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Using virtual reality to teach nursing students communication skills when breaking bad news: A focus group exploration of participant experiences

Laura Jillian Park[A]

Claire Ford[B]

Andrew Christian Melling[C]

A   Assistant Professor, Northumbria University

B   Assistant Professor, Nursing, Northumbria University

C   Dean of School of Nursing and Midwifery, University of Central Lancashire

Abstract

Within higher education institutions, the use of virtual reality technologies has increased. However, while research is rich in the gaming and entertainment industries, the evidence within the field of undergraduate nursing is only just starting to emerge. The aim of this project was to explore 2nd-year undergraduate adult nursing students' perceptions of using virtual reality as an adjunct to simulation teaching. Using a qualitative approach to enquiry and purposeful sampling, 17 students participated in one of 3 focus groups. Their responses were audio recorded, transcribed verbatim and analysed using thematic analysis. Data was independently coded and emerging themes, which were identified, were compared, and agreed upon by the research team. Four central themes emerged including *fidelity, facilitation, facilities, and student learning*, which have been incorporated into a multimodal pedagogical model. For successful implementation of this innovative teaching strategy, it is suggested that academics need to be cognisant of the study's central themes, and how these interact and impact student satisfaction and levels of immersion.

Introduction

Globally, over the last decade, digital technologies have become essential resources for providing and supporting safe patient care and have emerged as helpful tools to tackle some of the most challenging healthcare issues in the 21st Century (World Health Organisation, 2022). Topol (2019) predicts that their use will continue to increase, eventually influencing 90% of all future healthcare interactions. Digital technologies have now also expanded beyond direct patient care delivery and innovations like virtual reality are now being used to educate and teach the future healthcare workforce (Dubovi et al., 2017; Schleicher, 2019; Hagge, 2021).

Virtual reality technology involves the utilisation of computer-generated graphics and advanced technology to produce engaging three-dimensional settings. These environments can be replicas of real-world settings or entirely fictional, existing outside the boundaries of reality (Jeon et al., 2020). The increasing popularity of virtual reality can be attributed to advancements in the gaming industry and the availability of affordable options like Google Cardboard and inexpensive 360-degree cameras. These developments have expanded the use of virtual reality in various fields, including education, by unlocking its potential as a powerful learning tool. In a recent systematic review conducted by Hamilton et al. (2020), the use of virtual reality in various domains was explored. Surprisingly, only 14% of the reviewed articles were related to medicine and healthcare, while most studies focused on virtual reality in science education.

While the exploration of virtual reality technologies as a teaching tool within healthcare has been previously limited to medicine and dentistry (Harrington et al., 2018; Huang et al., 2018), or as a tool to enable safe procedural skill acquisition (Ulrich et al., 2014; Smith & Hamilton, 2015; Dubovi et al., 2017; Chang et al., 2019; İsmailoğlu et al., 2020). The utilisation of virtual simulation learning platforms has become more prevalent in nursing education, especially amid the COVID-19 outbreak. These offered students a secure and supervised environment to hone their skills repeatedly, which they may not have had the opportunity to do in a traditional classroom setting (Prion & Haerling, 2020; Chao et al., 2021; Chang & Lai, 2021). They also provided a solution for students who, because of lockdown and shielding constraints, had limited clinical exposure (Goldsworthy et al., 2022).

One of the rare benefits of the pandemic was the opportunity to look outside of traditional educational practices and try new approaches. The benefits of virtual reality as a teaching method in nursing have thus been seen to have additional benefits outside of COVID-19, with the approach improving traditional hands-on teaching methods by its ability to remove teaching constraints such as space and time (Chen & Liou, 2022). Healthcare academics should, therefore, be encouraged to incorporate various technologies in the classroom and consider the underlying pedagogy, as simply introducing a virtual reality product into an existing session does not guarantee effective and impactful learning (Vogt et al., 2021). There is, therefore, an urgent need to consider the evidence base and conduct further research that will provide evidence of the most beneficial learning and teaching approaches to assist academics and enhance the usefulness of virtual reality in nurse education.

Literature review

Literature was searched using several online databases (CINAHL, EBSCO, PubMed, Science Direct, Web of Science, and Google Scholar). Articles were then filtered for relevance by perusing the abstracts. Key terms included 'Virtual Reality', 'Technology for Learning and Teaching', and 'Nurse Education and Pedagogy'. Several themes emerged from the literature, including the benefits of virtual reality for skill development, the ability to expose students to a diverse range of scenarios in a risk and stress-free environment and limitations associated with costs, accessibility, and learning transfer.

