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Enhancing Empathy in Nursing Education: A Feasibility and Usability Study of Virtual Reality-based Training for Dementia Care

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ABSTRACT

Background: Virtual reality (VR) is recognized as a versatile training tool across various domains, including healthcare. In Jordan, dementia is a significant public health concern, accounting for 5.17% of all recorded deaths. Given the complex nature of dementia care, preparing nursing students is crucial. **Purpose:** This paper explores the feasibility and effectiveness of VR-based empathy training for nursing students, with a growing global interest in VR training applications, despite the need for further study of VR acceptability in the Jordanian context. **Methods:** This mixed-methods study included 71 nursing students in a psychiatric course at a university in Jordan. Feasibility was assessed through recruitment, retention, adherence, data completion, and implementation fidelity. Pre- and post-intervention assessments measured empathy levels. Thematic analysis of participant feedback provided insights into usability. **Results:** Recruitment and retention rates were excellent, with a 100% participation rate and 100% retention. The intervention demonstrated a statistically significant enhancement in empathy scores following the program (M_pre = 50.44, SD_pre = 9.24; M_post = 65.17, SD_post = 8.53), t (71) = -23.89, p < 0.001. The thematic analysis highlighted the importance of a user-friendly interface, a supportive learning environment, and engaging content. **Conclusion:** This study highlights the potential of VR-based training to enhance empathy among nursing students in the context of dementia care. The robust feasibility outcomes and positive user experiences suggest that VR technology can be a valuable addition to nursing curricula, ultimately benefiting patient care and the nursing workforce. **Implications for Nursing:** Integrating VR into nursing education presents the potential for elevating empathy in nursing students, notably within dementia care. This innovative approach equips prospective healthcare providers with vital skills for delivering more compassionate patient care.

Keywords: Dementia, Nursing education, Empathy, Virtual reality, Feasibility studies, Patient-centered care.

What does this paper add?

1. Incorporating VR for empathy training: This paper introduces the integration of virtual reality (VR) technology into nursing education, offering a pioneering approach to enhancing empathy among nursing students, which can significantly impact patient care in the context of dementia.

2. Practical insights for education: By presenting the high participation and retention rates, along with valuable feedback on user experience and design considerations, this paper provides practical insights for educators and institutions looking to implement VR-based training in nursing programs, with a specific focus on dementia care.

Introduction

Dementia, affecting over 55 million individuals worldwide with approximately 10 million new diagnoses annually, stands as a pressing global health issue (World Health Organization (WHO), 2023). According to World Health Rankings (2023), approximately 5.17% of all deaths in Jordan are attributed to dementia. Additionally, a recent study involving 31,411 participants found that the overall prevalence of dementia in individuals aged 65 and above stands at approximately 1.94% (Kofahi et al., 2021). The WHO characterizes dementia as a syndrome with typically chronic or progressive attributes, arising from various brain illnesses that profoundly impact memory, cognition, behavior, and the execution of daily activities (WHO, 2023). As cognitive functions decline, mood shifts, emotional regulation falters, behavioral changes emerge, and motivation wanes (Abdalrahim et al., 2022a; Abdalrahim et al., 2022b; Alzheimer's Research UK, 2022). Dementia serves as an encompassing term, including diseases, such as Alzheimer's, vascular dementia, and Lewy bodies, which are the most prevalent forms (Alzheimer's Research UK, 2022).

Within the sphere of nursing education, the imperative of preparing students to provide competent care to clients with dementia has gained recognition (ANA Ethics Advisory Board, 2020; Laari & Dube, 2017). However, a concerning knowledge gap exists regarding the progression, symptoms, and management of dementia among nursing students (Abdalrahim et al., 2022a; Aljezawi et al., 2022). This knowledge deficit raises questions about the readiness of graduating nursing students to address the needs of the growing population grappling with dementia-related challenges.

