

PRACTICAL SESSION “EXAMINATION OF A CADAVER AT THE SITE OF DISCOVERY” USING SIMULATION TECHNOLOGIES

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Abstract. This article presents the results of a comparison between the preparation of the protocol “Examination of a Corpse at the Site of Discovery” using traditional teaching methods and teaching methods that incorporate simulation technologies. It describes systemic issues in the practical training of students in the higher medical education system based on modern pedagogical concepts (andragogy, the theory of purposeful practice, Bloom’s taxonomy) and empirical research conducted at the simulation center of N. A. Semashko National Research Institute of Clinical Medicine at the Russian University of Medicine (a Federal State Budgetary Educational Institution of Higher Education under the Ministry of Health of Russia), and substantiates the effectiveness of simulation technologies in developing professional competencies. The results of a retrospective cohort study involving 5th- and 6th-year students are presented. Four scenarios for the session “Examination of a Cadaver at the Scene of an Incident” were developed and tested. The simulation method was shown to be significantly superior to the traditional method. Recommendations for implementing the developed methodology into the educational process are formulated.

Keywords: simulation-based education, medical education, practical skills, forensic medicine, andragogy, pedagogical supervision.

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Introduction

The Current State of Practical Training in Medical Education

Modern higher medical education in the Russian Federation and abroad faces a persistent contradiction: while graduates have a high level of theoretical training, their practical skills often fall short of employers’ expectations. This gap, known as the “qualification paradox,” is recognized as one of the key challenges in professional education in the healthcare sector. Numerous studies show that the traditional educational system, based primarily on the transmission of information and observation of clinical cases without active hands-on practice and practical skill development, does not provide a sufficient level of preparation for practical work.

The main factors contributing to this gap are multifaceted: first, there are organizational constraints, such as the absence of patients with the required medical conditions in clinics at the time of the training session; second, there are legal and ethical barriers, such as patients’ refusal to participate in the training process; the need to maintain patient confidentiality; and restrictions imposed by health care legislation; third, pedagogical challenges: large class sizes prevent every student from performing a procedure a sufficient number of times. As a result, the development of practical skills occurs spontaneously, through “trial and error,” right at the start of independent professional practice, which poses risks to patients [6; 2; 12; 13; 18].

In the global field of higher education pedagogy, simulation-based medical education (SBME) is considered one of the most effective ways to bridge this gap. Simulation-based learning refers to the reproduction, under controlled conditions, of a segment of professional practice using technical aids (mannequins, simulators, virtual environments) followed by an analysis of the actions taken. The key advantage of SBME is the ability to repeatedly practice procedures—in a manner that is safe for both the patient and the student—with immediate feedback [3; 7; 8; 15; 17].

Several fundamental pedagogical concepts serve as the theoretical basis for the simulation approach.

The first of these is the theory of deliberate practice, developed by Ericsson. According to this theory, a skill becomes automatic not through mere repetition, but through systematic practice with a clearly defined goal, immediate feedback, and correction of errors. A simulation environment perfectly meets these conditions: the learner performs a task, the instructor (or the system) identifies deviations, and during the debriefing, the performance is analyzed and a standard of performance is established [5; 6].

The second significant theoretical component is andragogy (adult education). Upperclassmen (5th–6th years of study) already possess a significant body of theoretical knowledge and initial clinical experience; many students enter universities not “straight out of high school,” but after completing college or gaining work experience as mid-level medical personnel. For this category of students, the most effective methods are those based on independent problem-solving, reflection, and the meaningful application of knowledge in a practical context. The andragogical model assumes that the instructor acts not as a conveyor of ready-made solutions, but as an organizer of cognitive activity, creating conditions for self-directed learning [7; 8; 10; 11].

The third theoretical foundation is Bloom’s taxonomy in the cognitive and psychomotor domains. Developing the skill of conducting a postmortem examination at the scene of an incident falls within the psychomotor domain and requires progressing through levels ranging from imitation (repeating after the instructor) to automatic performance [13; 16]. A simulation exercise allows for the development of a clear progression: from reproducing the algorithm (the lowest level) to making decisions in non-standard scenarios (the highest level).

Finally, the fourth — and most important — regulatory and methodological guideline is the INACSL (International Nursing Association for Clinical Simulation and Learning) standards, which define the mandatory components of effective simulation: pre-briefing, a realistic scenario, a structured debriefing, and evaluation of results. Debriefing is recognized as “the heart of simulation,” since it is precisely during the discussion of actions that reflective understanding and the integration of new experiences take place [6].