Skill development in an environment that is stress-free

Nursing students can benefit greatly from virtual reality platforms and programmes that provide realistic scenarios for skill acquisition, decision-making, and critical thinking. Across several contemporary empirical research studies (Chang & Lai, 2021; Saab et al., 2021; Chen & Liou, 2022), virtual reality environments and teaching practices have been considered stress-free by student participants.

Saab et al. (2021) adopted a phenomenological approach to understand 15 participants' viewpoints of learning through the medium of virtual reality. Findings revealed that students viewed this approach as safe and stress-free as it enabled them to practise nursing skills without the fear of failure or real-world repercussions. Participants also commented that they appreciated the flexibility and autonomy it afforded them, as they could revisit the scenario repeatedly, refine their skills and manage their own learning at a time convenient to them, which increased their feelings of confidence.

A mixed methods approach by Chang and Lai (2021) also provided similar results. Surveys and interviews were used to gauge students' stress perception and self-efficacy in learning nursing skills through virtual reality, and the findings indicated that participants perceived the use of immersive VR as a stress-free learning environment, students were less anxious and more comfortable when practising nursing skills in the virtual environment compared to traditional methods.

These findings were echoed in another 2022 study by Chen and Liou, who investigated the effects of immersive virtual reality on nursing education with the aid of a quasi-experimental design. 40 nursing students received training with the virtual reality equipment, and the other 40 students were provided with the same learning but through traditional teaching methods. Results revealed that less stress, associated with the use of virtual reality, increased confidence levels and improved learning outcomes.

Diverse scenarios that are free from risk of harm to patients

Another theme found when reviewing the literature was that the use of virtual reality platforms allows nursing students to experience a wide range of clinical scenarios, including rare or high-risk situations that they may not encounter during their clinical placements. It also has the potential to expose them to diverse patient populations, settings, and challenges without the risk of endangering patients (Cant et al., 2017; Foronda et al., 2020). Whilst it can be said that alternative forms of simulated teaching practices, such as high-fidelity simulation with the use of mannequins, and low fidelity with task trainers have been seen to offer students a range of clinical scenarios which can include sensitive topics that do not pose a danger to patients (Platt, et al., 2018), the added benefit of simulated practice with the use of virtual reality platforms is that it is less resource-intensive as it does not require staff, actors and medical consumables. Recently, Liu et al. (2020), Ma and Zheng (2020), and Shin et al. (2021) have published multiple systemic reviews and meta-analyses highlighting further advantages. According to the conclusions drawn from all three papers, virtual reality has the potential to be a more economical option as it eliminates the need for physical equipment and requires fewer teaching resources. In some cases, students may not require supervision and can use their own devices. Sessions can potentially be expanded to accommodate more students without requiring additional staff or resources. Alternatively, students can be encouraged to complete the work independently from a remote location, which diminishes the necessity for a physical classroom.

Limitations associated with costs, accessibility, learning transfer and cybersickness

However, the literature also reveals that the implementation of virtual reality technology in nursing education can be expensive, particularly at the early procurement stages, as the initial outlay for the equipment and software can be extremely costly (Baniasadi et al., 2020). Once the equipment is delivered, it is important to consider additional maintenance costs and technical support. To ensure a seamless and immersive experience, it is also crucial to review, invest in and enhance the infrastructure as Wi-Fi functionality can be affected by bandwidth and network limitations (Hamad & Jia, 2022).

The limitations of technology in replicating real-world scenarios may also affect learning transfer, and physical practice may be necessary for consolidating knowledge. This may offset the benefits of using this method instead of traditional teaching practices. Furthermore, a recent meta-analysis conducted by Chen et al. (2020) revealed no significant difference in skill acquisition between virtual reality and traditional teaching methods.

Cybersickness was also found by Hamad and Jia (2022) to be a downside to virtual reality. This is defined as an uncomfortable side effect associated with symptoms such as nausea, postural instability, disorientation, headaches, eye strain, and tiredness (Nesbitt & Nalivaiko, 2018). The effect of this can be increased if the user is standing rather than sitting if they use virtual reality for prolonged periods and if the user is predisposed to motion sickness or nausea (Laviola, 2000; Rebenitsch & Owen, 2014).

