Modern pedagogical technologies in teaching medical science

Yarmuhamedova Mahbuba Qudratovna[1], Ergasheva Munisa Yakubovna[2], Axmedova Saodat Toshboltaevna[3], Juraeva Gulbaxor Alisherovna[4]

[1]*Candidate of medical sciences, Docent, Samarkand state Medical Institution*
[2]*PhD, Senior teacher, Termez branch of Tashkent Medical Academy*
[3,4]*Assistant, Termez branch of Tashkent Medical Academy*
e-mail:munisa_ergasheva_81@mail.ru

Abstract: Medical education is rapidly changing, influenced by many factors including the changing health care environment, the changing role of the physician, altered societal expectations, rapidly changing medical science, and the diversity of pedagogical techniques. Changes in societal expectations put patient safety in the forefront, and raises the ethical issues of learning interactions and procedures on live patients, with the long-standing teaching method of "see one, do one, teach one" no longer acceptable. The educational goals of using technology in medical education include facilitating basic knowledge acquisition, improving decision making, enhancement of perceptual variation, improving skill coordination, practicing for rare or critical events, learning team training, and improving psychomotor skills. Different technologies can address these goals.

Keywords: technology, changes, training, improve, decision

1. INTRODUCTION

Technologies such as podcasts and videos with flipped classrooms, mobile devices with apps, video games, simulations (part-time trainers, integrated simulators, virtual reality), and wearable devices (google glass) are some of the techniques available to address the changing educational environment. This article presents how the use of technologies can provide the infrastructure and basis for addressing many of the challenges in providing medical education for the future.

The use of technology in medical education has been developing over many years. The trend in the use of technology has primarily developed in response to the challenges facing medical education. These challenges to medical education are numerous (Table 1). The changing healthcare environment, with the movement of medical care from the traditional hospital setting to ambulatory medicine, has necessitated the ability to provide care in a much shorter period of time and requires changes in documentation with all information, including both health knowledge and medical records, becoming digital. Emphasis on cost-containment and evidence-based use of resources is a national imperative. There are changes in societal expectations so that patient safety is a focus at all levels of medical education. This has also raised the ethical issues of learning interactions and procedures on live patients, with the

long-standing teaching method of "see one, do one, teach one" no longer being acceptable. There is also the change in curricular emphasis, both in undergraduate and post-graduate training, from simple knowledge acquisition to the need to demonstrate competencies in the learner (1). The explosion of medical knowledge no longer allows physicians to keep in their mind all knowledge that is necessary to provide quality patient care. It is estimated that more than 600,000 articles are published in biomedical literature every year. If a student attempted to keep up with the literature by reading 2 articles per day, in 1 year this conscientious individual would be more than 800 years behind (2). Although the profession has long held that physicians need to be life-long learners, this concept is now an imperative. There is also a new generation of learners; "digital natives," a phrase termed by Prensky (3). These are young people born into the digital world who speak the language of technology fluently. They expect their education to reflect their expertise in different levels of technology integration and are accustomed to technology-enhanced learning environments. Finally, medicine is experiencing a rapidly changing use of technology in the delivery of care.

The educational goals of using technology in medical education include facilitating basic knowledge acquisition, improving decision making, enhancement of perceptual variation, improving skill coordination, practicing for rare or critical events, learning team training, and improving psychomotor skills. Different technologies can address these goals. The task of medical educators is to use these new technologies effectively to transform learning into a more collaborative, personalized, and empowering experience. Bonk captures the essence of this new age of technology tools for education by stating "Anyone can learn anything from anyone at any time".

There are many technologies currently being used in medical education. Although the following attempts to present these as individual approaches, the applications overlap in terms of technological components and instructional possibilities.

2. COMPUTER-ASSISTED LEARNING

Education of undergraduate medical students can be enhanced through the use of computer-assisted learning. One example is the use of "flipped classrooms" in which students review an online lecture before the lecture session, and come to the classroom to have an interactive session with the teacher. This time can now be spent on further exploring complex issues or discussing and solving questions in a more personalized guidance and interaction with students, instead of lecturing. Research in this area has not been extensive. Although randomized trials in education suffer due to difficulty with standardization, contamination between two arms, inability to blind the participants, and difficulty measuring outcomes, a few randomized trials have been conducted asking outcome questions about flipped classrooms with some success (5, 6). These studies showed a positive effect in the areas of student involvement, satisfaction, and knowledge acquisition. Bridge et al conducted a 5-year retrospective study of streaming video use at Wayne State University School of Medicine and found the student response to be overwhelmingly positive, with just a small percentage of students reporting that they rarely or never used streaming video of lectures

Mobile Devices

Personal digital assistants (PDAs) are routinely used by students for medical questions, patient management, and treatment decisions. Medical apps for iPhones and Android devices are numerous. Although many focus on anatomy and physiology, some address medical problem solving, diagnosis, and treatment. The website iMedicalApps.com (7) provides recommendations for the best apps for students and residents and links to online app stores for purchases. Stanford University, as one example, has a "Student App" webpage and Stanford apps that can be obtained from the Apple store. Many medical apps are also available to be used on tablets as well as phones.

