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Exploring the Impact of the Use of Immersive Virtual Reality Interactive Experiences on Student Learning of Obstetrical Nursing

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ABSTRACT

Background: Virtual reality technology can improve traditional teaching methods by removing time and space constraints for learners, increasing learning interest, and promoting the potential for greater empathy and better communication skills in learners through immersion in the subjective experience of others from a first-person perspective.

Methods: An immersive virtual reality obstetrical nursing learning system was constructed and applied to an obstetrical nursing curriculum. Qualitative interviews and feedback forms filled out by students were used to understand nursing students' learning experiences and feelings about the application of VR interactive experiences to obstetrical nursing.

Result: Most of the students found that the VR interactive experience could inspire empathy, enhance communication between patients and nurses, provide a stress-free learning environment, and increase interest and confidence in learning.

Conclusion: The development of innovative VR learning materials will help students to overcome the constraints of time and space, and provide them with the opportunity to practice their skills in an immersive simulation should in-person classes be discontinued in response to emerging epidemics, thus facilitating learning continuity.

Keywords: Empathy, Interactive experience, Learning interest, Obstetrical nursing, Virtual reality,

INTRODUCTION

Because of the emphasis on patient-centred care and concern for patient safety, teaching with simulated scenarios has always been an important strategy in clinical teaching. As it becomes the trend for people to learn in many different ways and also in response to the COVID-19 pandemic, educators have had to adapt their teaching methods to suit learners. Virtual reality (VR), which provides an immersive experience, has in recent years been integrated into nursing teaching, creating an environment that resembles a clinical situation and allows students to make

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mistakes without harming real patients. VR is using a head-mounted display (HMD) to see a computer-generated, 360-degree panoramic view of a simulated scenario. In the 3D virtual illusion displayed in the HMD, the user can manipulate, control and reflect the events and objects in the virtual environment with a data glove, which greatly enhances the realism and interactivity.[1, 2] Simulation teaching is the design of a scenario that resembles an actual clinical scenario; the use of VR allows users to overcome the constraints of time and space. By having students participate in experiential tasks with a certain level of realism, they are trained in clinical judgement, skills and operations, and the risk of causing safety issues for patients due to inexperience is reduced, plus proficiency can be increased through repetitive practice, enhancing learning outcomes.

Many studies have shown that teaching with VR does improve nursing students' nursing skills, including surgical aseptic skills,[3] tracheostomy care[4], urinary catheterization[5], decontamination,[6] and the ability to communicate with those with dementia.[7] As a result of these learning experiences, most students found the VR experience interesting, and the knowledge and skills they learned left a greater impression on them, since immersion in a virtual environment allowed them to practice the skills quickly, continuously and repeatedly.[8, 9] Innovative, interdisciplinary VR teaching diversifies the learning content, and can be applied in the teaching environment to enhance the students' integration of what they've learned from different subjects and to let students to have interest in learning.[10] Empathy is a concrete expression of humanity in healthcare professionals; it is the ability of a carer to understand the patient's world, and to feel and think from the patient's point of view without being judgmental. Nursing educators should be doing more to guide students in developing their empathy.[11] Experiential thinking and mind-body medicine skills can help medical and nursing students to develop empathy and reduce their feelings of stress in learning.[12] Empathy is also the basis for effective communication, and only by improving the expression of empathy in nurses can treatment outcomes and communication between patients and nurses improve.[13] Therefore, it is important for nursing education to strengthen and improve students' empathy. VR has the potential to enhance the demonstration of empathy and communication skills by providing a first-person perspective on the subjective experience of others.

To summarise the background of this study, VR interactive experiences were applied to the teaching of obstetrical nursing; students put on VR headsets and entered an immersive VR environment from the perspective of a nurse to learn how to properly and smoothly administer a nursing intervention. Students were able to observe and rehearse the experience repeatedly, as well as train their nurse-patient communication skills; they could also switch to the first-person perspective of the woman in labour in order to experience the woman's nervousness and anxiety while nursing interventions were being administered, and demonstrate empathy in the nurse-patient relationship. Thus, the study aims to understand the learning experiences and feelings of nursing students studying obstetrical nursing towards VR interactive experiences.

