Journal of Vasyl Stefanyk Precarpathian National University
http://journals.pnu.edu.ua
Vol. 10, No. 3 (2023), 201-207

UDC 61:378.147
doi: 10.15330/jpnu.10.3.201-207

IMPORTANCE OF INTEGRATED SIMULATION APPROACHES IN MEDICAL EDUCATION WHEN TEACHING THERAPY DISCIPLINES TO STUDENTS OF MEDICAL FACULTY

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Abstract. The article is devoted to reviewing the main methods of practice-oriented teaching of medical students at the Department of Internal Medicine No. 1, Clinical Immunology and Allergology named after Academician Y.M. Neyko of Ivano-Frankivsk National Medical University (Ukraine). The significance of not only theoretical but also practical training of medical students in the conditions of blended learning is highlighted. The impact of new teaching methods on the level of future doctors' professionalism has been analyzed. Another important aspect of training is the introduction of simulation training, which allowed for obtaining a high level of knowledge without harming the patient. The article focuses on the role of the "virtual patient" in supervision, as this method, regardless of the form of study, allowed the student to be acquainted with a standardized patient, improve communication skills and choose the right method of diagnosis or treatment by the European guidelines. The article describes prospective systems for simulating clinical cases, which allow the creation of interactive training cases of various complexity levels depending on the goals set or the level of a specialist's training. The article presents the main online platforms for creating the most realistic cases with photographs of the affected body area and protocols of instrumental examinations, which allow you to reproduce the order of the doctor's actions and modify the intensity of the patient's condition if the prescription was incorrect. Moreover, the article highlights the positive impact of interactive teaching methods on student motivation and encouragement to deepen knowledge in a particular discipline, as an essential aspect is the discussion of examination results and prescription of therapy based on modern guidelines. It additionally outlines actions to be taken for ensuring efficient handling of new "virtual patient" cases and for inputting data on previously created clinical cases into the system. The article describes the main advantages of simulation-based teaching methods in comparison with traditional forms of teacher-student interaction. It is noted that training with the help of "virtual patients" allows us to evaluate the acquired practical skills and competencies of future doctors.

Keywords*:* virtual patient, clinical case, lesson discussion, simulation training, online modeling of clinical cases.

1. INTRODUCTION

The implementation of high technologies in all spheres of human activity, including medicine, acceleration of the pace of life, constantly growing amount of knowledge, and introduction of new medical and diagnostic techniques – all these factors make it necessary for the modern medical education system to develop qualitatively new approaches to training healthcare specialists. Hence, it is

natural that one of the main directions of development of medical education is the necessity to significantly strengthen the practical aspect of training while maintaining the appropriate level of theoretical knowledge.

The experience of leading medical universities in the European Union, the USA, and Canada has proved that "virtual patients" are effectively used to teach students professional communication skills as well as to develop and improve clinical thought. Based on the integration of a dialogue management system, the applications generate emotionally responsive interactive 3D characters that are created with high-resolution visuals and can conduct dialogue using natural language. The application of such programs helps improve the academic achievements of students in the corresponding sectors of the educational process by up to 25% (Berezutsky, 2021; p. 261). Further improvement of virtual scenarios allows us to expect that the whole range of diagnostic cases that a family doctor may encounter in their daily practice will be presented (Kononowicz, 2019; Kolesnyk, 2020).

Another important advantage of simulation technologies is the fact that the student gets a unique opportunity to practice certain types of practical skills without affecting the patient's health; perform the necessary manipulations; and gain teamwork skills. The simulation course includes two stages: a theoretical part based on the repetition of fragments of fundamental disciplines, and a practical part - work in “virtual patient” simulation (Zhdan, 2019, p. 12).

Simulation training with “virtual patients” provides several advantages over the traditional training system: it is conducted regardless of the availability of relevant patients in the clinic and the work schedule of the medical institution; the patient is in no way affected by the doctor's actions; and the final result of the workshop is improved by the objectivity of the assessment. Simulators are distinguished by the multiple and accurate reproductions of important clinical scenarios and the ability to adapt to the training situation. It is equally significant that simulation enables objective registration of the parameters of the professional activity performed to achieve a high level of training for each specialist (Zhdan, 2020, p.244). Thus, the undoubted advantage of “virtual patients” over traditional methods of teaching future doctors and improving clinical thinking has been realized. Of course, the best results are obtained by combining virtual patients and traditional pedagogical methods. Therefore, the promotion and extensive implementation of “virtual patients” in the educational process of medical institutions will improve the quality of training of future specialists.