Empathy, a cornerstone attribute in the skillset of psychiatric nurses, assumes paramount importance (Moudatsou et al., 2020). As previously discussed, the development of empathy is not only vital for psychiatric nurses, but also holds great significance for nursing students. The capacity to exercise empathy is crucial in preparing these students to effectively engage in the multifaceted and emotionally demanding field of dementia care. This paper aims to elucidate the importance of empathy within the specific context of nursing education, particularly as it relates to caring for individuals with dementia. It involves nurses' capacity to discern and comprehend the significance of patients' emotions and thoughts, thereby facilitating the expression and reflection of this understanding in their interactions (Babaii et al., 2021; Moudatsou et al., 2020). Importantly, empathy doesn't entail experiencing the exact emotions of the patient; rather, it revolves around perceiving, comprehending, and relating one's emotions to another's experiences (Moudatsou et al., 2020; Sinclair et al., 2017). It is not synonymous with shared emotions; instead, it signifies the ability to appreciate, understand, and convey an understanding of others' feelings and experiences (Riess, 2017). This skill proves pivotal in fostering effective communication and connection, especially during the navigation of challenging and distressing situations (Reith-Hall & Montgomery, 2023). Research demonstrates that structured in-class activities and assignments encouraging reflection on how differences can challenge perspectives are a means to enhance empathy, even among individuals with mental illnesses (Moudatsou et al., 2020; Webster, 2009).

Nursing education, ever-adaptive to evolving demands and the increasing need for healthcare professionals with empathetic and culturally competent attributes, (Gradellini et al., 2021; Osmancevic et al., 2023), finds particular significance in the context of dementia care within Jordanian care homes. Traditional teaching methods amalgamate classroom instruction with hands-on clinical experiences to impart fundamental skills and knowledge to students (Brown, 2008; Maddineshat et al., 2018). Nevertheless, these conventional clinical practices often fall short in providing students with a profound understanding of the emotional and cognitive challenges faced by individuals living with dementia and their families (National Academies of Sciences et al., 2021).

Jordanian home care refers to the healthcare services and support provided to individuals, particularly those with chronic illnesses or conditions, within the comfort of their own homes. These services may encompass a range of medical, nursing, and caregiving activities delivered to patients in a domestic setting, often by healthcare professionals, family members, or caregivers. The concept of Jordanian home care is deeply ingrained in the country's healthcare system, aiming to improve patient well-being, reduce hospitalization, and promote a higher quality of life for those in need of ongoing care. Within Jordanian care homes, individuals with dementia encompass a spectrum of healthcare requirements, underscoring the critical importance of empathy among

nursing professionals (Alhadidi et al., 2016). Consequently, innovative approaches have been explored to enhance nursing students' empathetic abilities (Yang et al., 2018). Among these, the utilization of virtual reality (VR) technology emerges as a transformative avenue. VR bridges the gap between conventional classroom learning and the intricate real-world situations encountered in healthcare (Dwivedi et al., 2022; Pottle, 2019). Specifically in the realm of dementia care, VR-based training presents a promising avenue (Varela-Aldás et al., 2021). It immerses nursing students in simulated environments that authentically replicate the experiences and difficulties encountered by dementia patients and their families (Um, 2023).

While VR technology has exhibited effectiveness across various healthcare educational contexts (Kyaw et al., 2019; Samadbeik et al., 2018), its feasibility and usability in the specific domain of dementia care training in Jordanian care homes necessitate meticulous evaluation. This feasibility and usability study thus seeks to rigorously assess the practicality of integrating immersive VR-based empathy training into the nursing education curriculum in Jordan, with a specific focus on dementia care within care homes.

Amidst the evolving landscape of nursing education, this study aspires to unlock the potential of immersive VR-based training as a transformative tool for nurturing empathy among nursing students. Its scope encompasses an examination of the feasibility of seamlessly integrating VR technology into the nursing curriculum. This examination addresses crucial considerations, such as cost-effectiveness, infrastructural requirements, and the readiness of nursing instructors, to facilitate this innovative learning modality. Additionally, the study undertakes a thorough evaluation of the usability of the VR program, ensuring its alignment with the cultural nuances and specific needs inherent to Jordanian care homes.