Simulation technologies have been actively implemented in the Russian medical education system since the early 2010s, but their use remains uneven. They are most widely used in anesthesiology and intensive care, surgery, and obstetrics [9]. At the same time, as rightly noted in the literature, the discipline of “Forensic Medicine” remains the least covered by simulation-based approaches [2]. Traditionally, practical classes in forensic medicine are based on the analysis of photographic materials, the solution and description of pre-prepared case studies based on expert opinions, or, at best, the observation of a forensic autopsy — the organization of which is currently extremely difficult.

However, according to Part 1 of Article 178 of the Criminal Procedure Code of the Russian Federation (hereinafter referred to as the CPC RF), the investigator conducts an examination of the body with the participation of a forensic medical expert, or, if the expert is unable to participate, a physician [1]. In other words, a physician of any specialty may be called upon to perform this procedure, regardless of their field of expertise. Consequently, all medical school graduates, regardless of their specialty — not only forensic medical experts, but also dentists, pediatricians, and gynecologists — must possess the practical skills to examine a corpse at the scene where it was discovered.

The examination of a corpse at the scene where it was discovered is a specific procedure that follows a set protocol, requires the use of specialized equipment (a forensic pathologist’s kit), and, most importantly, involves inter-agency cooperation (investigator, forensic scientist, witnesses) [4; 14]. It is practically impossible to simulate such a situation in real life due to legal restrictions (Article 310 of the Criminal Code of the Russian Federation (hereinafter—the Criminal Code of the Russian Federation) regarding the non-disclosure of preliminary investigation data) and the lack of access to actual crime scenes for educational purposes [2]. This is precisely why the simulation approach in forensic medicine is not merely desirable but the only feasible way to develop comprehensive skills.

Research Goal, Objective, Topic, and Hypothesis

The research object is a practical session on the topic “Examination of a Corpse at the Scene of Discovery,” conducted in a simulation center.

The subject of the research is the organizational and pedagogical system for conducting this session, including scenarios, checklists, and stages of pedagogical monitoring.

The research objective is to develop scenarios for the practical session “Examination of a Cadaver at the Site of Discovery” for fifth-year dental students and sixth-year medical students and to demonstrate its effectiveness compared to traditional teaching methods.

The hypothesis is that implementing the developed training program at the simulation center will improve the overall level of professional training, help students develop consistent practical skills in performing postmortem examinations, and allow them to hone their communica-

tion skills in a teamwork setting. The success of this endeavor depends on two conditions: pedagogical supervision must strictly align with the objectives of each stage, and the simulators used must provide a high degree of realism and immersion in a professional environment.

Materials and Methods

The study was conducted using a quasi-experimental design with randomized assignment of treatment groups. The data consisted of autopsy reports completed by fifth-year students in the School of Dentistry (624 students in



Fig. 1. "Injury Caused by Sharp Objects" Scenario



Fig. 2. Scenario: "Gunshot Wound"

the 2024–2025 academic year) and sixth-year students in the School of Medicine (580 students). The historical control group consisted of similar protocols from students in the previous cohort (2023–2024 academic year): 593 students (5th year) and 571 students (6th year). Students in the historical control group worked with photographic images (1 to 4 images per scenario). Assessment was conducted using standardized checklists developed for four types of scenarios: blast injuries, gunshot wounds, and injuries caused by blunt and sharp

objects (Figs. 1–4). Classes in both the experimental and historical control groups were conducted by the same three instructors.

Each item on the checklist was scored either on a binary scale (100 points for full compliance, 0 for non-compliance) or on a continuous scale (1–99 points for partial compliance). Groups of three to five people were randomly assigned a scenario, and the analysis was conducted based on individual protocols.



Fig. 3. Scenario: "Injury Caused by a Blunt, Solid Object"

The event was held at the simulation center of N. A. Semashko Scientific and Educational Institute of Clinical Medicine. The equipment and supplies included: three adult male manikins, one adult female manikin, and one infant manikin; sets of injury simulators (50 units), a set of internal organs; a forensic medical examiner's kit with standard equipment; mock trauma instruments, blood and clot simulators, bullets and shrapnel, and sheets. The total duration of each session was 240 minutes.

The lesson structure (breakdown) included the following stages with the following time allocations: initial assessment (5%), instruction and goal setting (20%), completion of the learning task in teams (50%), debriefing with error analysis (15%), and final preparation of the examination report at the simulation center (10%). The report was submitted for review no later than three days before the assessment session and was included in the student's portfolio as a prerequisite for the assessment.