Methodology

Aims

This study aimed to explore undergraduate nursing students' perceptions of immersive learning delivered within a pre-registration curriculum. In particular, the study aimed to evaluate student experiences of using virtual reality as an adjunct to simulation teaching. The study had 3 main objectives:

- To evaluate nursing students' reactions to using virtual reality technologies.

- To gain an understanding of any perceived added value of using virtual reality as opposed to traditional teaching.

- To develop guidance on the integration of virtual reality into the classroom for other healthcare academics.

Study design

This study was part of a three-stream research project that looked at evaluating technology-enhanced learning within undergraduate nurse education. The virtual reality stream of the study adopted a qualitative approach to enquiry using realist evaluation and was targeted at second-year BSc adult nursing students. The realist evaluation methodology, rooted in the realism philosophy, was selected as an appropriate approach for this study as it provides explanations and insights into why virtual reality 360 videos may or may not be effective, for whom, and in what contexts (Intrac, 2017; Public Health England, 2021). Data collection for the 3-stream project commenced in June 2017 and was completed in November 2018.

Procedure

A short clinical scenario, that had the potential to help students meet their module learning outcomes, was developed, and scripted by academic staff. The scenario focused on communication skills and highlighted areas of poor practice related to breaking bad news. The script was acted out by staff and students and filmed using a Kodak 360o camera within the University's clinical skills centre. The footage was edited using Premier Pro (Adobe) and Kodak Pixpro 360-stitch software, to create an immersive experience when viewed through a virtual reality headset. The video was then uploaded onto a secure YouTube account.

To participate in the research, students were first required to view the 360o video, which was embedded into a classroom-based seminar. Before the timetabled seminar, students

received preparatory information, which included advice to bring their smartphones and earphones to the session.

During the seminar, the students were given an introduction to the equipment, which included guidance on accessing the video and prompts for using the 'cardboard' headsets. Cardboard headsets are a cheaper alternative that allows the maximum number of students to view the video at one time (Lee et al., 2017). To troubleshoot technical issues, the research team also ensured they were present at each teaching session to assist students with the technology. Students were first asked to watch the 360o video in unison and then allowed freedom to replay the video before a debrief of the session learning outcomes, which was facilitated by the lecturer.

Ethical considerations

Ethical approval for the study was granted by the University Faculty Ethics Committee (ethics reference, 655). All potential participants were fully informed about the purpose and aims of the research via an information sheet, which was given immediately after the conclusion of the seminar. Students who indicated that they wished to participate were then invited to attend a focus group, which was conducted in another part of the University on the same day. At the start of each focus group, additional information was provided and written informed consent was obtained from all participants.

Sampling and recruitment

The cohort was split into 8 groups of approximately 20 students, giving a participant potential of N=160. Volunteer sampling was utilised, and all but one group was offered the opportunity to participate in a focus group to discuss their experience. Focus groups were conducted within a few hours of the completion of the seminar and always on the same day. The one group, which was not offered the opportunity to participate, had experienced the seminar late on Friday before a week's holiday and therefore, no research staff were available to lead the focus group. The rationale for recruiting on the same day was twofold, it aimed to increase participation and also to ensure that the virtual reality experience was fresh in the participant's minds.

Data collection and analysis

Focus groups, as a data collection method, allowed participants to not only respond to the questions posed by the researcher but also provided them with the opportunity to engage in a discussion and debate about the topic, unlocking information about an issue that they might have not thought of if they had been interviewed on their own (Harvey & Land, 2021). All focus groups were conducted by an experienced researcher, who made it clear that they had not participated in the creation of the video scenario or the seminar materials and facilitation. The focus groups lasted for approximately one hour and the researcher used a standard set of prompt questions to facilitate discussion, which assisted with focus and continuity between the

different groups, contributing towards the validity and rigour of the study (Gray, 2018).

Qualitative data analysis aims to comprehend the significance and provide a precise representation of it for others (Creswell & Poth, 2018). While there are multiple frameworks available for conducting qualitative analysis, there is no single definitive method for engaging with the data to facilitate understanding and interpretation. In this study, the data was audio recorded, transcribed verbatim, and analysed using thematic analysis. This process involved initial coding and identification of categories that were independently undertaken by members of the research team. This approach allowed for the transcripts to be checked and reviewed multiple times from a fresh perspective, with essentially a second and third layer of analysis, to minimise errors and enhance credibility and confirmability, as recommended by Green and Thorogood (2018). The data categories were then collaboratively reviewed before the final overarching themes were agreed upon.