METHODS AND MATERIALS

The Development of a VR Learning System

The theme of the study's VR scenario lesson plan is assessment and care during labour, which includes: admission assessment, provision of non-pharmacological pain relief measures, use and guidance of birthing balls, slow dance exercises, massage and acupressure, application and guidance of breathing relaxation techniques. During the exercise, students can demonstrate their empathy and effective communication skills. This study uses a mobile VR app with a low-cost VR headset as the basis for development. Both Android and iOS handheld devices

are supported, and the programme can run smoothly on both with the Google VR SDK tool; together with Unity, a software for developing 3D interactive experiences, all kinds of interactions and applications required in the VR can be developed. A 4K HD 360° panoramic camera was used to film the content of the lesson plan in real locales, and then post-production and editing was done with video editing software to create a 360° panoramic image that fits clinical contexts. The Unity Google VR SDK integrated the 360° panoramic image with the Unity interactive software, and then Unity was utilized to program the functions of the VR system, design the code for the interactive program, and pack and test the app. Finally, students only need an ordinary mobile phone and a 3D VR headset to experience the interactive obstetrical nursing VR app.

Operating Procedures for the VR Learning System

1. Click on the VR app; students can choose either the nurse's perspective or the mother's according to their learning needs.
2. After entering the system, students can put their mobile phones into the VR headset to begin the interactive experience.
3. Use the eye centre dot to select the menu, and the buttons on your handheld device to select the lesson and the content; the lesson icon will be enlarged and shown in colour as a prompt to students to confirm their choice. When students use their handheld devices to click on their selection, they'll be taken to their chosen VR lesson to begin learning (Figure 1).
4. Click on the Back button of the handheld device to return to the main menu, and continue onto the next lesson.
5. After leaving the system, students can then choose to continue their learning process from another perspective (nurse or mother), depending on their learning needs, until they have completed their learning objectives.

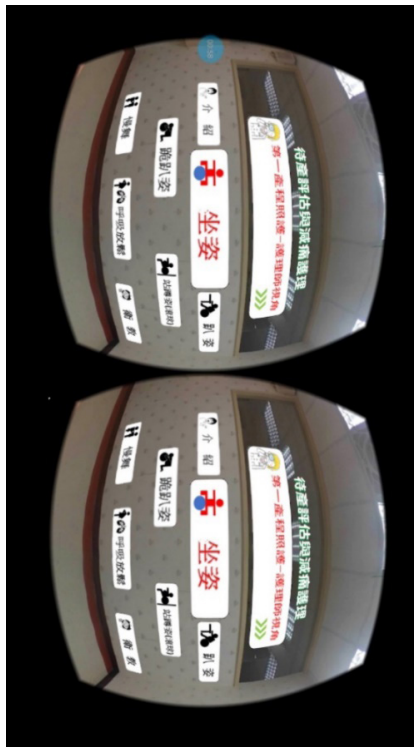

Fig. 1: The VR APP interface for selecting interactions

Procedures for Teaching with VR

- **Step 1:** The instructor explains how to use the VR learning system and clarifies learning objectives.
- **Step 2:** Students put on their VR headsets and practice how to demonstrate empathy in their interaction and communication with the woman in labour from the first-person perspective of the nurse (Figure 2). At the same time, they need to also correctly and smoothly conduct their assessment to collect a comprehensive set of subjective and objective information; carry out birthing ball exercises, slow dance exercises, massage relaxation techniques, and breathing relaxation techniques; and instruct the mother on various ways to relieve pain during labour (Figure 3).
- **Step 3:** Students learn to empathise with the nervousness and anxiety a woman in labour feels while nursing interventions are being administered in the first-person perspective of the woman (Figure 4).
- **Step 4:** The instructor leads a discussion in which students share with one another

how they made critical decisions in the VR scenario, so that they can look back, review and internalise the experiences and feelings they went through in the scenario.

- **Step 5:** Students fill in their feedback forms.

Fig. 2: Students put on VR headsets and enter the immersive virtual environment

Fig. 3: Conducting the exercise from the first-person perspective of a nurse

Fig. 4: Conducting the exercise from the first-person perspective of a woman in labour

RESULTS

The VR learning system was applied to an obstetrical nursing course in March 2022. In the after-class feedback of 42 students from the nursing department of a university in New Taipei City, Taiwan, the majority of the students gave positive feedback on the VR learning system. Points made in the students' feedback were grouped into the following categories:

1. **Inspiring empathy:** VR has the effect of stimulating the senses, and an immersive virtual experience enhances the feeling of being in a situation; students learned to put themselves in other people's shoes, which enhanced their ability to demonstrate empathy.

