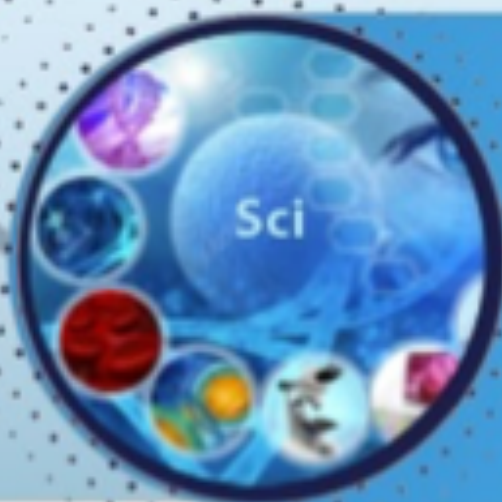




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# Simulation-Based Medical Education: the experience of Tashkent state medical university

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## ABSTRACT

*Simulation-based education has become an integral part of modern medical training, offering a safe and controlled environment for developing clinical competencies. Advanced simulation technologies allow students to train for both emergency and routine clinical situations without risk to real patients, fostering confidence, motor coordination, and teamwork.*

*This article provides an overview of the simulation-based education model and presents the experience of Tashkent State Medical University (TSMU) in developing one of the most advanced simulation centers in the region. The center, aligned with leading global standards including those of the University of Central Florida (USA), supports core disciplines such as surgery, internal medicine, pediatrics, and intensive care. The article highlights the structure, equipment, training modules, and the broader educational and patient safety implications of simulation-based learning.*

*This is a continuation of our publications in this direction [1-18]. The authors hope that this message will further explain the possibilities of the modern educational process in medicine.*

**Keywords:** medical education, simulation education, Tashkent State Medical University

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## INTRODUCTION

**M**odern medicine places ever higher demands on the training of young specialists. The traditional system of education based on observation and participation in real clinical cases inevitably faces a number of limitations. These limitations are related to limited access to a variety of cases, the inability to "repeat" rare or critical situations, and the risk of harm to the patient in the learning process. That is why simulation education is rapidly developing in the 21st century – an approach that allows you to model clinical scenarios without leaving the classroom.

Simulation technologies in medicine are a set of techniques and tools that allow you to simulate physiological processes, pathologies, manipulations and situations that require team interaction. With their help, you can not only work out basic clinical skills, but also form stable behavioral algorithms under stress, master decision-making tactics, and learn how to interact in a multidisciplinary team.

All over the world, simulation training is considered as a mandatory component of high-quality medical education. It is actively developing at universities in the USA, Canada, Great Britain, South Korea and the UAE. One of the most recognized centers is the simulation center of Central Florida University (UCF, Orlando), where training is built on a modular model with the integration of simulations at all stages of training. It was on these guidelines that Tashkent State Medical University relied when creating its own Center for Simulation Education, one of the largest and technologically equipped in the region.

### Modern Trends in Simulation Training: International Experience

**W**orld practice convincingly shows that simulation education has become an integral part of medical training. Moreover, in many countries it is regulated at the level of national educational standards. For example, in the United States of America, simulation simulators and centers are used not only at the stage of pre-diploma education, but also in postgraduate training, as well as in periodic certification of practicing doctors.

Leading universities such as Harvard Medical School, Mayo Clinic School of Graduate Medical Education, University of Toronto, and UCF (University of Central Florida) use multi-level simulation platforms covering both individual and team scenarios. These institutions have a clear logistics of training: from simple tasks of

placing an intravenous catheter to simulating an interdisciplinary resuscitation team with the participation of a student, an anesthesiologist, a surgeon and a nurse. Such scenarios are carried out using highly realistic mannequins, audio-visual systems, ultrasound simulators, laparoscopy, childbirth, endoscopy, and even complete operating rooms that reproduce the atmosphere of a real intervention.

Along with the technical component, much attention is paid to teaching methods. The principle of deliberate practice is used, in which the student has the opportunity to repeatedly practice a specific action until the standard is reached. The "debriefing" feedback format is also widely used - an analysis of actions immediately after the simulation scenario with the participation of the teacher and the entire team.

In recent years, the focus has shifted from imitation of technical manipulations to comprehensive modeling of clinical situations, including errors, non-standard complications and ethical conflicts. All this reflects the transition from "coaching" to the formation of clinical thinking and professional reflection.