2. ANALYSIS AND DISCUSSION

Teaching staff of the Department of Internal Medicine No. 1, Clinical Immunology and Allergology named after Academician Y.M. Neyko of Ivano-Frankivsk National Medical University are constantly improving their professional knowledge, communication, pedagogic and public speaking skills. At the beginning of any course, the basic principles of professionalism and professional responsibilities are discussed, and the instructors draw students' attention to the main points and preventive measures regarding future unprofessional behavior of medical students. We focus students' attention on three principles of professionalism when discussing clinical cases (priority of patient well-being, patient autonomy, and social justice aspects). In most cases, we actively use blended learning elements, successfully combining online training (online lectures, binary lectures, e-textbooks) and face-to-face teaching methods. Students work independently on a certain part of the material at a time convenient for them, using time management techniques.

For recent years, we have introduced discussions for 4th-year students at the department based on a certain scenario with real clinical cases simulation and active participation of students who play the roles of different specialists (the role of a patient according to a previously developed simulation scenario, family doctor, allergist, pulmonologist, immunologist, gastroenterologist, rheumatologist, nephrologist, laboratory doctor, rehabilitation therapist, medical director). (Yatsyshyn, 2021).

We also organize case clinical discussion (CCD) classes for 5th-year students, involving specialists

from other clinical departments and interns as clinicians. This promotes effective communication, the development of clinical thought, teamwork, and an interdisciplinary approach to work (Yatsyshyn, 2023) [9]. The final assessment is made by the lecturer, but an additional emphasis is made on the use of peer assessment (a student assesses a colleague) with further discussion of the issues of debate and their correction. The instructor coordinates students' teamwork (demonstrates expert-level practice - C2), considering the elements of the "hidden" curriculum, as well as the extremely important aspects of non-verbal communication.

In today's context, it is extremely important to develop communication skills, with an assessment of the main elements of emotional intelligence. To solve this problem, standardized patients are mostly involved (we practiced clinical simulations when a student or an intern played the role of a patient).

The department also actively uses the teaching methodology with the help of the "Virtual Patient" therapeutic profile, introduced at the IFNMU in recent years. This is an effective educational and assessment system that provides students with practical skills and the correct order of actions of the student with the patient (Yatsyshyn, 2021).

The OpenLabyrinth system is a reliable, time-tested, open-source online clinical case modeling system. It provides interactive learning cases with a unique approach as an alternative way of teaching students. The original Labyrinth application was initially developed by the Learning Technologies Unit at the College of Medicine and Veterinary Medicine at the University of Edinburgh. The latest version of OpenLabyrinth has been developed by institutions such as the Northern Ontario Medical School, the University of Edinburgh, St George's University of London, and the University of New South Wales in Australia (Open Labyrinth, 2023).

The "virtual patient" is based on a complex structure that simulates real-life decisions in the course of supervision. At the same time, the central element of this structure and its main focus is a kind of "maze". For each map of the maze, there is a series of linked pages called "nodes" (defining the parameters available to the user). A node is a unit of information presentation for a user, most commonly a web page. Although a map can have only one node, it usually consists of many interconnected nodes. In each node, you can specify a name, a condition of the situation, the availability of supporting materials for the student (documents, images, audio), and multiple options for moving to the next node situation. In addition, the software allows to set up a score calculator that will automatically calculate the points of the maze participant. From the first "nodes", students get to know their patients and immediately have a wide range of options for continuing their care. If there are specific symptoms that can be identified during the examination of the patient, they are presented in the form of photo illustrations. The students also receive a detailed description of the results of an objective examination by the system and have to identify the symptom they are facing and choose the correct option. The student can prescribe a full range of necessary laboratory or instrumental diagnostic procedures for the patient. It should be noted that navigation in a well-designed "virtual patient" is intuitive. Many cases have a simple, linear format designed in the HEIDR model (life and disease history, examination, research, diagnosis, treatment). But the OpenLabyrinth developers do not limit the authors of clinical cases to this style. OpenLabyrinth provides an application environment in which cases can have many different styles - several endings and different levels of complexity. When working with a "virtual patient", you can also simulate dialogues between a doctor and a patient. The student applies his/her knowledge to answer questions and explain the patient's disease or may choose not to communicate. The student is also given short information sections with illustrative materials. In case of difficulties with the choice of therapeutic tactics, you can always use the option of "tips" (recommendations for the treatment of patients with various diseases).

Since the "virtual patient" is realistic, if you choose the wrong tactics for treating a patient, their condition worsens and complications develop. The student will be penalized for a non-optimal choice of the next step in the supervision. If the student has coped with all the stages of management, he or she is asked to choose the appropriate recommendations for a particular patient. At the end of the supervision,

the student receives his or her final score (the higher the score, the more mistakes were made). This system allows the use of the "virtual patient" methodology not only for educational purposes but also for assessment.