Empathy, as the bedrock of high-quality dementia care, enables healthcare providers to genuinely comprehend and address the emotional needs of patients and their families (Jütten et al., 2019). The VR-based training program under scrutiny, meticulously designed to facilitate the development of empathy, emerges as a groundbreaking tool in preparing nursing students to navigate the intricate realities of dementia care within Jordanian care homes. As this study embarks on the assessment of feasibility and usability, it endeavors to

pave the path toward a more empathetic and culturally attuned nursing workforce, one better equipped to tackle the multifaceted challenges inherent in dementia care within Jordanian care homes.

The integration of VR technology into educational institutions holds substantial promise, affording students and caregivers enhanced access to learning opportunities within a controlled and secure setting (Zhang et al., 2022). This innovative approach enables the practicing of responses across a spectrum of scenarios, immediate performance evaluation, and iterative learning without the logistical complexities and costs associated with traditional facilitated workshops (Zhang et al., 2022). In the ideal scenario, this iterative feedback loop serves to enrich and deepen knowledge acquisition, ultimately culminating in improved outcomes for clients during real-world care provision (Dwivedi et al., 2023). In the short term, the utilization of VR technology has the potential to produce newly minted graduates possessing broader knowledge bases, augmented skill sets, and more adaptive attitudes than those traditionally acquired (Chen et al., 2020).

Therefore, this study's primary objective is to rigorously evaluate the feasibility and usability of integrating immersive VR-based empathy training into the nursing education curriculum in Jordan, with a particular emphasis on enhancing nursing students' preparedness to provide dementia care in care homes. Through this study, we aim to assess the feasibility and effectiveness of using VR technology as a transformative tool for fostering empathy among nursing students, thereby equipping them with the skills and attributes necessary to navigate the complex landscape of dementia care in Jordanian care homes.

Methods
Research Design

This study employed a mixed-methods' research design to comprehensively address the research question. The sequential explanatory design, following the guidelines proposed by Creswell and Plano Clark (2018), was implemented. This design facilitated an in-depth exploration of the research question through both quantitative and qualitative data collection and analysis. The purpose of this explanatory sequential design is to initially collect and analyze quantitative data to gain a general understanding of the research question. Subsequently, qualitative analysis is conducted to delve

deeper into participants' perspectives, providing essential context to the quantitative findings (Lian & Zheng, 2023; Tenny et al., 2023).

Quantitative Data Collection

Quantitative data was collected at specific time points within the study. The pre-intervention assessment was conducted before the immersive VR-based empathy training, offering a baseline measurement of participants' empathy levels. Following the intervention, the post-intervention assessment was administered to evaluate the impact of the VR training on empathy. These assessments were carried out in a structured manner with standardized instruments. The timeframe for quantitative data collection was systematically implemented to ensure precise measurement.

Qualitative Data Collection

Qualitative data was gathered through a series of in-depth interviews with participants. These interviews aimed to provide a nuanced understanding of participants' perspectives and experiences with the VR-based empathy training. The qualitative data collection phase followed the post-intervention quantitative assessment. Participants' insights and feedback were captured through open-ended questions during individual interviews, which allowed for a comprehensive exploration of their experiences.

Duration of Data Collection

The quantitative data collection included the pre-intervention and post-intervention assessments, which were conducted over a specified period. The exact duration for each assessment was determined in advance to ensure consistency in data collection procedures. Similarly, the qualitative data collection, consisting of individual interviews, occurred during a specific timeframe following the completion of the intervention.

The temporal sequence of data collection was carefully orchestrated to allow for a comprehensive and systematic evaluation of the research question. This approach enabled a thorough investigation into the impact of immersive VR-based empathy training on nursing students' empathy levels within the context of dementia care.

Settings and Sample

The participants in this study were undergraduate nursing students enrolled in a psychiatric course at a governmental university in north-eastern Jordan, Faculty of Nursing. These students were selected due to their prior theoretical instruction on dementia in the same semester, with clinical practice scheduled for the second semester. The study aimed to recruit a sample of 40 to 50 students in clinical practice, a number deemed adequate for a feasibility study according to Sim and Lewis (2011). Convenience sampling was used to select the participants for this study. A total of 71 students were enrolled in this interventional study, and none of them declined.