Inspired by these practices, the team of Tashkent State Medical University, when creating its own Center for Simulation Education, sought to reach the level of international standards - both in terms of technical equipment and teaching methodology.

### Center for Simulation Education of Tashkent State Medical University: Structure, Directions, Priorities

**T**he Center for Simulation Education of Tashkent State Medical University was established as a strategic project aimed at radically updating approaches to teaching students, clinical residents and interns. The main goal was to create an environment that is as close as possible to real clinical practice, but at the same time completely safe for the patient and comfortable for the student.

Architecturally and technically, the Center includes several functional zones:

1. The Basic Clinical Skills Hall, where students practice the technique of measuring blood pressure, making injections, vein catheterization, performing ECGs and other procedures. Dozens of simulators and phantoms adapted to different clinical scenarios are installed here.
2. Surgical module, including simulators of laparoscopic and endoscopic interventions, skin and vascular simulators, as well as full-fledged simulations of the operating room. Particular attention is paid to training in

emergency surgery and management of intraoperative complications.

3. Therapeutic and pediatric areas, equipped with adult and pediatric patient mannequins with the ability to simulate breathing, cardiac activity, skin changes, response to medications and voice interaction. Scenarios cover cardiopulmonary resuscitation, management of bronchial asthma, diabetes mellitus, infectious diseases.

4. An intensive care station and a simulation intensive care unit, where the atmosphere of the intensive care unit is recreated: monitors, ventilators, infusion machines, defibrillators. Emergency care scenarios, multidisciplinary training, and work in critical situations are carried out here.

5. A situational simulation room with an observation and feedback system, where the teacher monitors students in real time, and then an analysis of mistakes, positive decisions, and team dynamics is carried out.

To date, the Center provides more than 1,000 hours of simulation training per semester. Classes are held for students of 3-6 courses, clinical residents and teachers. The methodological content includes checklists, rating scales, multi-scenario training, as well as video recordings and interactive tests.

The key task of the Center is not only to pass on the skill, but also to foster a culture of safety, clinical awareness, and professional responsibility among future doctors.

Examples of implementation: how classes are held, cases and scenarios

Simulation training at Tashkent State Medical University is based on the principles of scenario flexibility, step-by-step and mandatory feedback. Classes are held both as part of the curriculum and in the format of unscheduled trainings, master classes and preparation for clinical exams.

One of the typical training modules is "Acute respiratory failure in an adult patient". A student enters the ward, where there is a highly realistic mannequin with voice control and changing life parameters. Complaints of shortness of breath, wheezing, a sharp drop in saturation are simulated. The task is to recognize the situation, call the team, establish oxygen therapy, start ventilation with an Ambu bag and prepare a defibrillator. are evaluated according to predetermined criteria.

Another example is "Emergency care for a child with convulsive syndrome". Students work in a team, applying knowledge of pediatrics, pharmacology, and basic resuscitation.

In the surgical module, the training "Appendicitis with signs of perforation" is regularly conducted, including preparation of the surgical field, anesthesia assessment, simulation of laparoscopic access and subsequent discussion of treatment tactics. Laparoscopic simulators with tactile feedback are used.

In the pediatric area, there is a popular scenario called "Sepsis in the newborn", in which both diagnostic actions (blood collection, peripheral perfusion assessment) and emergency care (administration of antibiotics, ventilation support) are simulated. Such modules prepare students to work in real hospitals, where the cost of error is high.

All classes end with a debriefing, where the teacher not only evaluates the student's actions, but also discusses with the group the ethical side, communication features, and stress resistance. This format forms a comprehensive approach to the patient and a sense of personal responsibility in the future doctor.

### **The Importance of the Simulation Approach for the Quality of Education and Patient Safety**

One of the key advantages of simulation education is the possibility of systematic formation of clinical competence without risk to the health of a real patient. Mistakes that can lead to tragic consequences in the clinic become elements of training and conscious professional growth in the conditions of the simulation center.

Simulation allows you to identify and eliminate gaps in knowledge, develop motor skills, automate actions, and improve the timing of procedures. Moreover, it forms stable behavioral patterns — the ability to work in a team, set priorities correctly, and maintain self-control in stressful conditions. All this has a direct impact on the graduate's readiness for independent clinical activity.

