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SIMULATION TECHNOLOGIES IN MEDICAL EDUCATION

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The article discusses the expediency of application of simulation technologies with use of innovative methods of research-oriented learning RBL. The author focuses on the fact that the use of simulation technologies allow students to carry out the relationship between the biomedical and clinical disciplines, enhance the cognitive activity, contribute to the assimilation of knowledge and their high integration.

Key words: innovation methods, medical simulations, competency assessment, integration study

Simply witness the widespread use of medical information technology across the continuum of lifelong learning: medical students now view lectures online or via podcasts; residents consult resources stored in personal digital assistants (PDAs) to help make patient management decisions at the point of care; practitioners receive continuing education credits by attending teleconferences broadcast over the internet. Simulations represent another form of technology that medical education has increasingly employed in recent years, and this article aims to provide a general overview of these educational innovations and their uses for training and assessment [3].

Medical simulations, in general, aim to imitate real patients, anatomic regions, or clinical tasks, and/or to mirror the real-life circumstances in which medical services are rendered. Our discussion here may use the term simulation, which in its broad sense includes any approximation of actual clinical situations, but in keeping with the technology theme of this special supplement, we will focus more narrowly on simulators. These can take many forms and span the range from low to high fidelity and from devices for individual users to simulations for groups of students of medical education. These simulators can be divided into 3 main groups: part task trainers, computer-enhanced mannequins, and simulators of virtual reality [1].

Simulator types and features. The first category which is known as part task trainers consist of 3-D representations of body parts/ regions with functional anatomy for teaching and evaluating particular skills, such as plastic body parts for venipuncture. In most cases, the interface with the user is passive (i.e., the device used as apparatus for explanation, or different types of medical related procedures are performed on it, with little more than rudimentary responses from the simulator). Although more sophisticated part task trainers may contain computerized instruments or apparatus, we nonetheless distinguish them from computer-enhanced mannequins (CEMs) because the latter reproduce not only the anatomical knowledge, but also normal physiological and pathophysiologic functions. In case of dealing with CEMs the interface with the user is more often active or even interactive: in the latter case, the simulator response will vary according to the demand of user (i.e., heart rate and blood pressure will change appropriately depending on the dose of a particular drug administered intravenously) [4]. Training and assessment using these simulators can focus on individual skills or the effectiveness of teams.

Virtual reality (VR) simulations are even newer innovations in which a computer display simulates the physical world, and user interactions are with the computer within that simulated (virtual) world. Existing technologies now allow for very high-fidelity simulations, ranging from desktop computer-generated environments (much like those in 3-D computer games) to highly immersive VR (e.g., CAVE simulations where the user wears goggles and sensor-containing gloves and sits within a specially designed display). Sound and visual feedback are often highly realistic in these simulations [2].

In all of these examples, the learner is required to react to the simulation as he or she would under real-life circumstances; of course, we realize that the fidelity of a simulation is never completely identical to «the real thing».

Adopting these models in medical education, specialties such as anesthesiology, critical care, and emergency medicine have led the way in using simulation modalities, especially for teaching and testing the skills needed to manage rare or critical incidents. Examples of the effectiveness of such simulation-based training include the mastery of advanced cardiac life support skills by Internal Medicine residents, and a systematic literature review details other features and uses of high-fidelity medical simulations that lead to improved educational outcomes in multiple domains [1].

Simulation for outcomes-based education. Finally, to understand fully all the influences driving the increased use of simulation in medical training today, we must consider them within a broader new context: «While student learning is clearly the goal of education, there is a pressing need to provide evidence that learning actually occurs» [1]. This statement reflects a recent worldwide shift in focus toward outcomes-based education throughout the health care professions. This paradigm change derives in part from attempts by academic institutions and professional organizations to self-regulate and set quality benchmarks, but chiefly it represents a response to public demand for assurance that medical professionals are competent. Accordingly, medical universities, postgraduate training programs, hospital, health system are all placing greater emphasis on using simulation methods for the evaluation of competence across multiple domains [4]. Thus, beyond its scope for teaching and learning, simulation technology offers potential advantages in the realm of clinical assessment.