At the department, we practice an educator-led joint study route for the most illustrative cases, followed by a briefing and discussion of non-optimal steps, and justification of individual items to avoid such moments in real clinical situations.

For further improvement of the "virtual patient" methodology, we started using the platform CASUS at the department (CASUS Virtual Patient System, 2023). Each simulation session includes the following mandatory components: 1) briefing instruction; 2) performance of the training task ("case study"); 3) debriefing (discussion of performance).

During the first stage (motivational and goal-oriented), the instructor (trainer) introduces the topic, defines the goals and objectives of the training, and explains the importance of gaining experience. He or she also introduces the students to the procedure and method of conducting the training, as well as the form of assessment of the results of acquiring the skill. The second stage of the training involves a clinical scenario. Before this, it is extremely important to define clearly the learning objective (goal) to be close to the trainee's professional activity. The last stage of the training is a debriefing, during which students analyze their actions, assess the quality of medical care provided, deviations from existing algorithms, and determine the appropriateness of this practice. A prerequisite is that all participants must take an active part in the debriefing, commenting on their actions and talking about the challenges they face during the scenario.

Using the CASUS platform, we have an excellent opportunity to model a clinical case, considering the details of the disease as much as possible, from,m the emergence of symptoms to the processes of differentiating diagnosis and treatment. When describing a case, we use a realistic, diverse, and lifelike approach to formulating patients' complaints. This method engages the student from the very beginning. At the same time, there is a survey in the form of a questionnaire, aimed at taking a broad anamnesis from the patient to include or exclude possible diagnoses. The replies are checked immediately by the system and each option is given a clear commentary with arguments for or against, so students and the tutor immediately analyze their suggestions. In these scenarios, it is crucial to consider the medication and the side effects that patients may experience. Therefore, in many cases of medication, a separate question is highlighted and students compare side effects so as not to confuse them with the symptoms of the disease. The comments after the answer provide information about these side effects, allowing students to analyze their answers with the instructor. Definitely, we never waste time at this stage of work, as this knowledge is extremely important for future doctors. In most cases, the next step is to analyze the objective examination data. And here, an important advantage is that, in addition to descriptive data, the case contains photographs of the disease site, which allows students to easily visualize the actual clinical situation. As a rule, at this stage, students are offered to perform physical diagnostic tests to confirm or disprove the preliminary diagnosis. After the physical examination, we move on to the laboratory and instrumental research methods that should be performed with the patient. Students choose from the given options, analyzing the data presented in the comments with the teacher. The patient's labs are provided and the main task is to relate the identified laboratory abnormalities to possible clinical symptoms and syndromes. As for the instrumental examination data on the CASUS platform, most cases provide examples of photos of ultrasound, radiography, computed tomography, or magnetic resonance imaging data, depending on the patient's diagnosis. These visualization methods bring students as close as possible to the real conditions of future medical practice. A broad comment is often provided with an explanation of the symptoms observed during the examination. To consolidate the material in assignments, it is necessary to supplement the information with word combinations by inserting them into the text with gaps. In this way, students can emphasize the important data twice.

Based on anamnesis, physical examination, laboratory, and instrumental data, students make their

suggestions about the diagnosis. Subsequently, they analyze the methods of treatment strategy, select the correct answers from the test options, and work carefully with the tutor to work through each option. The system calculates the percentage of correct answers and generates a result. The system discusses indications and contraindications for treatment, and possible side effects of therapy, and draws attention to drug interactions and dosage.

At the final stage of training, using various simulation methods, it is effective to have a debriefing - a team discussion of the results with a focus on positive aspects, the correct clinical route for patients, and the prescription of laboratory and instrumental examination methods. An important step in this process is the preliminary development of a debriefing plan. At the same time, it is necessary to understand certain elements of pre-briefing, when safety and confidentiality are important, as well as a preliminary acquaintance with the conditions of a particular simulation.

An important aspect is the discussion of the results of laboratory and instrumental methods of examination (of different levels) and the prescription of step-by-step therapy with justification based on current recommendations. A lecturer of the department with the appropriate level of qualification (facilitator) and specialty work experience asks direct questions, helps, corrects, and explains information without judgment, criticism, and using communication skills, elements of non-verbal communication, initiates adequate and high-quality feedback. After the discussions, we summarize the data, knowledge, and information we have gained, considering a specific clinical case. Instructors always draw attention to the points requiring improvement in the future.