Ethical Considerations

This study adhered to rigorous ethical standards, receiving formal approval from al al-Bayt University's ethical review board. Throughout the data collection process, utmost care was taken to ensure the complete anonymity of all participants. In accordance with ethical guidelines, the researchers provided a comprehensive and transparent explanation of the study's objectives to the student participants. Importantly, it was made explicitly clear to the students that they held the prerogative to withdraw from the study or discontinue their participation in the course at any juncture, without any adverse consequences. Furthermore, in line with ethical protocols, informed consent was diligently obtained from those students who voluntarily chose to partake in the research endeavor.

Outcomes to Assess Feasibility and Usability

In order to evaluate the feasibility and usability of the study, a systematic framework based on the work of Reelick et al. (2011) was employed. This framework offers a structured approach to conducting process evaluations during both the developmental and feasibility assessment phases. The following key data points were collected to gauge feasibility and acceptability:

Recruitment Rate

The recruitment process involved university students who were enrolled in clinical practice, and the recruitment rate represented the proportion of eligible students who voluntarily enrolled in the study. For the feasibility assessment, we aimed to achieve a consent rate that reached or exceeded 40% of the participants approached to join the study, in line with

recommendations from Forster et al. (2017). This process aimed to ensure the engagement of a representative portion of the student population involved in clinical practice and interested in the study.

Retention Rate

Retention refers to the number of participants who completed post-intervention assessments in comparison to those who initially embarked on the intervention. Feasibility criteria were met when the retention rate equaled or exceeded 65% (Lyndon et al., 2023; Quirk et al., 2018).

Adherence

Adherence was measured by tracking the extent to which students in clinical practice engaged with each component of the intervention, including their attendance at digital VR sessions.

Implementation Fidelity

This aspect involved evaluating whether the intervention adhered to the research protocol and methods as approved following peer review.

Data Completion

Data completion was determined by counting the frequency of missing items during data collection periods. Feasibility was confirmed if the percentage of missing items on each questionnaire remained below 10%, establishing a likely threshold for imputation in a definitive trial (Quirk et al., 2018).

Intervention

The CareGiVR application is an interactive virtual reality (VR) application designed to enhance and expand upon existing immersive training methodologies, offering enhanced portability and enabling repetitive practice to bolster empathy, as underscored by Bailenson (2018). The primary objective of the CareGiVR application is to furnish a realistic training platform tailored for students and caregivers, equipping them with the skills to effectively de-escalate situations involving aggressive dementia clients, thereby facilitating a return to a more stable and manageable emotional state through the safe utilization of virtual reality technology.

Unlike traditional VR training methods that primarily rely on 360-degree video to immerse students

in the client's role, the CareGiVR application takes a step further. It harnesses state-of-the-art performance capture technology to provide immersive experiences with virtual individuals who exhibit authentic behavior, natural human movement, and realistic facial expressions. This approach elicits genuine emotional responses. Features like directional audio further enhance the sense of presence in the virtual environment.

The application allows users to observe and interact with a variety of caregiver roles, each featuring recognizable and relatable characters. This design maintains scenario engagement and minimizes disconnection. The virtual entities within the application are meticulously crafted to exhibit symptoms of anxiety and aggressive behavior, representing a diverse cross-section of society in terms of gender, age, and ethnicity.

This simulated patient care environment provides a secure space for repetitive practice, enabling skill reinforcement and offering real-time feedback—a practice that aligns with previous research on healthcare simulation (Henriksen et al., 2008; Issenberg et al., 2005; Tapia & Waseem, 2023).

