

THE ROLE OF SIMULATION TRAINING AND DIGITALIZATION IN THE DEVELOPMENT AND IMPROVEMENT OF EDUCATION IN MEDICAL PROFESSIONAL INSTITUTIONS

Abdurakhimova Kamila Gayratovna

Deputy Director of the Academy of Medical Nurses

kamilagayratovna@gmail.com

Abstract

In the context of the digital transformation of the healthcare system, the demand for high-quality training of mid-level medical specialists is increasing. Modern approaches to education require the introduction of innovative technologies such as simulation-based learning and the digitalization of the educational environment. This article examines the key aspects of implementing these technologies in the educational process of medical professional institutions, presents data on their effectiveness, analyzes their advantages and limitations, and substantiates the need for a systematic approach to the digital modernization of secondary professional medical education.

Keywords: Competence, simulation training, digitalization, digital technologies, secondary medical education, innovations, practical training.

Introduction

Significance of the Topic: The field of secondary professional medical education requires an improvement in the quality of specialist training, especially given the growing demands of the healthcare system and the shortage of practical training facilities. According to the World Health Organization, up to 70% of medical errors are related to human factors, including insufficient staff training (WHO, 2021). Simulation technologies make it possible to create a safe environment for practicing clinical skills without risk to the patient. Combined with digital educational platforms, they provide flexibility, accessibility, and adaptation of the educational process to the individual needs of each student.

Purpose:

To analyze the impact of simulation-based training and digitalization on improving the efficiency of the educational process in medical professional institutions and to identify their role in the formation of professional competencies among future healthcare professionals.

Materials and Methods:

Simulation-based learning is a methodology based on the use of special training equipment, simulators, mannequins, computer programs, and virtual technologies to model real clinical situations. It enables students to practice professional skills in realistic yet safe and controlled





conditions. According to Baranov A.A. and co-authors, as well as other researchers, simulation technologies provide a safe and controlled space where students can make mistakes and learn from them — something that is not fully possible in real clinical practice. The review by Baydarov A.A., Vronsky A.S., Lazarkov P.V., Astashina N.B., and Shamarina A.M. “*Simulation Training in Medicine: Past, Present, and Future*” demonstrates that with the establishment of simulation centers at medical universities and institutes in Russia, simulation training is increasingly being integrated into educational programs, becoming a core element in clinical disciplines.

Modern medical education is undergoing transformation under the influence of digitalization, which requires rethinking not only teaching methods but also the entire organizational model of higher educational institutions. Digital changes should affect not only the academic but also the research and administrative domains, forming an integrated digital ecosystem. Three key challenges of medical education digitalization are identified: technical, ethical, and competence-related. Effective digital transformation is possible only through improving digital literacy among teachers and students, along with the creation of appropriate infrastructure.

The Importance of Simulation Training for Medical Professional Institutions

1. Improving the Quality of Specialist Training

- Students gain experience in clinical reasoning, learn to make decisions, and act effectively in stressful situations.
- Mistakes made during simulation exercises pose no risk to patients but become valuable learning experiences.

2. A Safe Learning Environment

- Especially important for junior students who do not yet have access to real patients.
- Builds confidence before entering clinical practice.

3. Development of Professional Competencies

- Enhances manual skills (injections, catheterization, patient care, etc.).
- Improves communication skills, teamwork, leadership, and patient interaction ethics.
- Simulation scenarios make it possible to apply unified training algorithms that comply with state educational standards and professional healthcare requirements.

The Importance of Digitalization for Medical Professional Institutions

- **Improvement of Professional Training:** Digital educational technologies allow nurses and medical assistants to study remotely, practice clinical simulations, and upgrade their qualifications without interrupting their work.
- **Fast Access to Information:** Electronic reference guides, databases, and treatment protocols are available in real time, which improves the quality of patient care.
- **Automation of Routine Processes:** Electronic medical records, online appointment systems, and telemedicine reduce paperwork and free up time for direct patient interaction.



- **Development of Digital Competencies:** Medical personnel increasingly use tablets, diagnostic software, and quality control systems—requiring new skills and stimulating professional growth.
- **Increased Professional Autonomy:** Digital solutions enable faster decision-making based on clinical protocols, decision-support tools, and artificial intelligence systems.

Advantages of Implementing Simulation Training

Advantage	Explanation
Practical Orientation	Training is closely aligned with real clinical practice.
Increased Student Motivation	Interactive methods engage learners and make the learning process more interesting.
Possibility of Repetition	Students can repeat procedures until full mastery is achieved.
Objective Assessment	Checklists, video recordings, and standardized patients are used for evaluation.
Preparation for Emergency Situations	Simulated emergency scenarios help students practice under stress-like conditions.

Implementation of Simulation-Based Learning in Medical Professional Institutions

1. Establishment of Simulation Centers

- Equipping medical colleges and technical schools with modern facilities such as phantoms, mannequins, interactive tables, and specialized computer programs.
- Developing simulation scenarios adapted to specific educational curricula.

2. Teacher Training

- Enhancing the qualifications of educators in the field of simulation-based learning.
- Mastering techniques for objective assessment and providing effective feedback.