Thus, it is necessary to note that modern students are extremely active, requiring a revision of teaching approaches and the use of the principles of fast and effective learning using mixed methods (but taking into consideration individual preferences).

As the department trains not only students but also junior doctors (interns) and doctors of various specialties, the proposed simulation training methods will contribute to a modern and comprehensive approach to patients and continuous improvement of students' and doctors' knowledge.

To promote the continuous professional development of healthcare professionals, we decided to support the development of “ClinCaseQuest”, a Ukrainian startup established in 2021 as a virtual simulation training platform for healthcare education. Using this resource, the educators of the department can demonstrate models of "virtual patients", work on cases for self-study or create their clinical case.

In addition to clinical assignments, training, and debriefings are held on the platform, which allows students to accelerate the acquisition of clinical experience and reduce the number of medical errors in the professional activities of doctors (ClinCaseQuest, 2023).

In the future, we plan to gain access to the online platform LOOOP-share (Learning Opportunities, Objectives, and Outcomes Platform) to enter data on already developed patients into the system, with the subsequent possibility of creating our patients.

3. CONCLUSIONS

1. The use of various simulation training methods is important for all participants in the educational process (students, educators, interns, doctors of various specialties), as training should be focused on applying the acquired knowledge in practice, using mixed methods.

2. The use of the “virtual patient” methodology to teach the discipline “Internal Medicine” contributes to the expansion of knowledge, and development of clinical thinking, and motivates students, interns, and teaching staff of the department to continuously improve their knowledge in professional, communication (during the debriefing at the final stage of the class), and scientific areas, as well as the effective use of individual elements of information (or their combination) in practice.

3. Training with the help of “virtual patients” of the therapeutic profile using various platforms allows us to assess the acquisition of practical skills by the student and the correctness of their future

implementation when working with real patients.

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Received: August 26, 2023; **revised:** September 6, 2023; **accepted:** September 26, 2023; **published:** September 30, 2023**.**

Яцишин Роман, Чернюк Наталія, Дрогомерецька Оксана, Курилів Галина, Салижин Тетяна, Бойчук Юлія. Значення комплексних симуляційних підходів в медичній освіті при викладанні терапевтичних дисциплін для студентів медичного факультету. *Журнал Прикарпатського університету імені Василя Стефаника*, **10** (3) (2023), 201-207.

Стаття присвячена огляду основних методів практично-орієнтованого навчання студентів-медиків на кафедрі внутрішньої медицини № 1, клінічної імунології та алергології імені академіка Є.М. Нейка Івано-Франківського національного медичного університету (Україна). Визначено важливість не лише теоретичної, а й практичної підготовки студентів-медиків в умовах змішаного навчання. Проведено аналіз впливу нових методів викладання на рівень професіоналізму майбутніх лікарів. Важливим аспектом навчання було упровадження симуляційних тренінгів, що дало змогу отримати високий рівень підготовки спеціалістів без шкоди для пацієнта. У статті зроблено акцент на ролі «віртуального пацієнта» у проведенні курації, саме ця методика, незалежно від форми навчання, дозволяла студенту ознайомитися зі стандартизованим пацієнтом, навчитися комунікації та обрати вірний метод діагностики чи лікування згідно з європейськими рекомендаціями. Розглянуто перспективні системи моделювання клінічних випадків, які дозволяють створювати інтерактивні навчальні кейси різного рівня складності залежно від поставлених цілей чи рівня підготовки спеціаліста. Описано основні онлайн-платформи для створення максимально реалістичних кейсів зі світлинами ураженої ділянки тіла й протоколами інструментальних обстежень, що дає змогу відтворювати послідовність дій лікаря та змінювати важкість стану пацієнта, якщо призначення було хибне. Крім того, у статті зазначено про позитивний вплив інтерактивних методів навчання на мотивацію студентів та заохочення до поглиблення знань з певної дисципліни, адже важливим аспектом є обговорення результатів обстеження та призначення терапії з обґрунтуванням, що базується на сучасних рекомендаціях. Також визначено заходи, які необхідно впровадити для забезпечення ефективної роботи над новими кейсами «віртуального пацієнта», а також для введення в систему даних по вже розроблених клінічних випадках. Розглянуто основні переваги симуляційних методів навчання у порівнянні із традиційними формами взаємодії «викладач-студент». Зазначено, що навчання за допомогою «віртуальних пацієнтів» дозволяє оцінити набуті практичні навички та компетентності майбутніх лікарів.

Ключові слова: віртуальний пацієнт, клінічний кейс, заняття-дискусія, симуляційний тренінг, онлайн-моделювання клінічних випадків.