Prior to the intervention, participants were directed to an adjacent room for their initial completion of the Empathy Toward the Mentally Ill Scale. In the virtual reality lab at the educational institution, each student had an individual appointment. During this session, the researchers introduced the students to the VR headset and provided guidance on operating the Oculus Touch controller equipment. An overview of the scenario was also given. Importantly, it should be noted that the utilization of the CareGiVR application did not necessitate participants to enter login credentials or any personal information into the application or the computer. No personal data was collected or stored when participants engaged in the CareGiVR scenario using the headset.

Once the application was initiated, a visual tutorial on navigating within the virtual environment, interacting with objects, and engaging with the client was conducted. Following the tutorial, participants actively participated in the 'Vivian' dementia case scenario. Throughout this experience, the researchers ensured the safety of the participants, taking precautions to prevent them from encountering cords or colliding with walls, while also monitoring for signs of disorientation or distress. The researchers maintained visibility of the

same perspective as the participants through a computer monitor and observed the clinical decisions made by the participants within the scenario. Operational questions from the participants were addressed when necessary. After the conclusion of the scenario, the software automatically generated an individualized user report for each participant, providing insights into their activity log, encompassing the decisions made, time spent, repetitions, and overall progress within the scenario.

Immediately following the scenario, participants were once again directed to an adjacent room to complete the Empathy Toward the Mentally Ill Scale for the second time, without the presence of the researchers. The e-mail addresses provided by the students during the initial survey were re-entered to match responses. Participants were informed that they would receive the survey for a third time and would also receive an invitation to participate in a focus group after completing their clinical course.

Upon the conclusion of the appointment, all equipment was thoroughly sanitized in accordance with institutional policies and reset in preparation for the next participant. Appointments were intentionally scheduled with time intervals in between, affording students the opportunity to leave the lab while safeguarding their confidentiality. It is worth noting that the implementation of the intervention proceeded without encountering any delays or technical malfunctions, with the exception of a single instance where the system had to be restarted before the participant commenced the scenario, and this issue was promptly addressed.

In the qualitative phase of our study, we conducted semi-structured interviews with a subset of our student participants. Out of the total student sample of 71, 15 students voluntarily participated in the qualitative interviews, providing in-depth insights into their experiences with the immersive VR-based empathy training. These interviews were chosen, as they allow for open-ended exploration while providing some structure to the discussion.

The semi-structured interviews with the students aimed to uncover their perceptions, emotions, and reflections related to the VR-based empathy training program. We wanted to gain a deeper understanding of how this immersive training influenced their perspectives on dementia care, their feelings towards patients, and their overall learning experiences.

The interview questions posed to our student participants were thoughtfully designed to encourage them to share their experiences and insights. The following are examples of key questions used in the interviews:

1. Can you describe your overall experience with the immersive VR-based empathy training program?
2. How has the training impacted your perceptions of dementia care and patients with dementia?
3. Have you noticed any changes in your feelings or attitudes toward individuals with dementia as a result of the training?
4. Could you share any specific moments or scenarios from the training that have left a lasting impression on you?

By conducting these semi-structured interviews with our student participants, we aimed to capture a comprehensive range of perspectives that helped us gain a deeper understanding of the impact of the training on their empathy, skills, and overall learning journey.

Outcome Measures

Subsequent to the completion of consent and recruitment protocols, the acquisition of baseline data was carried out by impartial researchers who were not directly involved in the implementation of the intervention. Following the intervention, students in clinical practice who had completed the program were then solicited to undergo identical outcome assessments immediately post-intervention. Both the baseline data and follow-up data were obtained through a self-report questionnaire, encompassing the following outcome measures.

Socio-demographic Questionnaire

A questionnaire was administered to gather socio-demographic information from the students. This included details, such as their unique code number, gender, age, home address, previous academic experience in care homes, work history, and any prior contact with patients dealing with dementia. These socio-demographic characteristics were derived from relevant literature.

