenge is differences in students' digital competence. Students may enter medical universities with different levels of computer knowledge.

The third challenge is teacher readiness. Teachers should possess both professional knowledge and digital pedagogical competence.

Another challenge is the rapid development of digital technologies. Educational programs must be continuously updated to reflect changes in healthcare technologies.

Finally, ethical issues must be considered. Medical students should understand data protection, cybersecurity, patient confidentiality, and ethical principles related to digital healthcare.

Discussion. The results of this study indicate that the development of Information Technology education is an important component of modern medical education.

Healthcare is becoming increasingly digital. Future healthcare professionals will work with electronic health records, digital diagnostic systems, telemedicine platforms, and medical databases. Therefore, medical universities must prepare students for these professional requirements.

The findings suggest that traditional approaches to IT education should be reconsidered. The teaching process should focus not only on theoretical computer knowledge but also on the practical application of digital technologies.

A competence-based approach is particularly important. Students should develop practical skills that can be applied in professional situations.

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The integration of interactive and project-based learning can improve student participation and motivation. Students are more likely to understand the importance of Information Technologies when they participate in practical activities related to healthcare. Simulation technologies also provide important educational opportunities. Simulated digital healthcare environments can help students practice professional tasks without risks. Another important finding is the value of personalized learning. Students have different levels of digital competence. Adaptive learning systems can provide individualized learning pathways.

However, technology alone cannot guarantee educational success. Teachers play an essential role in the effective implementation of digital pedagogical innovations. Faculty members should receive continuous professional development in digital technologies and modern teaching methods.The curriculum should also be regularly updated. Medical information technologies are developing rapidly, and educational programs should reflect contemporary professional requirements. The integration of topics such as artificial intelligence, telemedicine, medical data analysis, cybersecurity, and electronic health information systems may increase the relevance of IT education. A blended pedagogical model may provide the most effective solution. Traditional teaching methods can be combined with online learning platforms, simulations, interactive technologies, and project-based activities. This approach can provide both theoretical knowledge and practical experience.

Conclusion. The development of Information Technology teaching is essential for improving the quality of modern medical education. The findings of this study demonstrate that innovative pedagogical approaches can contribute to the development of students' digital competence and professional readiness. Interactive learning, project-based learning, simulation technologies, learning management systems, and adaptive learning platforms can improve student engagement and create more effective learning environments. Information Technology education should be connected with real healthcare contexts. Medical students should understand how digital technologies are applied in hospitals, clinics, research institutions, and public health systems. A competence-based and practice-oriented approach can help students develop the ability to apply digital technologies to professional problems.

However, successful implementation requires appropriate technological infrastructure, high-quality educational content, teacher training, and continuous curriculum development. The study concludes that the modernization of Information Technology education should become an important priority for medical universities. The integration of digital pedagogical innovations can help prepare future healthcare professionals for the technological transformation of modern healthcare.

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