

Immersive Virtual Reality Environments for Perioperative Nursing

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Synopsis

Perioperative nurses require ongoing education throughout their career to stay current in their practice. While there are many formats available for nurses to gain continuing education knowledge, virtual reality may enhance current learning options. Virtual reality environments are flexible spaces where users are able to interact with each other and the space around them. Virtual reality education options include both synchronous and asynchronous learning.

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An overview of the Association for Operating Room Nurses (AORN) website (1) reveals a robust online learning system where Registered Nurses (RNs) could access learning modules, continuing education (CE) articles and exams, and both live and pre-recorded webinars. While these offerings are numerous, immersive virtual reality (VR) environments may further expand opportunities for perioperative nursing education in an engaging and customizable format. Immersive virtual reality environments utilize three dimensional (3-D) online computer programs where users interact with each other and the environment via touch, text, and voice through computerized representations of themselves called avatars (2). Avatar appearance can be customized based on user preferences. Using a computer mouse, users can walk their avatar through the environment, touch objects, and interact with others. VR offers the potential for asynchronous learning where individuals can visit sites on their own similar to visiting a website in order to gain information. VR also offers the potential for synchronous learning. This is where individuals can meet online at a specific time and virtual space for the purposes of networking, group discussions, presentations, or simulation. This paper describes the use of VR environments for perioperative nursing education, and potential barriers to its use.

Adult Learning Theory

While VR is a relatively new educational tool, adult learning needs can be met based on adult learning theory principles. Knowles (3) characterizes adult learners as different from children as learners in that adults are capable of being self-directive, they have experiences to build on, and they have internal motivations for learning. In order for adult learners to best accept and learn new information, they must be able to see that new information is relevant to their needs. In addition, adult learners want to be able to see how they can immediately apply the new information (3,4). Immersive VR is a good fit with the learning needs of adults, because the

information can provide adults with the opportunity to learn relevant and applicable information in a variety of both synchronous and asynchronous formats.

Virtual Reality for Interactive Learning

Learning opportunities for perioperative nurses using immersive virtual reality environments include group discussions, multimedia lectures, simulations, and tours through educational spaces. There are several different virtual reality options available for educational use. Dalgarno, et al (5) surveyed the trend of 3-D virtual world use in higher education and found 201 subjects offered in which 9% of respondents were healthcare educators. Further 78% of these subjects were offered in *Second Life*. With over 15 million registered members, *Second Life* is currently the most popular virtual reality platform (6). However, there are other platform options available such as *Open Sim* and *Active Worlds*. Regardless of the platform, current trends indicate that virtual reality is used in education for communication spaces, digital recreation of the physical environment, and for simulation experiences (7).

Spaces and Communications

Virtual reality spaces offer the potential for asynchronous learning by self-directed or synchronous learning by faculty-directed tours of various sites. In a survey of health-related activities on *Second Life*, 34 of the 68 sites had a focus on education and awareness (8). These sites included information presented on posters, bulletin boards, multimedia productions, slideshows, games, and links to webpages. Topics varied and included sexual health, genetics, and environmental health hazards. Another example of a self-directed tour to learn a health concept is *Virtual Hallucinations*, where the experiences of people with schizophrenia have been recreated in virtual reality (2). Participants explore the environment while experiencing visual and auditory hallucinations. Researchers of the simulation surveyed participants who may or may not have been healthcare workers and found the majority of respondents believed the

experience improved their ability to understand auditory and visual hallucinations and 82% would recommend the experience to others (2).

Virtual reality can be utilized as a communication space as a forum to conduct a synchronous meeting or lecture. These could be informal small group discussions, or an instructor may stand as an avatar on a virtual stage behind a podium and conduct a lecture while attendees sit in stadium style seats. I experienced this type of presentation example when I spoke at The University of Texas Arlington, College of Nursing in *Second Life* (9). Speakers presented in a virtual outdoor auditorium and used PowerPoint slides they advanced as needed. Attendees were invited to ask questions by text or voice. After the presentations, attendees could view poster presentations on display at the virtual exhibit hall. The benefit to this type of virtual presentation is that presenters and attendees were not limited by geography and could attend the offering from any location. Attendees were able to interact with the speakers, other attendees, and the virtual space around them experiencing an environment similar to a live conference setting different from a webinar or other online presentation.