Empathy Toward the Mentally Ill Scale

The Empathy Toward the Mentally Ill Scale is a 16-item questionnaire designed to assess students' levels of empathy towards individuals with mental illnesses. It employs a 5-point Likert scale, with scores ranging from 16 to 80. A score falling within the range of 16 to 48

suggests a lower level of empathy, whereas a score exceeding 48 indicates a higher level of empathy. Turner (2007) adapted this scale from the original Emotional Empathic Tendency Scale (EETS) developed by Mehrabian and Epstein (1972). The Empathy Toward the Mentally Ill Scale has demonstrated validity and reliability, with a Cronbach's alpha coefficient of 0.71 (Turner, 2007).

Data Analysis

Quantitative data was subjected to analysis using IBM SPSS Version 26.0, a renowned statistical software package for social sciences. Descriptive statistics were employed to elucidate sample characteristics, recruitment rates, retention rates, completion rates, attendance metrics, and adherence rates, presented as frequencies, percentages, means, and standard deviations. To facilitate parametric statistical analyses, an evaluation of data normality, a prerequisite, was conducted for each outcome measure. Rigorous data scrutiny included the identification of outliers through examination of boxplots, and in instances where data deviated from normality, non-parametric analyses were invoked. P-values were computed to discern statistically significant disparities in participant demographics and characteristics.

To address the quantitative objectives of this study, tests were carried out to ascertain differences between baseline scores and post-intervention scores pertaining to empathy. The pre-determined threshold for statistical significance was established at $p < 0.05$.

Concerning the qualitative data, a thematic analysis approach, as delineated by Braun and Clarke (2006), was employed to identify and delineate key themes. NVivo, version 12, was enlisted for data organization and management. All interviews in this study were conducted in the Arabic language, necessitating the verbatim transcription of audio recordings. Subsequently, post-analysis, the transcripts were translated into English to ensure the preservation of cultural nuances within the data, a practice in alignment with the guidance provided by Chen and Boore (2010).

Results
Sample Characteristics

A total of 71 student participants were assessed for eligibility within a single educational setting. Remarkably, all 71 students met the eligibility criteria

and were included in the study cohort, resulting in a 100% participation rate. Notably, no students were excluded, reflecting a comprehensive and complete enrolment.

Baseline data was diligently collected from the entire cohort of 71 eligible participants. The study participants exhibited a mean age of 21.71 years (SD=1.3 years, range= 21-24 years), with a gender distribution fairly balanced (49.3% were females). Furthermore, 59.2% of the participants reported having had no prior interaction with individuals with dementia, while 60.6% indicated a lack of prior academic exposure or experience in a care home setting.

Retention Rate

The study demonstrated exceptional retention, with a 100% retention rate, thereby retaining all 71 participants throughout the course of the study.

Completeness of Data Collection

A thorough evaluation of questionnaire completeness was conducted, ensuring that data collection was comprehensive and without omissions. No missing data was identified in any of the outcome measures, affirming the completeness and integrity of the dataset.

Feasibility of Outcome Measures to Detect Change

Table 2 displays the variations in study variables before and after the VR intervention, as assessed through the paired-sample t-test. Following the execution of the VR intervention, a substantial disparity was evident in the domain of empathy (t = -23.89, p < 0.001). This outcome underscores the statistically significant enhancement in empathy attributable to the VR intervention.

Implementation Fidelity

The VR intervention adhered rigorously to the research protocol and methodologies, which had undergone scrutiny and approval through a peer-review process. Throughout the study's execution, no protocol violations were reported, affirming the faithful execution of the intervention as outlined in the study protocol. All student participants received the VR sessions as planned, and the individual VR sessions were meticulously scheduled and delivered to the majority of participants as per the predefined protocol.

Adherence to the Intervention

Intervention adherence was assessed primarily through session attendance. The data gleaned from this study underscored the attainment of commendable adherence levels when employing VR for student participants. Specifically, the median session attendance for those who received the intervention reached a substantial 80%.

Experience of Participants

Thematic analysis of participant feedback unveiled three overarching themes pertinent to the effective utilization of a VR application among students. These themes encompassed the importance of the application being " User-friendly," the necessity for a " Supportive Environment" to support engagement, and the requirement for "Engaging Content" to sustain interest and participation. Table 1 provides a summary of these key themes, with in-depth information available upon request.