In international practice, simulation training is directly related to the concept of patient safety. It is believed that a doctor who has undergone simulation training makes fewer clinical errors, acts more confidently in difficult situations, recognizes threats earlier and interacts more effectively with colleagues. At the system level, this reduces the number of incidents related to medical errors, reduces the cost of correcting complications and increases confidence in the medical institutions.

For medical university students, the simulation center becomes a space where they can not be afraid to make mistakes, ask questions, repeat actions as much as necessary to achieve confidence. And for teachers, it is a tool for objective control and an individual approach to each student.

In the context of modernization of medical education, the introduction of a national accreditation system and the desire for international recognition, simulation training is becoming not just an addition, but the most important condition for the quality and competitiveness of the educational process.

### **History of the Center: from idea to implementation**

The idea of creating a modern simulation center at Tashkent State Medical University did not arise by accident - it became a response to the challenges of the time and a strategic decision based on the analysis of global trends. Already in the early 2010s, it became obvious that the classical methods of training doctors — lectures, practice cycles, participation in clinical rounds — needed to be supplemented with more flexible, interactive, and technologically rich forms of training.

The first impetus was given after foreign internships of university staff, in particular, at the Center for Simulation Training at the University of Central Florida, Orlando. It was there that not just a simulator as a device was first seen, but a whole methodological philosophy: students, starting from junior years, go through a step-by-step mastery of skills - from basic procedures to interdisciplinary simulations of resuscitation, team interactions and clinical conflicts. It was not just a technical training – it was a model of the educational environment of the future.

It was this approach that formed the basis of the idea of our project. Several key objectives were identified:

- to create an infrastructure comparable to leading foreign centers;
- cover all levels of training - from student to teacher;
- integrate simulation training into official educational programs;
- provide the possibility of independent assessment of skills (OSCE, checklists, video analysis);
- to cultivate not only technology, but also a culture of responsibility, safety, and cooperation.

### **The process of creating the Center took several years. It included:**

1. design of architectural space for specific educational tasks;
2. selection and purchase of equipment - from basic phantoms to digital highly realistic simulators;
3. training of teachers and formation of a team of methodologists;
4. development of scenarios, modules and benchmarking tools;

5. Phased implementation - first at pilot departments, then throughout the university.

A special role belongs to the rector of the Tashkent Medical Academy, Professor A.K. Shadmanov and the rector of the Tashkent State Medical University, Professor Sh.A. Boymuradov, who took the project under his personal control, defining it as a strategic priority for the development of the university. Thanks to this, the Center was not only opened, but also received the status of a new generation model in the system of training medical personnel in Uzbekistan.

### **International Cooperation and Integration: From Idea to Partnership**

The creation of the Center for Simulation Education at Tashkent State Medical University was initially considered not as a local project, but as a step towards the international integration of the university into the global academic space. Already at an early stage of design, a benchmark was set: to reach the level of the best simulation centers in the world - both in terms of equipment and teaching methodology.

That is why the Center's team has been actively studying and adapting the experience of leading foreign universities, primarily the University of Central Florida (Orlando). The internship of teachers and administrative staff at UCF made it possible to see from the inside how the organization of the simulation cycle is built, how team scenarios are built, and how skills are assessed. are taken as a basis for the design of the Uzbek Center.

In addition to UCF, the vector of studying the experience was sent to other international organizations, including:

1. SSH (Society for Simulation in Healthcare, USA) — standards for accreditation and quality assessment;
2. SESAM (Society in Europe for Simulation Applied to Medicine) — methodological recommendations for simulations in medical universities in Europe;
3. AMEE are international documents on the implementation of the simulation component in medical accreditation and licensing.

On the basis of the Center, it is planned to organize international trainings and master classes with the involvement of foreign specialists, as well as participation in grant programs for simulation training. Initiatives are being worked out to include the Center in academic networks and platforms that unite simulation centers in Asia, Europe and the CIS.

Particular attention is paid to teachers who have undergone foreign training, who are proficient in the meth-



ods of debriefing, checklist assessment, and simulation design. In the near future, there are plans to conduct bilingual advanced training courses and develop export educational modules for universities in Central Asia.

Thus, the Center for Simulation Education of Tashkent State Medical University becomes not only an internal resource, but also a potential growth point for international cooperation, the export of educational technologies and the formation of a national brand in the medicine of the future.