The new outcomes-based educational paradigm serves as a suitable framework for considering the best applications of simulation technology for testing purposes. The Accreditation Council for Graduate Medical Education (ACGME) describes 6 domains of clinical competence: 1) patient care, 2) medical knowledge, 3) practice-based learning and improvement, 4) interpersonal and communication skills, 5) professionalism, and 6) systems-based practice [2]. Evaluators may use simulations to assess various knowledge, skills, and attitudes within these domains.

We can evaluate medical knowledge: using a full-body simulator during a simulated cardiac arrest, verbalize the correct steps in the algorithm for treatment of pulseless electrical activity. We can assess interpersonal and communication skills and professionalism: during a simulation integrating an SP with a plastic mannequin arm, demonstrate how to draw blood cultures while explaining to the patient the indications for the procedure.

Simulation for competency assessment. Additionally, within any of the domains of competence, we can assess learners at 4 different levels, according to the pyramid model conceptualized by Miller [1]. These levels are: a) knows (knowledge) – recall of basic facts, principles, and theories; b) knows how (applied knowledge) – ability to solve problems, make decisions, and describe procedures; c) shows how (performance) – demonstration of skills in a controlled setting; and d) does (action) – behavior in real practice.

Various assessment methods are well suited to evaluation at these different levels of competence; for example, written instruments, such as exams consisting of multiple-choice questions, are efficient tools for assessing what a student «knows». Conversely, it makes little sense to test the ability to perform a procedure by writing about it. Rather, for evaluation of those outcomes that require trainees to demonstrate or "show how" they are competent to perform various skills, and it is proved that simulations are the most appropriate instruments.

Spanning the continuum of educational levels and bridging multiple health care professions, medical simulations are increasingly finding a place among our tools for teaching and assessment. Technological advances have created a diverse range of simulators that can facilitate learning and evaluation in numerous areas of medical education. Simulation technology holds great promise to improve physician training and, thereby, to impact patient safety and health care outcomes in a positive and significant way.

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СИМУЛЯЦИОННЫЕ ТЕХНОЛОГИИ В МЕДИЦИНСКОМ ОБРАЗОВАНИИ

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В статье обсуждается целесообразность применения симуляционных технологий с использованием иновационных методов научно-ориентированного обучения RBL. Авторы акцентируют внимание на том, что применение симуляционных технологий позволяет студентам осуществлять взаимосвязь между биомедицинскими и клиническими дисциплинами, усиливают познавательную активность, способствуют усвоению знаний и их высокой интеграции.

Ключевые слова: инновационные методы, медицинские симуляции, оценка компетентности, интегрированное обучение

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МӘСЕЛЕЛІК-БАҒЫТТАЛҒАН ОҚЫТУ: МАҢЫЗДЫЛЫҒЫ, КЕМШІЛІКТЕРІ, АРТЫҚШЫЛЫҚТАРЫ
Қарағанды мемлекеттік медицина университетінің патологиялық физиология кафедрасы

Мақалада дәстүрлі және мәселелік-бағытталған оқытудың маңызы, кемшіліктері мен артықшылықтары туралы талқыланады. Оқыту үрдісінің дәстүрлі үлгісі білікті маманға кәсіби салада туындаған жаңа тапсырмаларды толық көлемде сапалы шешуге мүмкіндік бермейді. Нақты мәселелік жағдай білім алушының танымдық қажеттілігін туындатуға көмектеседі, шығармашылық және коммуниакативтік қабілеттілігін дамыту үшін ішкі жағдай жасауға мүмкіндік береді, студенттерді өздігімен танымдық қызметке баулуға мүмкіндік жасауға ықпал етеді.

Кілт сөздер: мәселелік-бағытталған оқыту, мәселелік жағдай