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The Emergence of Virtual Reality Simulation and Its Implications for Nursing Profession

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With the growing number of advancements of technology in health care, a paradigm shift is noted in health care service and health education. Virtual reality (VR) was originally created for leisure activity but has become one of the fastest growing technology with a plethora of opportunities for health care professionals. While VR has been around for decades, it has only been the last decade that VR technologies have become introduced and applied in the field of health service and education.

Nursing profession does embrace the idea of new development, implementation and evaluation of technological advancements to improve nursing practice and nursing education. The use of simulation in nursing education emerged in 1874 [1] and is now recognized as a valuable teaching method [2]. However, VR simulation is a relatively new and research around VR and its application in nursing education and practice is still in infancy.

The aim of this paper is to provide a brief overview of the emergence of VR simulation in nursing and to discuss its implications for nursing profession.

VR simulation has begun in early 1990s where students were given an opportunity to "visit a virtual reconstruction of ancient Greece" [3]. The use of VR simulation for treatment of anxiety disorders was a pioneering attempt in health care [4].

VR is a computer-based, interactive and three-dimensional technology which allows the users experience scenarios or situations as real as possible through sensory perception, physical movement and/or text/speech communication [5]. Depending on the degree of immersion, there are three common types of virtual reality displays [6]. Head-based VR is highly immersive and head-mounted display (HMD) is an example where the user wears goggles that display a stereo image to the user's eyes. Projection-based VR is categorized as a medium immersive display using a lifelike image which is portrayed on walls of a room (CAVE), screens or large computer monitors. The CAVE allows the user walk within a defined space and the project image changes with movement. Monitor-based VR is less immersive than the HMD or CAVE. Video game platform is an example and a virtual environment is displayed in a computer and movement is controlled by a joystick, mouse, or other movement device [6].

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VR simulation can be applied in, but not limited to, 3 key nursing areas where nurses practise, educate and research. In practice, using VR, patient education can be provided in a safe but realistic environment to teach many topics and skills in various care settings. For example, the use of VR with goggles has been found to have a relevant effect on reducing pain among the children with severe burn in a Burn Treatment Centre (BTC) in Southern Brazil [7]. Head-based VR was used and well-accepted not only by the children but also by adult and older population as well. Some exemplars include the use of an adjuvant pain management strategy for older patients [8], an aid to manage symptoms of anxiety and posttraumatic stress disorder [9,10], and demonstration of "teach back" regarding mobility precautions for fall prevention [11].

It is notable that VR simulation is increasingly applied and evaluated in nursing education and research. Padilha et al. [12] assessed the ease, usefulness, and intention of pregradute nursing students (n=426) to use a clinical virtual simulator (CVS), and recommended the use of CVS as an important complementary strategy for nursing education. In another study, a virtual gaming simulation was used to explore student satisfaction, self-confidence and engagement in a mixed-methods study [13]. Students (n=43) reported positive learning experience and enhanced knowledge, engagement and self-confidence. At the University of Newcastle, Australia, midwifery students are the first in the world to use a virtual neonatal resuscitation scenario as part of their Bachelor of Midwifery study. The VR technology intends to close the gap between the classroom and emergency room where life or death decisions need to be made under pressure. The virtual neonatal resuscitation provides students with a safe and repeatable environment to practise key techniques. The RCT (intervention vs. control) will measure students' stress using biometric sensor, confidence and satisfaction [14]. These studies clearly demonstrate that the benefits of VR simulation provide nurses with opportunities to improve patient care, nursing practice and nursing education.

The major benefits of VR are widely discussed in literature. Immersing students into a virtual environment has the potential to be effective for critical thinking and skill development [11]. Depending on the displays used, users experience flexibility in learning as they can practise in their own time and space which has potential to reduce the costs involved in the number of resources and facilitators required for training [15,16]. In addition, replicability and repeatability of the simulation means that users have control over to meet their learning needs in their own pace and the improved portability and accessibility has contributed to the distribution to individuals and groups over the world [5,15]. In experimental studies, testing performance within a VR environment allows for each study participant to have exactly the same testing conditions [17], and the ability to measure variables that would be difficult to measure in real life due to safety concerns [18].

However, the challenges with VR simulation must also be considered. The most common challenge is called 'simulation sickness' which include nausea, vertigo and general malaise experienced by users mainly due to the mismatch between the sensory information perceived visually and experienced by the vestibular system [19]. This is more common (22–56% of cases) among the HMD users [20,21]. Another challenge is 'physical discomfort' while wearing HMD, sitting at a computer, using a joystick or looking at a computer screen [6]. In addition, when linear scenarios are used in a computer device with a 2-dimensional screen, the disengagement of users is reported, and the authenticity and the impact of fidelity of VR simulation are questioned [5,15,16]. Whilst VR simulation has potential to generate cost-effectiveness in the longer-term, the costs involved in earlier stage during the development, piloting the simulation and trainings required for educators and researchers can be expensive and cumbersome.

This is in addition to the costs involved in trouble shooting, regular maintenance and updates of technology [15].