Analysis and discussion

Participant characteristics

In total N=17 participants attended one of three focus groups conducted. Participants were all 2nd year BSc adult nursing students, consisting of students from 5 different seminar groups. There were 14 female and 3 male students. Four overarching themes emerged from the focus groups: facilitation, fidelity, facilitation, and student learning, which have been used to create the Three F Key Concept model (Figure 1) for successful implementation. Each theme is presented in turn and supported by verbatim quotes, which are attributed to individual sample participants.
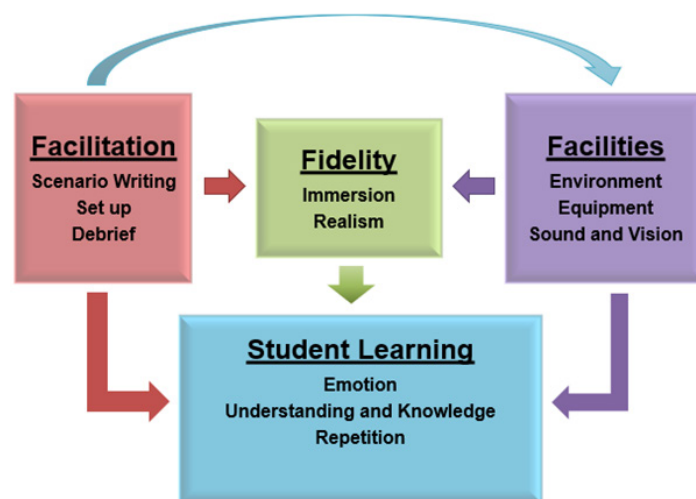

Figure 1: The Three F Key concept model.

Theme 1: Facilitation

The role of facilitation for virtual reality implementation was identified as a key theme which influenced the levels of fidelity experienced by the students as well as the overall student learning. Facilitation was characterised by the sub-themes of scenario writing, the setup and the debrief.

Participants suggest that careful consideration of the content, the timing of delivery and the target audience can all impact engagement. In this study, second-year students felt that the virtual simulation would have had a greater impact in the first year, particularly before any clinical practice.

"I think the technology and the scenario might be good for first-year students who are very anxious about basic life support." (FG3 / P4)

"That's what I mean about being in the situation….. For me, that would be a great thing to see before I went into practice." (FG1 / P1)

Developing scenarios that are closer to reality, that stretch and challenge individuals may be key to greater immersion and more effective learning.

"Like I'm going into the third year soon and I thought it was quite a simple video and it was something we've gone over before. So, it's like drawing on previous learning experience but I thought it could've been a lot more challenging." (FG1 / P2)

Scenario realism was seen to impact fidelity, which may be why participants believed that virtual reality as a teaching strategy should not be overused or implemented as a replacement for real-life simulation facilitation.

"Yeah, it was like a good gap between like normal seminars and practicals." (FG2 / P5)

"I don't think it should replace anything; I just think it should be in addition to." (FG2 / P6)

"I don't think it should be overused though. I think it should be like a treat." (FG1 / P1)

It is clear that careful planning and preparation are required to deliver virtual simulation away from traditional simulation settings and the role of a technical facilitator is crucial. Participants noted that the facilitator's presence and their level of input were important to their learning and overall experience.

"She was really good actually. She knew what she was doing, she knew how to fix them, how to work it but she knew exactly what to do." (FG1/ P2)

In addition to assisting with technical issues, the participants pointed out that the facilitators' role was vital in keeping students focused on the aims and outcomes of the session and that if they had been left to view this as a self-directed study, the learning would not have been as effective.

"New stuff like that, is always done better in class. Some people won't do it or do it properly, so it is better to do it in class with, like a member of staff directing you." (FG1/ P2)

"I did benefit from talking about it afterwards, rather than just sitting at home. I think people just wouldn't put the glasses on and it wouldn't be the full experience I don't think, at home." (FG2 / P6)

However, there was some suggestion that the pre-brief was not helpful.

"I think if you want to get people to take it more seriously and pay more attention, then a suggestion would be, to not put the prompts on the board before putting the headsets on." (FG3 / P4)

Instead, they preferred discussing what they had discovered after watching the video and expressed the need for the facilitator to lead this debrief to gain and share student feedback.