The entrance assessment took the form of a 15-question multiple-choice quiz. Preparatory materials (lectures, presentations) were made available to students online.

Results

Comparative effectiveness. In the experimental group (simulation education), sixth-year medical students achieved an average protocol completion score of 93 (out of a maximum of 100), with a standard deviation of 5.7. The confidence interval ranged from 92.54 to 93.46, meaning that, with 95% probability, the true mean lies within this range. In the historical control group, which worked with photographs, the mean score was 67, with a standard deviation of 8.0; the confidence interval ranged from 66.34 to 67.66. The analysis used Student's t-test, which yielded a value of $t = 63.41$ — an extremely high value, indicating that the variation in the sample was not random. For



Fig. 4. Scenario: "Mine- and Explosive-Related Injury"

fifth-year students in the School of Dentistry, the difference was similar: 87 versus 64 points. In the experimental group, the standard deviation was 6.2, and the confidence interval was 86.51–87.49. In the historical control group, the standard deviation was 8.4; the confidence interval ranged from 63.32 to 64.68, and the Student's t-test for the dental groups yielded a value of 54.4. The difference between the means (87 and 64), given these sample sizes and variances, cannot be accidental, indicating that the differences are statistically significant ($p < 0.01$) and are consistent with meta-analysis data showing that the simulation approach yields a 20–30 percentage point advantage over traditional methods in the assessment of practical skills (Fig. 1).

Following the training, students demonstrated the development of these skills. The use of mannequins, attachable injury simulators, and a forensic medical examiner's kit allowed students to practice the sequence of actions in conditions as close to real-life as possible. Students had the opportunity to repeatedly practice procedures (body examination, documentation of injuries, and collection of physical evidence) without the risk of compromising the evidentiary value of the evidence or violating procedural rules.

Development of Team Collaboration. The assignment of roles (investigator, expert, forensic specialist, witnesses) within each scenario helped develop communication skills. During the debriefing, not only technical errors but also communication breakdowns (failure to convey information, duplication of actions, role conflicts) were noted.

