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ADVANCED AND PROGRESSIVE FORMS OF THE SIMULATION TRAINING IN THE MEDICAL EDUCATION

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Abstract

In this paper, we have described the realities and prospects of the simulation training in the medical education through the discussion about main variants and forms of this advanced variant of healthcare studying progression. In medical education, advances like simulations, virtual patients, and e-learning have evolved as pedagogical strategies to facilitate an active, learner-centered teaching approach. Use of e-learning modules, patient surrogates such as virtual patients and virtual-reality simulators is needed especially in the time of this SARS-CoV-2 pandemic. Simulators have shown to be as effective as live actor-patients for teaching purposes We concluded, increasingly integral to the practice of medicine, technology endeavors to streamline a clinician's work and medical education,

and to offer credible, easily accessible information. To enhance trainee growth and empower innovative scientific leaders, educators should play a crucial role in how technology transforms medical education.

Keywords: Simulation-based medical education, e-learning modules, virtual reality, augmented reality, mixed reality.

Introduction. Healthcare and medical training have no immunity to universal, rapidly changing technology. In medical education, advances like simulations, virtual patients, and e-learning have evolved as pedagogical strategies to facilitate an active, learner-centered teaching approach [1, 5]. The medical educators need to rapidly evolve the methods of teaching to minimize the onslaught of disrupted medical education, while also building innovative systems to accommodate the medical student cohorts stuck in the time of this SARS-CoV-2 pandemic.

The current situation demands use and furthering of these pedagogical innovations. Use of e-learning modules (flash multimedia and digitized images), patient surrogates such as virtual patients (to teach clinical examination, procedural, diagnostic skills and communication skills) and virtual-reality simulators (to teach palpation, surgical and resuscitation skills) is needed. Simulators have shown to be as effective as live actor-patients for teaching purposes [7].

The main part. Patient simulation is a useful tool for training students and ascertaining competency prior to students entering clinical environments. Simulations using patient manikins allow students to acquire necessary skills and practice without fear of harming patients. In order for knowledge gained during patient simulations to translate into clinical practice, scenarios must feel realistic to students [9, 12]. Augmented reality, which combines virtual reality with physical materials, instruments, and feedback, is increasingly being used as a teaching and learning tool to make simulations even more realistic for students [14].

Simulation to enhance patient safety has 4 general purposes: education (for example, in transitioning trainees from content knowledge to experiential practice, and in continuing education); assessment (for example, in quality control or quality improvement, or usability testing); research (for example, regarding clinician behaviors) and health system integration (for example, team processes) [15, 16].

Augmented reality (AR), mixed reality (MR), and virtual reality (VR)–based technologies open novel ways of teaching and training for medical education, as they allow for immersive experiences that may foster the teaching and learning of complex medical contents [3].

Virtual reality (VR) modalities may create a digital environment, designed to resemble aspects of the real world. As a result, trainees using VR simulation learn tasks in a setting closely mimicking relevant realistic situations. Relevant scenarios can thus be practiced in surroundings where exploration and troubleshooting are safe. Applications using VR have shown to be able to improve learning outcome for different training procedures for various medical specialists [4].

Augmented reality (AR) differs from VR because the focus of the interaction of the performed task lies within in the real world (AR) instead of the digital environment (VR). AR thus offers the opportunity of a digital, often interactive overlay onto a real or virtual environment. Augmented reality applications (ARAs) are digital applications offering such an extra layer. To the user, layers of the virtual and physical environment are blended in such a way that an immersive, interactive environment is experienced. Due to the advantages that AR technology offers; several programs have been successfully implemented in the field of medicine. Broadly, these can be categorized into two subgroups. The first involves treatment programs which help patients and/or practitioners within a hospital or clinical setting, such as therapies, rehabilitation, or surgical procedures. The second includes training programs which are instead designed to aid teaching and learning outcomes within the academic university setting [6, 8].

Modern teaching curricula aim to educate trainees efficiently and in a safe environment. Educational methods currently being used in medical specialist training include practice-based learning, problem-based learning, team-based learning, eLearning and (VR) simulation training. Although VR learning environments offer opportunities for full- and partial-task training, they are often a mere representation of a task in reality. This may result in medical specialists that may be well trained for a particular task on the job in a set context, but who lack competencies needed to adapt to ever-changing situations in the real working environment. To acquire stable, crossover competencies, it is necessary to create a training environment offering flexibility and adaptation in training true-to-life working processes in changing environments as is much needed in medical settings. As medical specialist training involves complex learning, ARAs are of great potential. AR allows the transfer of digital information into the real world, therefore blending two worlds together [6, 11].

Educational technology, and more specifically AR, is promising for facilitating meaningful learning and transfer; furthermore, it may offer organizational advantages because:

– the physical training environment may be very similar to, if not the same, as the professional work environment;

– the augmented (virtual) part may visualize the invisible and simulate relevant 3D, tactile and other aspects of the real-world task;

– the AR learning environment may provide the necessary variations in the training task including collaboration which supports authentic learning;

– the real time interactive nature of AR provides immediate learner feedback which supports taking control over the learning process;

– AR learning environments do not always require an expert or instructor to observe trainee performance;

– AR learning environments can provide situated just-in-time and just-in-place learning [3, 13].

Medical training involves extensive learning about social interactions and human behaviour, as future practitioners are expected to perform their duties across a vast spectrum of health care settings. AR provides a unique opportunity to prepare the trainees for

complex social situations in a controlled and managed environment. Moreover, AR supports development of inter-professional competencies that are critical for healthcare professionals. Although commonly AR medical training has been viewed as mainly a way to increase knowledge and practical skills, it also provides valuable scenarios to support work-related social skills.

Mixed reality (MR) technology is a new digital holographic image technology, which appears in the field of graphics after virtual reality (VR) and augmented reality (AR) technology, a new interdisciplinary frontier. As a new generation of technology, MR has attracted great attention of clinicians in recent years. The emergence of MR will bring about revolutionary changes in medical education training, medical research, medical communication, and clinical treatment. At present, MR technology has become the popular frontline information technology for medical applications. With the popularization of digital technology in the medical field, the development prospects of MR are inestimable [9].

Despite the undoubted advantage of IT and simulation-based education, in the current situation, there are distinct disadvantages. The foremost is the fact that all these tools can be supplemental to clinical teaching but not a replacement. Secondly, setting up of a virtual learning environment or a simulation laboratory is costly and time taking, making it especially unsuited for the low and middle income countries. Thirdly, while virtual simulators will maintain the tenet of both non-contact with patient and social distancing amongst students, mannequin simulators will flout social distancing needs amongst students precluding their use currently [8, 13].

Conclusions. Thus, increasingly integral to the practice of medicine, technology endeavors to streamline a clinician's work and medical education, and to offer credible, easily accessible information. To enhance trainee growth and empower innovative scientific leaders, educators should play a crucial role in how technology transforms medical education. Trainees prefer technology-associated modalities that offer learning material that is interactive, reputable, simple, pragmatic, and coupled with relevant feedback. Innovations like virtual reality and simulations effectively increase knowledge, performance skills, and team communication through realistic clinical cases. Optimal utilization and continued usage of digital learning tools has the potential to reform the medical education sector. Technologies like augmented reality (AR), mixed reality (MR), and virtual reality (VR) make learning content more accessible and engaging, whereas for educators, it broadens their educational impact beyond the classroom and face-to-face teaching.

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