## CONCLUSION

### Course for the future and prospects for scaling

**S**imulation education at Tashkent State Medical University is not just a new format of education, it is a cultural transformation of medical education. It changes the very philosophy of training a doctor: from "knowledge for the sake of credit" to "competencies for the sake of the patient".

The created Center is not a one-time investment, but the basis of a sustainable model that can scale, develop and set new standards. In the near future, it is planned:

1. expanding the range of simulation scenarios with a focus on rare and critical conditions (acute blood loss, trauma, anaphylaxis, multiple organ failure);
2. the introduction of VR/AR components, including virtual operating rooms, three-dimensional anatomy and digital clinical cases;
3. integration of the simulation component into the final state certification and licensing;
4. development of directions for professional retraining, especially for primary care doctors and young specialists;
5. creation of a simulation module within the framework of international cooperative programs and accreditations.

The main vector is the export of the model. The experience of Tashkent State Medical University can become the basis for the creation of simulation platforms in other medical universities in Uzbekistan and the countries of the region.

Simulation education is a tool not only to improve quality, but also to increase trust. A doctor who is confident in his skills is a calm patient, it is fewer mistakes, it is a new culture of responsibility. This is what Tashkent State Medical University strives for, creating the medicine of tomorrow today.

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**SIMULYATSION TA'LIM TIBBIYOTDA:  
TOSHKENT DAVLAT TIBBIYOT UNIVERSITETI  
TAJRIBASI**

**Boymurodov Sh.A., Oxunov A.O.**

**Toshkent davlat tibbiyot universiteti**

**ANNOTATSIYA**

Tibbiyotda simulyatsion ta'lim bugungi kunda mutaxassislar tayyorlashning ajralmas qismiga aylangan bo'lib, klinik ko'nikmalarni shakllantirish uchun xavfsiz va nazorat qilinadigan muhitni ta'minlaydi. Zamonaviy simulyatsion texnologiyalar talabalarni shoshilinch va rejalashtirilgan klinik vaziyatlarda harakat qilishga o'rgatib, bemorga xavf tug'dirmasdan ishonch, harakat koordinatsiyasi va jamoaviy fikrlashni rivojlantiradi.

Ushbu maqolada simulyatsion ta'lim konsepsiyasining umumiy ko'rinishi berilgan hamda mintaqadagi eng zamonaviy markazlardan biri — Toshkent davlat tibbiyot universiteti (TDYU) qoshidagi Simulyatsion ta'lim markazi faoliyati yoritilgan. Mazkur markaz AQSHdagi Florida markaziy universiteti kabi yetakchi xalqaro tajribalar asosida tashkil etilgan bo'lib, jarrohlik, terapiya, pediatriya va reanimatsiya yo'nalishlarini qamrab olgan. Maqolada markazning tuzilishi, texnik jihozlanishi, o'quv modullari va simulyatsion yondashuvning tibbiy ta'lim sifatiga va bemor xavfsizligiga ta'siri tahlil qilinadi.

**Kalit so'zlar:** tibbiy ta'lim, simulyatsion ta'lim, Toshkent davlat tibbiyot universiteti

**СИМУЛЯЦИОННОЕ ОБРАЗОВАНИЕ В  
МЕДИЦИНЕ: ОПЫТ ТАШКЕНТСКОГО  
ГОСУДАРСТВЕННОГО МЕДИЦИНСКОГО  
УНИВЕРСИТЕТА**

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**АННОТАЦИЯ**

Симуляционное образование в медицине стало неотъемлемой частью подготовки специалистов, обеспечивая безопасную и контролируемую среду для формирования клинических навыков. Современные технологии симуляции позволяют отрабатывать действия в экстренных и плановых ситуациях без риска для пациента, формируя у студентов уверенность, моторику и командное мышление.

В данной статье представлен обзор концепции симуляционного образования и освещён опыт Ташкентского государственного медицинского университета (ТашГМУ) в создании одного из самых современных в регионе центров симуляционной подготовки. Центр ориентирован на лучшие международные практики, включая опыт Центрального университета Флориды (США), и охватывает ключевые направления — хирургию, терапию, педиатрию и интенсивную терапию. Рассмотрены структура, оборудование, примеры образовательных модулей и значение симуляционного подхода для повышения качества медицинского образования и безопасности пациентов.

**Ключевые слова:** медицинское образование, симуляционное образование, Ташкентской государственной медицинской университет