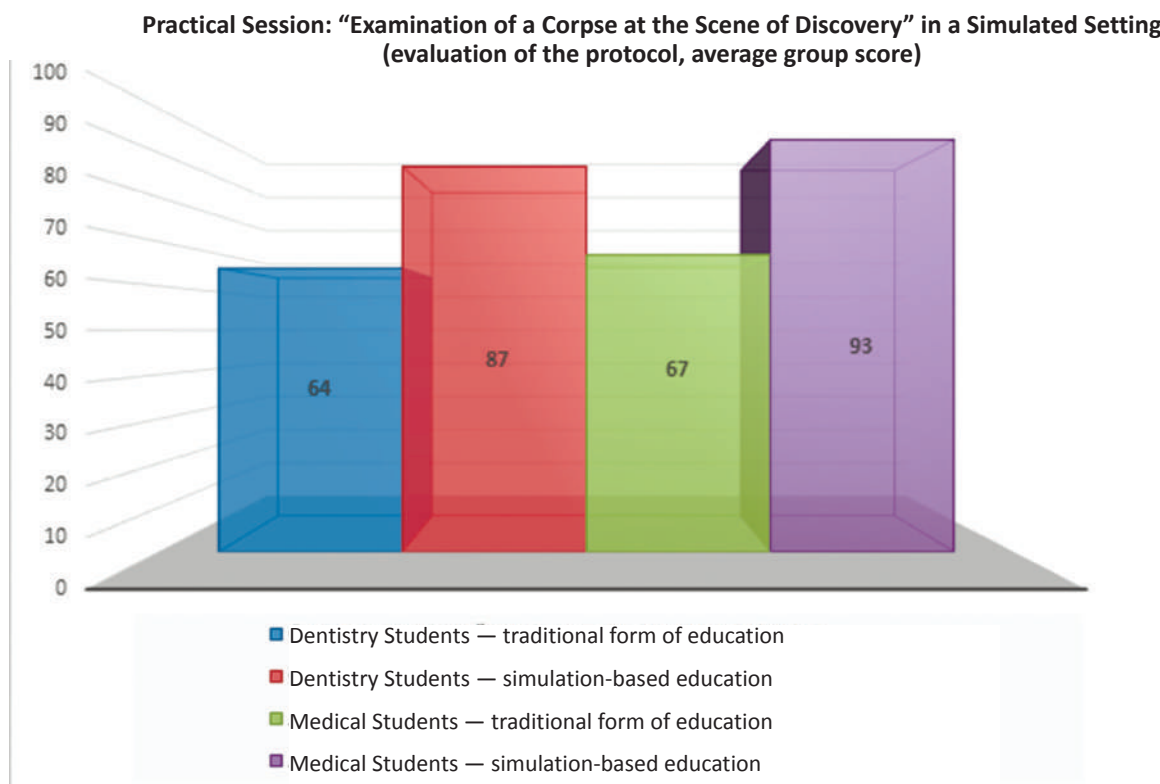


Figure 1. Comparison of traditional teaching methods with simulation-based methods among 5th-year dental students and 6th-year medical students

Students recognized the experience of working in an interdisciplinary team as one of the most valuable aspects of the class.

Overcoming the Limitations of Traditional Methods. The study confirmed that the simulation approach allows for the circumvention of key barriers: the inability to visit a real incident site for organizational reasons, the lack of a guaranteed occurrence of a suitable case during class hours, and legal restrictions (Article 310 of the Criminal Code of the Russian Federation). Simulation provides standardized conditions for all trainees, which is impossible with variable real-life cases.

Discussion

The results obtained fit into the broader context of research on the effectiveness of simulation-based education. According to the theory of deliberate practice, the key factor is not the duration of training but its structure: the presence of a clear goal, immediate feedback, and the opportunity for correction. In our study, these conditions were implemented through debriefing — a mandatory component that took place immediately after the task was completed and accounted for 15% of the session time. The literature indicates that debriefing increases the effectiveness of simulation by 2–3 times compared to simply repeating the procedure without analyzing errors.

The andragogical context is also important: 5th- and 6th-year students already have experience working with real

patients (as part of their clinical rotations). For them, simulation is not a “toy” but a tool for practicing algorithms that are rarely encountered in real life or involve high risks. The students’ self-assessment scores, collected through an anonymous survey, indicate a high level of satisfaction specifically with the realism of the scenarios and the opportunity to “make mistakes safely.”

It is important to emphasize that the proposed methodology fully complies with INACSL standards: a pre-briefing was conducted (including an overview of “hot spots”), the scenario was authentic to a professional situation, the debriefing was structured according to the “pros/cons/recommendations” model, and the results were evaluated using structured checklists. A distinctive feature of our approach is the integration of interagency collaboration into the simulation—an aspect that is rarely modeled in standard medical simulation courses.

Conclusion

The system developed and tested for conducting the practical training session “Examination of a Cadaver at the Scene of Discovery” in a simulation center has proven effective. Students who trained using mannequins and simulators scored an average of 93 points (School of Medicine) and 87 points (School of Dentistry) on their protocols, which significantly exceeded the results of the control groups (67 and 64 points, respectively). Simulation technologies enabled students to develop practical skills in conducting a postmortem examination, including the use of specialized instruments and the documentation

of findings in procedural records, under conditions that simulate real-world scenarios.

Teamwork within an interdisciplinary group (investigator, expert, forensic specialist, witnesses) helped develop effective communication strategies and coordinate actions. Simulation-based training overcomes the organizational, ethical, and legal limitations of the traditional approach (in particular, the prohibition on disclosing preliminary investigation data). It ensures repeated, controlled practice of the skill with step-by-step debriefing.

The research hypothesis has been confirmed: pedagogical supervision synchronized with the objectives of each stage, combined with the use of highly realistic simulators, guarantees an improvement in the level of training for future forensic medicine physicians.

It is recommended that the developed scenarios (four types of mechanical trauma) and methodological guidance be incorporated into the curricula of disciplines for the medical and dental faculties, as well as for other medical specialties, whose practitioners, pursuant to Article 178 of the Criminal Procedure Code of the Russian Federation, may be called upon to examine a corpse at the scene of an incident.

Authors' Contributions

O. I. Kosukhina — development of the research concept and design;

M. M. Shcherbak, O. E. Konyayeva — preparation of simulators and creation of conditions for conducting classes; Leonova L. A., Leonov S. V., Kosukhina O. I. — development and preparation of scenarios; Kosukhina O. I., Leonova L. A. — data collection, analysis, and interpretation;

Kosukhina, O. I., Leonov, S. V., Shcherbak, M. M., and Konyayeva, O. E. — statistical analysis of data and article design.

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