Beyond High-Fidelity Simulation: Emerging Technologies in Leadership Development

abstract
Technology offers educators active learning and new teaching strategies. Five lower cost and scalable technology applications are presented as alternative or complement to high-fidelity simulation. Professional nurse educators should adopt technology when teaching and interact with vendors to generate real-world applications that advance development.


Professional nurse educators live in a technology-rich teaching and clinical environment. Technology usage and competencies are now an expected part of a professional nurse educator's toolbox to advance active learning within their learners. The nature of active learning helps students to take in and process information by focusing their attention, enhancing information processing, assimilating content with a bridge to application of new concepts, and advancing critical thinking linked to decision making and action taking (Scheckel, 2016). These same techniques augment long-term knowledge retention.

A team of faculty at the University of Nebraska Medical Center (UNMC)—Kearney Division embraced technology-enhanced learning strategies because of their potential to secure higher level learning outcomes, creatively augment and enrich the classroom lectures for the benefit of learners, and enrich the diversity, inclusiveness, and interest of learners through new forms of engagement. These educators acknowledged the background variability of learners, many of whom come to higher education and the health care workforce with varying degrees of technology-enriched experiences that drives their way of being; it is how they communicate, are entertained, create communities of interest, and learn.

In recent decades, high-fidelity simulation has been introduced into most nursing programs globally and in many clinical settings to the point where simulation is now normalized as essential for testing critical thinking in life-like situations where decisions are linked to clinical actions. The benefits of high-fidelity simulation are generally accepted as:

- Providing a standard set of clinical experiences, equalizing experience that may or may not be plausible to achieve during clinical rotations.
- Linking cognitive mastery with actual clinical mastery aimed at communication, technical performance, organizational skills, and more.
- Enhancing the rapid uptake of information application through recorded interactions and debriefing sessions that accelerate self-reflection.
- Moving past individual performance into team performance with patients and families.

Despite the advantages of high-fidelity simulation, new technologies have emerged and are emerging that will further enhance learning opportunities. These new technologies are often less expensive, are available in classrooms and clinical settings, are more easily scalable, and show potential for increasing knowledge acquisition and long-term recall—essential for success with NCLEX and employment. The purpose of this article is to prepare professional nurse educators for the imminent new vistas in teaching and learning technologies, to encourage educator experimentation and involvement with technology and vendors to ensure nursing's place at the development table, and to generate creativity in active learning.

To appreciate the technology exemplars that follow, it is helpful to clarify the terms virtual, augment, and three-dimensional reality. “Virtual Reality (VR) is the use of computer technology to create a simulated environment… VR places the user inside the experience…users are immersed and able to interact with three-dimensional worlds” according to Jackson (2015, What is Virtual Reality section, para. 1). Jackson stated that in VR, as many senses as possible
are used, with the computer being the gatekeeper to this artificial world. Augmented reality (AR) “simulates artificial objects in the real environment, whereas VR create an artificial environment to inhabit” (Jackson, 2015, What's the Difference Between Virtual Reality and Augmented Reality section, para. 1). With computer assistance, sensors and algorithms are used to determine the position and orientation of the camera, placing three-dimensional computer-generated images over a user's view of the world. With computers, three-dimensional reality is achieved in both VR and AR scenarios. To summarize, the learner has the experience in the VR of being in that world experiencing the width, height, and depth of the environment (the three dimensions), whereas the AR world imposes an object into the existing setting—such as a classroom—and the object appears with width, height, and depth. Both VR and AR provide learners with opportunities to interact in an immersive environment, exploring in a believable manner that which fosters in the learner a concrete sense of reality.

TECHNOLOGY EXEMPLARS AND THEIR POSSIBILITIES IN NURSE EDUCATION

Anatomage

The authors were first exposed to the anatomage table through interprofessional sharing with physician assistant and radiography faculty on our campus. Nursing co-collaborates with the health professions faculty in a new building in rural Nebraska, approximately 3 hours from the main campus. Nursing faculty and students were riveted with the extent to which the human body could be dissected in augmented reality. Approximately the size of an adult human, the table comes with preloaded human specimens and select other animals to demonstrate comparative anatomy structures. With a swiping motion of a finger, learners can dissect through the various anatomical layers of models that include both genders and across-the-lifespan specimens. Like an iPhone®, organs can be sized to reveal more levels of detail with simple finger motions to expand or contract the screen; learners surround the table for ease of viewing.

We found an outstanding use of the table was that learners could experience the human body in three-dimensional, viewing the human body as if it were a cadaver. Learning is enhanced by visualizing the juxtaposition of solid organs with the nervous system, and the like. Real radiographic examinations can be loaded, and the pathology associated with actual patients can be reviewed, bridging didactic reinforcement with anatomage visualization in a postconference or other classroom settings. A cost estimate for the table approximates at $100,000 per table, which is moveable and can be used without the expense or unlikely availability of cadaver laboratories within a nursing school or clinical facility. Further, the images seen on the table can be projected to computer screens throughout a classroom or in off-site settings for distance education (Custer & Michael, 2015).

Smartphones

Smartphones are in common use, but the next generation of applications offers unprecedented applications for easy access to quick and reliable information. The ready availability of smartphones allows for its utilization in settings from the classroom, home, or in clinical environments (Dimond, Bullock, Lovatt, & Stacey, 2016).