Table 1. Overview of the experiences of the participants

Themes	Sub-themes	Participant Quotations
User-friendly	Intervention's Flexibility	"I found it really convenient that I could zoom in and adjust the screen size during sessions. It was especially helpful, because my eyesight isn't perfect, and I used this feature in all our sessions."
	Simplicity of Format	"The sessions were incredibly user-friendly and straightforward. I had no trouble participating in them, and I believe that they don't need any changes."
Supportive Environment	Minimizing Distractions	''The sessions had a great ambiance that made them enjoyable to attend."
	Adaptation to Digital Touch Screen Technology	"Using digital touch screen technology during the sessions required a bit more focus and sometimes left me feeling mentally drained."
	Availability of Guidance	"I found it easy to grasp and navigate all the app features. Whenever I had a question or got stuck, I could easily reach out for assistance."
Engaging Content	Structural Organization	"The sessions were well-structured around our own experiences and daily life. I really appreciated how they connected with our lives."
	Variety in Presentation	"The diverse ways content was presented, especially with visuals, made the sessions more engaging."

Discussion

The findings of this feasibility and usability study underscore the transformative potential of VR-based training in nursing education, particularly in the context of dementia care. One of the key outcomes of this study is the exceptionally high participation and retention rates, with 100% of the eligible nursing students participating and completing the study. This result is notable and exceeds the recruitment and retention rates reported in several previous studies that explored VR-based interventions (Kim et al., 2021; Langford et al., 2015). The comprehensive enrolment reflects the strong interest and willingness of nursing students to engage

with VR technology for empathy training.

Comparatively, some prior studies have reported challenges in recruiting and retaining participants in VR interventions, often citing concerns related to technology complexity, discomfort, or motion sickness (Brady et al., 2023; Chang et al., 2020; Weech et al., 2019). The exceptionally positive recruitment and retention rates observed in this study suggest that, with careful design and implementation, VR can be well-received and embraced by nursing students.

The significant improvement in empathy scores among nursing students' post-VR intervention aligns with the outcomes of previous research (Bailenson,

2018; Khalil et al., 2023). Our findings contribute to the growing body of evidence that supports the efficacy of immersive VR experiences in enhancing empathy. Several earlier studies have demonstrated that VR can effectively simulate real-world scenarios, enabling participants to step into the shoes of others and experience situations from different perspectives (Dwivedi et al., 2022; Tan et al., 2022). Such immersive experiences can foster a deeper understanding of patients' emotions and perspectives, a cornerstone of empathy (Bailenson, 2018).

While the enhancement of empathy is a consistent theme across various VR-based interventions (Bailenson, 2018; Khalil et al., 2023), it is important to note that the magnitude of improvement may vary based on the specific intervention and target population. In our study, the substantial increase in empathy scores suggests that VR-based training holds promise for addressing the empathy deficit observed among nursing students preparing for dementia care.

Improved empathy, as demonstrated by the significant enhancement in empathy scores among nursing students post-VR intervention, holds significant implications for healthcare practice. Empathy is not merely a desirable attribute in healthcare providers; it is an essential component of patient-centered care. When nurses possess heightened empathy, they are better equipped to establish rapport with patients, understand their unique needs, and provide emotional support. In the context of dementia care, where patients often grapple with cognitive and emotional challenges, empathetic nursing professionals can make a substantial difference. They can foster trust and cooperation, reduce patient and caregiver stress, and contribute to overall improvements in the quality of care. Moreover, as research suggests, increased empathy can lead to better patient satisfaction, adherence to treatment plans, and potentially improved clinical outcomes (Derksen et al., 2013; Moudatsou et al., 2020).

The thematic analysis of participant feedback provides valuable insights into the user experiences and usability of the VR application. Participants emphasized the importance of a user-friendly interface, highlighting features such as screen adjustments for convenience. These findings corroborate the results of previous studies that have emphasized the significance of user-friendly design in VR applications (Issenberg et al., 2005; Punchoojit & Hongwarittorrn, 2017; Wei et al.,

2020). The ease of use and intuitiveness of the VR platform likely contributed to the high levels of adherence and engagement observed in this study.

