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Is virtual reality (VR) a future trend in nursing education?

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Abstract: Background: Virtual reality (VR) has been developed and applied diversely from aviation into education. VR can help students for immersive experiences from different scenarios. In this regard, nursing educators play an important role in effective VR application. The feature aspects of VR in nursing education included safety, convenience, motivation, and interactivity. The challenges of VR in nursing education were related to participants' recruitment and selection, as well as the budget and settings. The future VR in nursing education must be VR equipment well supported including maintenance, user friendly to better learning experiences among nursing students, reasonable budget and funding for the technology learning environment, and preparation of nursing educators to become more innovative in the application of VR in nursing. What this paper contributes: This paper aims to discuss the current VR application and the future aspects in nursing education. Nursing education should have the new aspects and views supported by the technology to improve nursing students' comprehensive competencies for the better nursing cares in the future.

Keywords: *Nursing care, Nursing education, Review, Virtual reality.*

1. Introduction

Virtual reality (VR) has been developed diversely and applied into education to help students for immersive experiences from different scenarios. VR is the simulation of a three-dimensional environment using computer-related technology 0 which also creates an immersive experience to users.

The first concept of virtual reality (VR) was recorded in 1838 when British physicist Charles Wheatstone proposed stereoscopic vision. Until 1929 the VR was first used in pilot simulation training of airplane operations and trained more than 500,000 pilots annually in the world [2][3]. VR has been rapidly blooming and growing in the gaming industry since 1991 including the SEGA VR (SEGA VR) to Nintendo Virtual Boy (Virtual Boy) hooded glasses in 1995, then Sony's home VR video game console (PlayStation VR) in 2020, which allows gaming users to feel like the real-world immersive effects [4].

Currently, many universities have been applying VR technology to create virtual learning environments that enhances students' learning motivations and immersive experiences in the real world [5]. VR serves as a bridge to link nursing students immersive learning experiences and simulation training in virtual settings among theoretical knowledge, nursing skills, and clinical practice. Nursing students use VR to experience the complex clinical situations to provide a more realistic visualization that improve their involvement and creativity in nursing practice [9][10].

Since some schools and programs have been adopting VR and technology in nursing education. Is it a trend to apply VR in nursing education? If yes, nursing educators should play important roles in effective teaching in VR nursing education. This paper aims to discuss the current VR applications and the future aspects in nursing education.

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2. VR in Nursing Education

VR technology have been developed various medical virtual teaching software, such as vSim for Nursing virtual case software, Shadow Health Digital Clinical Experience, Osso VR, and SimX. VR is now actively used in nursing education in China. For instance, Hong Kong Polytechnic University utilized VR for nasogastric tube indwelling training, while Shanghai University of Traditional Chinese Medicine implemented the 'intravenous virtual injection system'. Additionally, Macao applied VR in gerontological nursing, allowing nursing students to experience the daily life of the elderly in an immersive way [12]. VR can facilitate student learning. It can improve teaching methods, enhancing student learning instead of solely delivering information [9].VR has been used to provide nursing students immersive experiences in clinical scenarios and interaction with virtual patients independently in a safe virtual environment that also decreased the communication problems with real patients. The VR approach can improve nursing students' immersive learning experience without the limitation of time and place which also enable nursing students' problem solving through individualized simulation exercises [13] and the quality of nursing care.

VR can simulate real-life scenarios in nursing practice, allowing nursing students to gain an immersive experience before actual practice. Nursing studies have concluded that nursing students received VR simulation and scenario had better knowledge in mechanical ventilation care and pharmacology [15]. VR also contributed to the disaster preparedness and competency among nursing students that that enhances students' resilience and decision-making skills for the education of disaster preparedness. Nursing students reported that VR immersive experiences improved knowledge of type 2 diabetes nursing cares [16], the judgments in the clinical settings [17], and performances of nasal feeding regardless training time and practice place [18]. Gerontological nursing (GN) education combined aged simulation through aged simulation set and VR activities, nursing students provided positive feedbacks that aged simulation and VR activities should be applied into geriatric nursing programmes [12].

Does VR technology in nursing education have the potentials to improve students' theoretical and skill knowledge as well as academic satisfaction? Most nursing students at theirs 20s are familiar with electronic devices and social medias, VR opens a new learning path to nursing students for the ubiquitous and immersive learning experiences to take care virtual patients. That could be the feature in nursing education as VR can provide immediate feedbacks of nursing practice to nursing students in a virtual environment. The most advantage of virtual reality technology in nursing education is to provide virtual scenarios to nursing students for the immersive experiences that improve their knowledge and skills as well as critical thinking process.

2.1. The Feature Aspects of VR in Nursing Education

There are some feature aspects summarized for the VR in nursing education as the following:

Safety is the most concern of nursing practice. Nursing students can practice invasive skills to virtual patients repeatedly without any risk and negative consequences to real patients [17].