Despite of the challenges with VR simulation, the potential benefits outweigh those challenges and its potential is strongly appealing to nursing profession. It is anticipated that VR simulation with a various degree of immersion will become available in health care, and nurses and nurse educators are entering into new era of practice, education and research. Nursing profession must become an active member of team advocating patients' needs and integrating technology of VR into care provision. Individuals, health and environment are the focus of nurses and the care they provide. With the rapid development and growth of VR simulation nurses can maximise its strengths to prepare the next generation of nurses, and to measure the differences they make in patient care. The use of VR provides nurses with opportunities to collaborate with interdisciplinary team, and expand and translate scientific knowledge into practice.

REFERENCES

1. Nehring WM, Lashley FR. Nursing simulation: a review of the past 40 years. Simulation & Gaming. 2009;40(4):528-552.
   CROSSREF

2. Scherer YK, Foltz-Ramos K, Fabry D, Chao YY. Evaluating simulation methodologies to determine best strategies to maximize student learning. Journal of Professional Nursing. 2016;32(5):349-357.
   PUBMED | CROSSREF

3. Bricken W. Learning in virtual reality [Internet]. Seattle: University of Washington; 1990 [cited 2019 Apr 5]. Available from: https://eric.ed.gov/?id=ED359950.

4. Rothbaum BO, Hodges L, Kooper R. Virtual reality exposure therapy. Journal of Psychotherapy Practice and Research. 1997;6(3):219-226.
   PUBMED

5. Ludlow BL. Virtual reality: emerging applications and future directions. Rural Special Education Quarterly. 2015;34(3):3-10.
   CROSSREF

6. Sherman W, Craig A. Understanding virtual reality: interface, application, and design. 1st ed. San Francisco: Elsevier Science; 2003.

7. Scapin SQ, Echevarría-Guanilo ME, Fuculo PR Jr, Martins JC, Barbosa MD, Pereima MJ. Use of virtual reality for treating burned children: case reports. Revista Brasileira de Enfermagem. 2017;70(6):1291-1295.
   PUBMED | CROSSREF

8. Garrett B, Taverner T, Masinde W, Gromala D, Shaw C, Negraeff M. A rapid evidence assessment of immersive virtual reality as an adjunct therapy in acute pain management in clinical practice. Clinical Journal of Pain. 2014;30(12):1089-1098.
   PUBMED | CROSSREF

9. Beidel DC, Frueh BC, Neer SM, Bowers CA, Trachik B, Uhde TW, et al. Trauma management therapy with virtual-reality augmented exposure therapy for combat-related PTSD: a randomized controlled trial. Journal of Anxiety Disorders. 2019;61:64-74.
   PUBMED | CROSSREF

10. Wiederhold MD, Gao K, Wiederhold BK. Clinical use of virtual reality distraction system to reduce anxiety and pain in dental procedures. Cyberpsychology, Behavior and Social Networking. 2014;17(6):359-365.
    PUBMED | CROSSREF

11. Dreesmann N. Virtual reality check: Are you ready? Journal of Gerontological Nursing. 2018;44(3):3-4.
    PUBMED | CROSSREF

12. Padilha JM, Machado PP, Ribeiro AL, Ramos JL. Clinical virtual simulation in nursing education. Clinical Simulation in Nursing. 2018;15:13-18.
    CROSSREF

13. Verkuyl M, Hughes M. Virtual gaming simulation in nursing education: a mixed methods study. Clinical Simulation in Nursing. 2019;29:9-14.
    CROSSREF

14. Williams J, Jones D, Ebert L, Williams C. Exploring the use of virtual reality technology in neonatal resuscitation simulation for midwifery students. Women and Birth. 2017;30 Suppl 1:13-14.
    CROSSREF

15. Chang TP, Weiner D. Screen-based simulation and virtual reality for pediatric emergency medicine. Clinical Pediatric Emergency Medicine. 2016;17(3):224-230.
    CROSSREF

16. Ferguson C, Davidson PM, Scott PJ, Jackson D, Hickman LD. Augmented reality, virtual reality and gaming: an integral part of nursing. Contemporary Nurse. 2015;51(1):1-4.
    PUBMED | **CROSSREF**

17. Smith-Coggins R, Howard SK, Mac DT, Wang C, Kwan S, Rosekind MR, et al. Improving alertness and performance in emergency department physicians and nurses: the use of planned naps. Annals of Emergency Medicine. 2006;48(5):596-604.e3.
    PUBMED | **CROSSREF**

18. Davis RL. Exploring possibilities: virtual reality in nursing research. Research and Theory for Nursing Practice. 2009;23(2):133-147.
    PUBMED | **CROSSREF**

19. Wilson CJ, Soranzo A. The use of virtual reality in psychology: a case study in visual perception. Computational and Mathematical Methods in Medicine. 2015;2015:151702.
    PUBMED | **CROSSREF**

20. Treleaven J, Battershill J, Cole D, Fadelli C, Freestone S, Lang K, et al. Simulator sickness incidence and susceptibility during neck motion-controlled virtual reality tasks. Virtual Real. 2015;19(3-4):267-275.
    CROSSREF

21. Munafo J, Diedrick M, Stoffregen TA. The virtual reality head-mounted display Oculus Rift induces motion sickness and is sexist in its effects. Experimental Brain Research. 2017;235(3):889-901.
    PUBMED | **CROSSREF**