Similarly, the need for a supportive learning environment emerged as a key theme. Participants appreciated the ambiance of the VR sessions, which made them enjoyable to attend. This aligns with prior research that has highlighted the role of the environment in shaping the VR experience (Dwivedi et al., 2022; Zhang et al., 2022). Creating a comfortable and immersive environment can enhance the effectiveness of VR-based training.

Moreover, the requirement for engaging content was another prominent theme in participant feedback. The diversity in content presentation and its connection to participants' daily lives were noted as strengths of the VR application. These findings resonate with previous studies that have emphasized the importance of content variety and relevance in VR interventions (Marougkas et al., 2023; Santos Garduño et al., 2021). Engaging content is essential for maintaining participant interest and motivation.

In comparison with prior studies on VR usability and user experiences, our findings highlight the importance of a holistic approach to VR design. It is not solely about the technology, but also about creating a user-centered and supportive environment that fosters engagement and learning. These findings resonate with previous studies that have emphasized the importance of a holistic approach to VR design (Fromm et al., 2021; Oje et al., 2023).

Despite yielding valuable insights and contributing to the existing knowledge on nursing students, this study exhibits several weaknesses that warrant attention.

The evaluation of students' empathy relied solely on a single simulated experience, raising concerns about its ability to accurately reflect real-world empathy levels. Furthermore, the use of a single group design, combined with variations in student roles, may have introduced confounding factors that could have complicated the interpretation of results.

Moreover, given that the research relied on self-reported data, it is crucial to acknowledge the potential influence of desirability bias on the study's findings. Consequently, the study's generalizability should be approached with caution. Notably, this study lacked randomization and a comparative cohort, opting instead for a pre-posttest design.

Implications for Nursing

The findings of this study hold significant implications for the field of nursing education and practice. Firstly, the successful integration of VR technology into nursing education underscores the importance of incorporating modern educational tools. As demonstrated in this study, adopting VR-based training can significantly enhance students' empathetic abilities, particularly in the context of dementia care. It not only prepares nursing students for real-world patient interactions, but also equips them with the skills necessary to navigate the complex landscape of dementia care within healthcare facilities. Therefore, nursing institutions should consider embracing and adapting to modern technology to ensure that the next generation of healthcare professionals can provide higher quality and more empathetic care to patients.

Secondly, as healthcare providers increasingly focus on patient-centered care, the findings of this study highlight the potential for VR-based training to promote patient satisfaction and improved outcomes. Enhanced empathy, a result of this training, can lead to better patient experiences and more effective healthcare interventions, particularly in dementia care. Therefore, healthcare institutions should consider incorporating VR-based empathy training into their curricula to create a more compassionate and patient-oriented nursing workforce.

Lastly, the positive feedback on user experience and design considerations from this study offers practical insights for nursing educators and institutions looking to implement VR-based training in their programs. These insights include the importance of a user-friendly interface, supportive learning environments, and engaging content. Nursing schools and institutions can use these recommendations to design effective VR-based training modules, ensuring a smoother transition to modern education methods.

In conclusion, the integration of VR technology into nursing education has the potential to transform how nurses are prepared to provide care, particularly in the context of dementia. The implications discussed here pave the way for more empathetic, patient-centered nursing practices and provide practical guidance for their successful implementation in nursing curricula.

Conclusion

This study underscores the promising role of VR-based training within nursing education, with a specific focus on dementia care. The robust feasibility outcomes, coupled with the enthusiastic engagement of participants and the notable enhancements in empathy scores, underscore the viability of incorporating VR technology into nursing curricula. The valuable user feedback gleaned from this study offers a roadmap for future refinements. Importantly, the integration of VR-based training emerges as a potent tool for augmenting empathy among nursing students, with the potential to yield tangible benefits in the realm of patient care.

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Conflict of Interest

No conflict of interest is to be declared by the authors.

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