3. Integration into the Educational Process

- Incorporating simulation-based learning into academic curricula.
- Conducting assessments, practicums, and examinations using simulators.

The Role of Simulation Training in Competency Development

Simulation-based learning contributes to the formation of the following key competencies among students:

- **Manual Skills:** Practicing injections, catheterization, wound dressing, and basic manipulations on mannequins helps reduce errors in real-life practice.
- **Emergency Skills:** Mastery of cardiopulmonary resuscitation (CPR) and first aid in acute conditions—simulation is vital for life-saving preparedness.
- **Communication and Teamwork:** Simulation scenarios often include interaction with “role-playing patients,” incorporating communication and ethical components.
- **Clinical Thinking and Decision-Making:** Scenario-based exercises, debriefings, and error analysis help students develop critical reasoning in conditions close to real clinical practice.
- **Confidence and Reduced Psychological Stress:** Training on mannequins helps students overcome fear and anxiety before performing complex procedures on real patients.





Challenges and Limitations

- **Limited Resources:** High-fidelity mannequins and simulators are expensive; not all institutions can afford to purchase such equipment.
- **Insufficient Teacher Training:** Effective simulation sessions require instructors skilled in scenario development, assessment, and feedback. Preparing staff to work in a digital environment has become a priority for medical professional institutions.
- **Incomplete Curriculum Integration:** Simulation training is often offered as an elective or supplementary component rather than a mandatory part of the educational program in secondary institutions.
- **Lack of Standardized Scenarios and Unified Simulation Requirements:** The absence of consistent national or institutional standards complicates quality assurance in simulation-based education.

Digitalization of Medical Education: A Sustainable Trend

Digitalization in medical education is not a temporary measure but a long-term trend requiring systemic transformation. The main barriers to effective digital transformation include ethical risks, technical constraints, and insufficient digital literacy among educators and students.

Prospects

- **Development of modular programs** in which simulation is integrated into the main curriculum of medical colleges and technical schools as mandatory practical training.
- **Creation of interregional and national simulation centers** that local institutions can access and collaborate with.
- **Training and professional development of simulation instructors** to ensure high methodological and pedagogical standards.
- **Standardization of simulation scenarios and assessment tools** (checklists, certification maps).
- **Research on the effectiveness of simulation-based learning** specifically in medical colleges — focusing on quantitative indicators such as skill improvement, error reduction, increased confidence, and accelerated training.

The Study

The research was conducted on the basis of medical colleges during 2023–2024. The following methods were used:

- **Content analysis** of scientific and regulatory literature;
- **Questionnaire survey** of 212 students and 38 instructors;
- **Comparative analysis** of interim and final assessment results between groups trained using traditional methods and those using simulation and digital learning approaches;
- **Observation** of the educational process in digital laboratories and simulation centers.

Results

The findings confirmed the high effectiveness of simulation-based and digital learning approaches:

- In groups trained using simulators and digital platforms, **practical skill performance improved by 28%**, while the **error rate in control situations decreased by 35%** (according to pedagogical monitoring data, 2024).





- **87% of students** reported increased confidence in performing medical procedures after simulator-based sessions (survey data, 2024).
- Instructors noted **time savings** in explaining procedural algorithms, as well as the opportunity for repeated practice and individual progress tracking.
- Digital technologies enabled a **flexible and adaptive learning process**, which is particularly important in the context of limited clinical training facilities.

These results align with **global trends in medical education**, where simulation-based training is recognized as an effective method for reducing clinical risks.

Conclusion

Simulation-based learning and the digitalization of the educational environment serve as key tools for modernizing secondary medical education. They not only enhance the quality of specialist training but also ensure alignment with the demands of modern healthcare systems.

Effective implementation of these technologies requires a **comprehensive approach** that includes equipping educational institutions with modern resources, training instructors, updating curricula, and improving regulatory frameworks.

Future prospects include the **development of digital twins, virtual simulators**, and the **use of augmented reality technologies** in the educational process.

References:

1. Иванчук О. В., Плащевая Е. В. Цифровизация медицинского образования: новые вызовы и границы применимости // Цифровые технологии в системе образования (ЦИТИСЭ). — 2022. — № 1 (31). — С. 121–131.
2. Куликов А. Г. Симуляционное обучение в подготовке специалистов среднего медицинского звена // *Сестринское дело*. — 2023. — №2. — С. 44–48.
3. World Health Organization. *Digital Education for Building Health Workforce Capacity*. — WHO, 2021. — URL
4. Якубова Л. Н. Использование симуляционного оборудования в обучении студентов медицинского колледжа // *Проблемы и перспективы развития образования*. — 2021. — №5(59). — С. 38–42.
5. Баранов А.А., Симуляционные технологии в медицине. — М.: ГЭОТАР-Медиа, 2022.
6. А.А. Байдаров, А.С. Вронский, П.В. Лазарьков, Н.Б. Асташина, А.М. Шамарина - «Simulation training in medicine: past, present and future» // *Perm Medical Journal*, Vol. 40, No. 6, декабрь 2023 г