"I thought the feedback at the end was quite good. Then we went on and spoke about de-escalation like different aggressive patients, like inappropriate patients and all of that." (FG1 / P1)

"Talking about the video was quite good…..you know seeing things in real life, erm, and talking about it was interesting." (FG1 /P3)

"You get other people's views as well, like the stuff you didn't notice." (FG2 / P4)

For some participants, this short, virtual experience, which was followed by a detailed debrief, was beneficial. It instilled a sense of inclusion and reduced feelings of anxiety sometimes associated with in-person simulation.

"It kind of brought everyone back at the end, everyone kind of had time to say what they thought." (FG1 / P2)

"I felt less pressure. 'Cos, I don't tend to like when we do the like, role play or those kinds of thing. I don't tend to enjoy them. So, I felt a lot more relaxed and found it easier to get involved." (FG2 / P3)

Theme 2: Facilities

The facilities theme encompasses four sub-themes including the equipment, the learning environment, sound, and vision, all of which were reported by the participants to have a direct influence on the levels of immersion, fidelity and student learning, and as the model illustrates is also closely aligned with facilitation.

Students were asked to bring their own headphones; however, ambient noise was reported by some participants as being a negative factor and had a direct impact on their ability to listen to what was being said.

"I did feel like I was in it, but I could hear everyone else talking." (FG1 / P1)

"I think there was a difficulty with sound, even though I had earphones in, I struggled to hear a lot of what was going on. There was a lot of movement, shuffling and other kinds of background noise that made it difficult." (FG3 / P4)

Linked with sound, the importance of the overall quality of the video was also found as a sub-theme and was often mentioned by participants to have a direct impact on

feelings of immersion. As the students viewed the video via their own devices, through cardboard headsets, the quality differed as some mobile devices could not show the video at higher resolutions. Consequently, those who had devices with higher resolutions and better images appeared to experience higher levels of immersion than those with poorer video quality.

"Yeah, it was a lot more immersive, you could see the picture really well and the sound was really loud." (FG3 / P3)

"Graphics is a big thing though like if you have the better quality, you're more involved in it. Because for me I couldn't properly see things, so you were just listening really. You weren't paying as much attention because you couldn't hear and see very well." (FG3 / P1)

Students also commented on poor Wi-Fi connection, equipment failure and suitability, and even access as some participants reported having to borrow a fellow student's phone to view the video.

"Like the technology, like some of our mobile phones weren't working quite right or took ages to buffer and stuff."(FG2 / P7)

"Well, I couldn't even get my phone to work." (FG2 / P3)

"Yeah, it all depends on the quality of the phone. Some people had newer phones, some people had older, and some people had smashed screens so needed to borrow mine." (FG1 / P1)

The cardboard headsets used to view the video were also an equipment topic which was commented on by many participants, with both positive and negative perspectives being voiced.

"The goggles themselves were pretty good. They block out all the other lights and stuff, so that was good. A good piece of equipment." (FG1 / P2)

"It felt like double magnification. Like, quite distorted. It reminded me of the glasses I used to wear when I was younger. You know like it just wasn't... the quality just wasn't very good. Like, for me it was like, very blurry." (FG2 / P3)

"I think a better headset would've been better. They weren't comfortable." (FG3 / P3)

As well as the equipment, the learning environment emerged as being equally important. All seminars were conducted in standard seminar rooms with up to 20 students taking part and simultaneously watching the video. Students suggested larger rooms that facilitated safe movement would have been beneficial.

"Yeah, maybe if it was like in a different setting. Obviously, not in something bizarre, but because it was like in a classroom layout, if we were maybe in a hall." (FG3 / P5)

"Would've been better to do it maybe in a bigger space with no tables. So, you could walk around a bit more freely." (FG1 / P1)

Theme 3: Fidelity

Fidelity relates to the degree of exactness with which the real world is reproduced (McMahan et al., 2012) and this emerged as a central theme which was influenced by facilitation and facilities and comprised of the subthemes, scenario realism and immersion (the perception of being physically present in a non-physical world).

Although levels of immersion were expressed by most participants, for some, the scenario narrative was overdramatised and exaggerated which reduced immersion and therefore, fidelity.

"It made you feel like you were there, and I did like the video, but I think what would've made it better for me would've been an even more realistic scenario." (FG1 / P2)

"There were little things that would quite often happen, like the curtain being left a little bit open; that's quite believable. However, I think some things were a bit exaggerated." (FG2 / P4)

"It's not what you would say unrealistic, but it was quite exaggerated. So, I think for me, for future virtual reality videos, I would have liked to have seen something a bit more realistic." (FG1 / P3)

"Cos half the things that were going on, you know wouldn't happen in reality, so it was overdramatised." (FG2 / P2)

Levels of immersion and realism for fidelity were also found to be influenced by the location in which the video was viewed by participants. This was exhibited by participants who felt that being in the same or a similar clinical location when watching the video would contribute to the levels of immersion felt.