Digital Games

The application of digital games for training medical professionals is on the rise. The so-called "serious" games provide training tools that provide challenging stimulating environments, and are often used for training for future surgeons. Use of serious games for surgical training improves eye-hand coordination and reflex times. At Florida State University College of Medicine, students in geriatric clerkships play ElderQuest, a role playing game in which players work to locate the Gray Sage, a powerful wizard in poor health that each player must nurse back to health. One published assessment of this tool was used to teach geriatric house calls to medical students. The investigators found that this method provided medical students with a fun and structured experience that had an effect not only on their learning, but also on their understanding of the particular needs of the elderly population.

Simulation

The aim of simulation is to imitate real patients, anatomic regions, or clinical tasks, and/or mirror the real-life circumstances in which medical services are rendered. Simulations can fulfill a number of educational goals. A qualitative, systematic review by Issenberg et al, spanning 34 years and 670 peer-reviewed journal articles, found that the weight of the best available evidence suggests that high-fidelity medical simulations facilitate learning under the right conditions. The learning characteristics identified included providing feedback, repetitive practice, curriculum integrations, range of difficulty levels, multiple learning strategies, capture of clinical variation, individual learning, and the ability to define outcomes or benchmarks. Issenberg et al concluded that although research in this field needs improvement in terms of rigor and quality, high-fidelity medical simulations are educationally effective and simulation-based education complements medical education in patient care settings. Bradley has published a review on the history of simulation and Lane et al, a comprehensive review of simulation in medical education. The use of simulation spans a spectrum of sophistication, from the simple reproduction of isolated body parts through to complex human interactions portrayed by simulated patients or high-fidelity human patient simulators replicating whole body appearance and variable physiological parameters. One of the earliest simulators, a mannequin named Rescusi Anne, was developed 35 years ago when mouth-to-mouth resuscitation protocols were introduced. About the same time, Harvey, a

simulator to teach cardiac examination skills, was developed and is still used worldwide in medical schools and hospitals.

Part-task trainers consist of 3-D representations of body parts/regions with functional anatomy for teaching and evaluating procedural or psychomotor skills, such as plastic arms for venipuncture or suturing. Palp-Sim is an example of a program that uses a haptic system which provides simulation for placing a cannula in the femoral artery. Haptic systems refer to those simulators that replicate the kinesthetic and tactile perception and produce a feeling of resistance when using instruments within a simulated environment.

Integrated simulators combine a mannequin (usually a whole body) with sophisticated computer controls that can be manipulated to provide various physiological parameter outputs that can be physical (such as a pulse rate or respiratory movements) or electrical (presented as monitor readouts). These simulators are often used as the core platforms of simulation centers. Simulation centers attempt to replicate fully functioning operating rooms, intensive care units, emergency departments, or patient rooms. A well-structured case in the simulation center can teach and assess many, if not all, of the patient and process-centered skills, as well as team involvement and management.

Virtual Reality (VR) simulation refers to the recreation of environments or objects as a complex, computer-generated image. In VR simulations, the computer display simulates the physical world and user interactions are with the computer within that simulated (virtual) world. There are a number of VR programs used in medical education. One example, MIST VR (Minimally Invasive Surgery Trainer–Virtual Reality), has been specifically designed to provide trainees with a realistic and assessable environment for developing skills, particularly in the area of laparoscopy.

The LINDSAY Virtual Human Project, a computer-generated 3-D anatomy and physiology model, permits the user to visualize anatomy and other human components in a 3-D simulation using 2-D computer interfaces, including mobile devices, and provides an immersive approach to anatomy and physiology. Use of anatomy simulation models have not been well studied although computer-generated 3-D models to teach anatomy have proliferated. One randomized study by Nicholson did show that the 3-D computer-based anatomical model enhanced students' learning of anatomy of the ear.

Second Life is an online virtual world, developed by Linden Lab (a company based in San Francisco, CA) and launched on June 23, 2003, as of 2014 has approximately 1 million regular users. Within any Second Life simulated environment, users exist through avatars which interact realistically with other avatars online. Islands or areas of learning can be established where avatars can visit, interact with other avatars, and also interact with information provided by institutions such as the CDC, NLM, PubMed, and medical schools to mention a few. Second Life currently features a number of medical and health education projects and educators are in the process of evaluating the value of Second Life in different aspects of medical education.