Two students stated the following:

> "Once I got used to it, I began to feel like I was the woman in labour, and I could feel that the nurses were very nice to me and that I had to cooperate with treatment."

> "I gradually got into the situation, and I could feel that I was the woman in labour, so I followed the nurse's instructions and started doing birthing ball exercises. What a unique experience."

2. **Improving nurse-patient communication skills:** In the VR learning system, students can switch the nurse's and the mother's first-person point of view. This provides a variety of scenarios in which the nurse and the patient communicate with each other, which can enhance communication skills and in turn improve the nurse-patient relationship.

Two students stated the following:

> "When I experienced things from the nurse's point of view, it allowed me to observe the pregnant woman's reactions over and over again and learn to communicate more effectively."

> "The VR was very realistic. When I was the woman in labour, it allowed me to sense if the nurse's tone, method of asking questions and provision of information during health education was appropriate, so I could correct what I used to do wrong often while communicating."

3. **Stress-free learning environment:** With traditional teaching approaches, skills are inevitably taught and demonstrated by instructors in person. But, this often causes learners to feel nervous, afraid, or unconfident, which can affect their

performance. However, the VR creates a self-directed and stress-free learning environment.

Two students stated the following:

"When instructors teach one-on-one, I always got nervous and felt afraid of making mistakes, but the learning environment provided by the VR system allows me to learn better without stress."

"In the learning environment provided by the VR system, we can practice skills without the presence of instructors, and so the learning pressure is greatly reduced."

4. **Increasing interest in learning and self-confidence:** In VR, students can do things repeatedly to enhance their proficiency and skills, so their interest in learning and self-confidence is increased in a virtual environment.

Three students stated the following:

"It's amazing how the VR can recreate clinical scenarios in a realistic way and make the learning process more interesting. Things are no longer taught in just one boring way, and I learned a lot from it."

"VR not only made the course more interesting but also helped me learn the correct care-providing process during labour and reinforced that knowledge, which gives me more confidence for my future internship in obstetrics."

"I've never had such a realistic and interesting experience of learning about obstetrics through VR. It's very realistic, and I won't be afraid of caring for women in labour if I work in a maternity ward in the future."

DISCUSSION

The VR interactive experience was applied in obstetrical nursing education to help students think and learn deeply; it would be worthwhile to explore abstract issues in depth through using VR experiences. In the VR Obstetrical Nursing Learning System, students can choose between the first-person perspective of either the nurse or the woman in labour, depending on their learning progress. Students are able to not only learn about assessments during labour as well as various kinds of pain relief, but also experience the anxiety and fear that women feel when nursing interventions are administered; it helps students to enhance their communication skills, ethical literacy, caring spirit and empathy as well as to think from the perspective of their patients, understand how their patients would feel, and provide care that is humane. The VR learning system provides students with the opportunity to view exercises and practice repeatedly, so they can familiarise themselves with common aspects of caring for women during labour, make the link between professional knowledge and real-life clinical scenarios, and explore learning objectives in real-life scenarios during labour. More importantly, the design of virtual versions of clinical scenarios in the lesson plan allows students to repeat the exercises safely, which not only reduces training costs but also prevents patient exposure to high-risk environments, allowing learners to train in a way that is safe and secure[8]. In addition, most students reported that VR made learning more interesting, since a stress-free learning environment provides positive learning effects, inspires empathy, and enhances one's proficiency in a skill; not only did VR reduce the students' worries about their learning, but also increased their interest and confidence in learning[9, 14, 15]. Incorporating virtual reality into courses can create a positive learning experience and serve as an effective teaching tool to enhance course activities[16], thus facilitating a more fun learning environment.

CONCLUSION

This study aims to establish an innovative teaching model for obstetrical nursing that uses simulations via the development and application of lesson plans that incorporate

VR scenarios, which will help students overcome constraints of time and space and give them the opportunity to practice their skills in an immersive simulation should in-person classes be discontinued in response to emerging epidemics, thus facilitating learning continuity.

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