Convenience is the advantage of VR in nursing education. Nursing students can use VR technology to practice their skills without time limitation that was different from the traditional nursing skill practice in nursing education [18][13]. VR in nursing practice provides flexible time to student for the easy access to practice their skills from time to time.

Motivation is the most powerful ways of VR to improve nursing students' knowledge and skills for better nursing practices. VR can also increase student motivation and engagement in the learning process. VR enables personalized learning based on individual student needs and progress levels. Students can adjust the training content and difficulty according to their learning progress and needs, resulting in improved learning outcomes.

Interactivity is also important during learning process of nursing education. Immersive experiences and interactivity of VR technology can enhance students' learning interests. VR can create interactive virtual even gaming scenarios that promote nursing students more engagements and

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practice with virtual patients. Nursing students can communicate and interact with virtual patient without time strain and limitation that also improve nursing students' critical thinking skills.

Empathy. The use of VR in teaching and learning has the potential to improve nursing students' empathy to perceive and understand the feeling or emptions of patients [20]. VR technology provides nursing students' immersive experience to go through vivid real situation that can promote nursing students' empathy for their future careers.

2.2. Current Issues of VR in Nursing Education

VR technology has contributed to nursing education with positive outcomes and learning effects in nursing education, there were limitations and issues emerged.

First, the challenge of recruiting enough participants that affected enough sample size. Second, most studies measured short-term knowledge gains and did not follow long-term knowledge change. Third, participants selection of qualitative study for those nursing students are familiar with technology, that may have selection biases for the study. The last, the supports of schools were the important issue of VR in nursing education that include funds[18], experienced educators and researchers in VR, settings, and participants.

3. Discussion and Conclusion

3.1. VR Equipment and Support

The hardware devices of VR for the head-mounted display and the hand-handle set to enter the virtual space need to be lighter and easier to be applied and used. The software of VR for nursing education needs to be tailor-made to the specific programme in accordance with learning outcomes. Thus, the technology support of VR will be the key and important in development and application.

It's suggested that VR devices should be easy accessed, accuracy, and capable that can provide immersive experiences to nursing students during application. The technical support should be regular maintained and updated to the latest version of VR product.

3.2. User Friendly

Currently, studies confirmed that VR technology can cause discomfort to users during application. Nursing students reported dizziness and discomfort happened during VR activity wearing the head-visualization device, there is still space for the improvement of VR system in localization accuracy and speed [20]. Users experienced dizziness, nausea, fatigue, and disorientation during VR activity, those symptoms were caused by lacks of congruence between visually perceived motion and the information provided by the vestibular system [21]. It is recommended that nursing students' VR activity time should be no longer than 20 minutes for wearing VR head-set per use to avoid the feeling of disconformable.

3.3. Budget and Funding

The use of VR technology in education requires financial support, including equipment purchase, software for the development of virtual scenarios, and maintenance [22].The continuous and stable financial support is essential to VR technology in nursing education. It is hoped that government, organization, and school or university will plan the budget for the application of VR in nursing education.

3.4. Preparation of Nursing Educators

Nursing educators play the important role for VR technology in nursing education. They should collaborate with VR programming experts to develop and improve equipment as well as act as instructors for teaching and training in nursing education [22]. Therefore, nursing educators should participate actively in VR teaching and apply more VR activities in nursing education that will enhance students' ability to nursing practice [13].

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3.5. Conclusion and Implications for Research/Practice/Education

The development and instruction of VR systems necessitates significant financial backing, which restricts its widespread implementation and advancement. The help of virtual reality technology in nursing education is expanding with the development of related technologies in the future. Therefore, there is a great potential for the future application of virtual reality technology in the field of nursing education. The nursing profession emphasizes a teaching philosophy of integration and openness, inheritance, and innovation. This philosophy enables new technologies to play a full role in nursing education. In the future, the application of VR technology will also bring brand new rewards for nursing teaching [24]. Innovative teaching methods and diverse learning experiences can help nursing students overcome their inherent student mindset, promoting the development of clinical experiences and empathy [21].

The applications of VR described in this paper are limited in the scope, but it can help educators to explore the current trend of teaching and provide one new idea for VR into future teaching plans. This article explored current innovative applications of virtual reality (VR) to broad teaching styles and provide new ideas in nursing education. Nursing education combining with VR technology can enrich students' theoretical knowledge and strengthen their clinical practice. The positive application and practice of VR in nursing education provide an innovative and beneficial direction for future models of health and nursing education. Nursing education should have the new aspects and views supported by the technology to improve nursing students' comprehensive competencies for the better nursing cares in the future.

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Authorship Contribution Statement:

Ye Qian Liao: Conceptualization, Resources, Formal analysis, Data Curation, Writing – original draft, Writing – review & editing. Mei Hua Kerry Hsu: Conceptualization, Resources, Formal analysis, Review & editing, Supervision, Project administration, Funding acquisition.

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