Wearable Technologies

Google Glass is being tested as a new layer of technology that makes education more realistic and potentially more effective. At the University of California, San Francisco (UCSF) School of Medicine, a cardiothoracic surgeon, Pierre Theodore, MD, has used Glass in more than 20 surgeries. He uses Google Glass to project radiologic images (CTs, MRIs, etc) into the field of vision as he operates to assist in cases where he can use additional clinical data to help guide activity.

The role of Google Glass and other devices will become commonplace across the healthcare continuum and provide an essential clinical tool, from use by the paramedic on location to advanced care and consultations. The University of California, Irvine School of Medicine may be the first to integrate Google Glass into the curriculum. Educators believe that students will benefit from Glass's unique ability to display information in a smartphone-like, hands-free format, being able to communicate with the internet via voice commands and being able to securely broadcast and record patient care and student training activities using proprietary software compliant with the 1996 federal Health Insurance Portability & Accountability Act.

3. DISCUSSION

Medical education is rapidly changing, influenced by many factors including the changing healthcare environment, the changing role of the physician, altered societal expectations, rapidly changing medical science, and the diversity of pedagogical techniques. Societal influences and the changing healthcare environment are influenced by the internet, globalization, cost containment, aging of society, increasing public accountability, a medically informed public, demands of personalized care, population diversity, expansion of healthcare delivery by non-physicians, and changing boundaries between health and healthcare. Physicians now work in teams, are salaried, part of a complex organization, and must be highly accountable. Challenges of preparing the future doctor involve emphasis and standardization of competencies and learning outcomes, integration of formal knowledge and clinical experience, patient-centered care, population health, cost-conscious−high value care, and understanding the organization of health services.

Use of technologies for undergraduate, postgraduate, and continuing medical education has become increasingly prevalent. There are a number of educational advantages that are listed in. These modalities facilitate knowledge acquisition, improve decision making, enhance perceptual variation, improve skill coordination, and provide an educational environment that engages the learner and allows learning that does not endanger the patient. Use of computer technologies has the additional benefit of being able to assess competencies and milestones, and provide the student, at any level, with the tools to continue to access the medical knowledge necessary to deliver quality care and be a life-long learner.

4. REFERENCES

[1] Sherwin J. Competency-based medical education takes shape. Association of American Medical Colleges. 2011. Apr, [Accessed October 12, 2014]. Available at: https://www.aamc.org/newsroom/reporter/april11/184286/competency-based_medical_education.html.

[2] Barnett OG. Information technology and medical education. J Am Med Informatics Assoc. 1995;2:285–291. [PMC free article] [PubMed] [Google Scholar]

[3] Prensky M. Digital Natives, Digital Immigrants. On the Horizon (MCB University Press) 2001;9(5):1–6. [Google Scholar]

[4] Bonk CJ. The World is Open: How Web Technology is Revolutionizing Education. San Francisco, CA: Jossey-Bass; 2009. [Google Scholar]

[5] Greenhalgh T. Computer assisted learning in undergraduate medical education. BMJ. 2001;322(7277):40–44. [PMC free article] [PubMed] [Google Scholar]

[6] Bridge PD, Jackson M, Robinson L. The effectiveness of streaming video on medical student learning: a case study. Med Educ Online. 2009;14:11. Available at: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2779626/ [PMC free article] [PubMed] [Google Scholar]

[7] Husain I, editor. Medical Application. 2014. Website. Available at: http://www.imedicalapps.com/

[8] Graafland M, Schraagen JM, Schijven MP. Systematic review of serious games for medical education and surgical skills training. Br J Surg. 2012;99(10):1322–30. [PubMed] [Google Scholar]

[9] Rosser JC, Lynch PJ, Cuddihy L, et al. The impact of video games on training surgeons in the 21st Century. Arch Surg. 2007;142:181–6. [PubMed] [Google Scholar]

[10] Rosenberg BH, Landsittel D, Averch TD. Can video games be used to predict or improve laparoscopic skills? J Endourol. 2005;19(3):372–6. [PubMed] [Google Scholar]

[11] Community and Continuing Education, Utah Valley University. Elderquest. 2013. [Accessed October 13, 2014]. Web site. Available at: http://www.uvu.edu/ce/elderquest/

[12] Duque G, Fung S, Mallet L, Posel N, Fleiszer D. Learning while having fun: the use of video gaming to teach geriatric house calls to medical students. J Am Geriatr Soc. 2008;56(7):1328–32. Epub: http://www.ncbi.nlm.nih.gov/pubmed/18482292. [PubMed] [Google Scholar]

[13] Issenberg SB, McGaghie WC, Petrusa ER, Lee Gordon D, Scalese RJ. Features and uses of high-fidelity medical simulations that lead to effective learning: a BEME systematic review. Med Teach. 2005;27(1):10–28. [PubMed] [Google Scholar