The smartphone is listed as an emerging AR technology because three-dimensional applications are under development. An existing application, Essential Anatomy 5, is a miniature version of the anatomage table. With Essential Anatomy 5, students observe the layering of flesh, muscles, nerves, blood vessels, tendons, ligaments, and bones in the human body. Like the anatomage, the human body can be dissected with finger strokes a layer at a time, giving the learner context for the depth, breadth, and relative height of each anatomical feature, something that in the past could only be achieved through dissection. Pictures can be viewed horizontally or vertically, enabling visualization of each body part from preferred vantage points. This award-winning application has more than 8,200 high accurate structures for viewing (Stern, 2016) and can be purchased for around $25. Further, the application has a series of quizzes and learner feedback mechanisms for learner knowledge assessment; more applications are expected soon. This generation of the Apple iPhone includes a camera with the capacity for three-dimensional facial mapping; creating three-dimensional images.

HoloLens

By donning a pair of glasses learners can immerse in a three-dimensional world, viewing and interacting with the environment from the first-person perspective. The HoloLens is Microsoft's entry into the AR space, so readers will want to observe for other similar devices offered by competitors. The HoloLens is a device worn as glasses that generates a hologram in a physical space in which the learner maintains physical connection to the space. The HoloLens is controlled by hand gestures in the air, using swiping or pinching movements similar to those made on an iPad® or smartphone, or with voice commands.

Imagine a three-dimensional image of an individual with a mobility impairment and having the learner walk around that image, assessing
the client from the front, back, and sides. At the end of the assessment, the learner reports on potential interventions to ensure safety and energy conservation, derived from an ability to see the client completely. The image is animated, and comprehensive interaction is possible.

Current costs are shifting, but the developmental edition in spring 2016 approximated $3,000 with the intent that sharable applications would accelerate usage; a commercial edition is now available. There are limited numbers of free or nominal cost applications available, but we believe that health-related content will expand rapidly over the next several years as health care provides an enormous market for this technology. On the UNMC campus at Kearney, allied health faculty purchased the HoloLens to augment their experience with the anatomage table. Similar to other technologies, content and ideas are being mutually shared between the schools of nursing and allied health, potentiat­ ing interprofessional education and faculty sharing. Our view is that the HoloLens is easy to use, content can be visualized within being tethered to other devices or requiring special facilities to operate if space is available for learner movement around the client or object. Learners can easily transfer the skills they use on smartphone devices to manipulate screens. Limitations include cost per unit, device-to-student ration, and limited content currently.

**MultiTaction iWall**

The MultiTaction curved iWall is used on our UNMC medical center campus for pilot testing and future distribution. The essence of the iWall and its corresponding software suite is to replace whiteboards with liquid-crystal display (LCD) multitouch displays potenti­ ating hands-on activities by an unlimited number of learners. The LCD panels are stackable to any size and shape, most commonly to create a 9-foot wall where learners can experience screen resolution that is unparalleled with current classroom visualization aids. The design of the iWall is intended to advance collabor­ ative problem-solving opportunities with enhanced learner engagement and promote data visualization and networking between sites that share the iWall with no signal delay, regardless of where in the world teams are engaging with each other. The iWall removes the single-screen static pre­ sentation of data into a multiscreen, dynamical display of data, notes, graphics, and more so that learners can experience multidimensional uptake of information and its processing (http://www.bing.com/videos/search?q=iWall+multitaction&view=detail&mid=AC3A9303D8A545F6B747AC3A9303D8A545F6B747&FORM= VIRE).

**LESSONS LEARNED AND NEXT STEPS**

What does all of this mean for the professional nurse educator? We learned that educator awareness of emerging devices is extraordinarily limited and awareness of technology use in classroom and clinical settings sparse. This is at a time when developers are eager to create applications for health care and nursing has much to gain in terms of what it can mean to animate learning. Developers see the medical field as major users but will need real-world applications to capture a return on the investments they have made in the development process. This article achieves educator awareness of several exemplars.

Educator immersion into technology usage should not be a fear-filled experience, although we realize there are individuals averse to changing teaching–learning methods. Most technology applications are intuitive, and knowledge acquisition can be phased in. The use of smartphones is so common that educators will be surprised that most new technology applications build on simple motions and screen management, so transfer of knowledge from one device to another is ensured. Animating the classroom, accelerating learning, and appealing to individual students who learn differently are already attributes that most faculty embrace. VR and AR are the next generation of learning enhancements that will promote long-term knowledge retention. When the faculty becomes the student in learning about VR and AR technologies, there is support available through the technology companies, online resources, and individuals who enjoy being early adopters and intuitive users.

Many of the examples used in this article were of anatomical subject matter because of broad-based use and high-impact factors. We know that an increased number of context-bound applications that can test communications, functional status assessment, decision making in high stakes settings, leadership responses to scenarios, and more are just around the corner as a complement to high-fidelity simulation centers; AR will broaden competency validation. VR opportunities to provide home care, practice field-based emergency skills, or experience homelessness are all plausible.

The use of AP and VR means that that new ways of testing student and professional nurse competencies, creating standardized learning that is less dependent on often limited clinical rotations or have rare occurrences. In our setting, we may be able to substitute for experiences in a tertiary care center, whereas urban settings may benefit from learning the complexities of rural health care. Global nursing courses could be enriched by experiencing a culture without the expense of travel.
Having a visiting guest lecturer brought virtually into the classroom three-dimensional creates exciting possibilities for teacher–learner interactions without the constraints of travel. Hologram technology could open new vistas for students who may learn from a national or international expert who possesses wide-ranging knowledge, skills, and abilities in real time (Walker, 2013).

Teaching today’s learners requires new tools. Like it or not, professional nurse educators are competing with technology in common use, increasing the pressure to animate classrooms and keep learners engaged. Each of the exemplars presented achieve that aim. We hope this article stimulates curiosity and interest that extends beyond any fear of change that rests within educators. Helping learners achieve rapid uptake and long-term knowledge retention in multidisciplinary classrooms is a noble pursuit worth the effort.

REFERENCES