Wiecha, et al (10) used this presentation method to study the effectiveness of conducting a 1-hour long continuing medical education (CME) offering for primary care physicians using VR. The findings for this pilot study included an increase in pre- and post-test scores, an increase in confidence as reported by subjects, and all participants agreed that their learning session was effective. Furthermore, the respondents rated their *Second Life* experience as more beneficial than other online CME offerings and that they would recommend them to a colleague.

Virtual Reality Simulation

There are several examples of simulations that have been developed for healthcare training in VR. VR simulations include scenarios where learners interact in a realistic

environment with their peers and an instructor. This section illustrates several examples of emergency cardiopulmonary response simulations, other simulation experiences, and mixed learning methods that include simulation conducted in VR.

In the first example, researchers conducted small group simulations of cardiopulmonary resuscitation (CPR) training. Students had to perform a series of CPR measures that included initiating treatment, relieving rescuers, and reporting to the oncoming paramedic, and then repeat the virtual reality scenarios after six months to evaluate learning decay (11). Kilmon, et al (12) described a research project where the team recreated the equipment, medications, and hospital environment used during a cardiac code. The objects and environment were programmed to respond to the actions of the user based on a touch screen monitor and Global Positioning Systems (GPS) technology. The anticipated plan was that the team develops scenarios and a virtual patient to test their simulations with students and nurses. Bodily (13) has also developed emergency response equipment for CPR scenario training. In this case, the instructor controls the heart rate rhythms and the vital signs displayed on a cardiac monitor that visible to simulation participants. The expected outcome is that participants are able to recognize the observed cardiac rhythm and intervene according to advanced cardiac life support standards.

In addition to cardiopulmonary resuscitation simulations, other VR simulations have been developed. Veltman, et al (14) described a VR simulation based on a postpartum hemorrhage. The students were to assess a patient and provide nursing interventions relevant to a hemorrhage including lowering the head of the bed, obtaining vital signs, and providing fundal massage. Immediately after the simulation, a debriefing session was held with the students and faculty to reflect on the scenario. Phillips & Berge (15) provided an example of how virtual reality was

used in dentistry simulations where the faculty logged on as avatar patients and students were to teach them about oral health.

Finally, there are sites that combine learning trends available in immersive VR by offering several different types of learning formats. One example that incorporates space for lecture format teaching, asynchronous self-directed learning, operating room simulations, and post-anesthesia recovery simulations is located at Imperial College (16). Another example is the Allied Health & Science College, Munck (17), where students have the opportunity to explore the environment and learn about radiopharmacy. In addition, educators are invited to participate in the experience by joining the site and offering their expertise.

Potential Barriers

Potential barriers for perioperative nurses participating in continuing education as include the inability to get time off from work, cost, and home responsibilities (18). These barriers could potentially be overcome using VR as a delivery method. However, VR presents its own limitations. For example, VR offerings can often be labor intensive to create by the educators (14), thus potentially limiting the amount of experiences available. Orientation to the VR environment could be a barrier for nurses seeking educational opportunities. It is important for the learner to be well oriented to the environment so the focus can be on the learning not the technology (19). Other potential barriers include the need for reliable Internet connection, adequate Internet speed, and computers that meet the requirements for specific VR environments.

Conclusion

Perioperative nurses require ongoing training and education to continually develop current evidence based knowledge and skills. VR may be one of the ways nurses are able to

acquire new information. VR offers the potential to increase the learning opportunities developed for and offered to perioperative nurses. Opportunities include small group discussions, large group classes, tours of educational sites, and simulations. Barriers for the learner to access VR education offerings include the computer requirements, Internet access, and orientation to the specific virtual environments. There are examples of virtual reality used in healthcare education, while not all of them are specifically geared to perioperative nurses' learning needs, they could be used as templates to be adapted for use with perioperative nurses in the future.

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