"Maybe even in the clinical skills bit itself so when you take the glasses off, you are kind of there." (FG1 / P1)

Theme 4: Student learning

Whilst acknowledging that the facilitation and the facilities theme have a direct impact on fidelity, the 3 F's (facilitation, facilities, and fidelity) together and individually play a central role in student learning. Simulation in healthcare is time and resource-intensive, which often means students are not provided with the opportunity to repeat simulation sessions. Creating a virtual reality real-world clinical scenario was reported by participants as being important for supporting student learning as it allowed for repetition.

"I liked how you could watch the video as many times as you wanted to. You could be like: "Oh, I missed a bit" and do back." (FG2 / P6)

"Yeah, you could re-watch it and you could think of things you've missed, whereas you'd miss a lot I think if you'd just watched a video or listened to someone." (FG1 / P7)

Participants articulated that although the video was watched individually, it felt interactive and fun, which helped with engagement and that this along with the facilitation and debriefing, increased knowledge and understanding.

"I could turn about and do my own thing, so I guess it was more like an interactive thing." (FG1 / P2)

"I wasn't bored I was engaged all the time. Like sometimes I do switch off, but I didn't switch off I think." (FG1 / P1)

"I feel like it's more memorable, because it's something different, like another learning opportunity that you've kind of given us." (FG2 / P7)

The final subtheme of emotion was found to influence students' learning experiences, as increased feelings of immersion were associated with feelings of emotion, particularly if the students had not witnessed this scenario in clinical practice.

"I think like, emotionally, you feel like you're there and like... like you're breaking bad news, like sitting in a side room with the family or something. Which is good cos sometimes you don't get to be in the room when you're a student in those situations." (FG2 / P4)

"For me, ...to actually be there and experience it for the emotional side and to see what's going on." (FG3 / P3)

The findings highlight that to enhance student learning, it is vital to consider the elements associated with facilitation, facilities, and fidelity and that these need to be addressed collectively and not in isolation from one another. Current emerging research (İsmailoğlu et al., 2020; Jeon et al., 2020; Liaw et al., 2021; Petersen et al., 2022) examining and exploring the use of virtual reality technologies, have found similar findings, especially regarding facilities and facilitation, which are considered paramount for increased fidelity. According to Ulrich et al. (2014), giving students prior exposure to equipment and session preparation can help them familiarise themselves with the equipment and potentially reduce problems with the headsets and video-playing devices during the actual teaching session. It is also important to consider potential issues with the technology and equipment until it becomes more widely used, and to factor in a troubleshooting plan in any material development (Foronda et al., 2014).

Verkuyl et al. (2021), Brown et al. (2022) and Goldsworthy et al. (2022) have also concluded that group debriefing enhances clarity and depth of learning as this allows students to reflect on their experiences. Location was found by Saab et al. (2021) to be important from a safety aspect as students needed a safe area to practise by trial and error. The findings from this study echoed these views as students stated they needed room to truly benefit from the 360o perspective; they found the pre-brief and introduction to the hardware beneficial and attributed the debrief and facilitator-led discussion to be advantageous for their knowledge and learning and created a more inclusive environment as opposed to roleplay or simulation.

Based on the results, it is evident that the quality of headsets, availability of equipment, and ambient noise levels have a significant impact on immersion and fidelity, which in turn affect student learning. It is imperative to have reliable equipment that enhances immersion through proper visual and noise management to improve the overall student experience and facilitate effective learning. Moreover, the environment, number of students in each session, effective session planning, and facilitator skills can also be adjusted to enhance immersion.

Limitations

Several limitations have been identified and are worthy of consideration. Firstly, due to the limited sample size and the involvement of only one BSc nursing cohort, findings from this study may not be applicable to other student populations or academic settings. Additionally, as only one scenario was viewed by the students, the scores of responses are limited. To broaden the efficiency of the pedagogical model, it would therefore be beneficial to replicate this project with a larger and more diverse cohort of students and also to review a range of videos and scenarios to see if they trigger varying reactions.

Notwithstanding the limitations, the responses from the students have provided valuable insight into the positive and negative aspects associated with virtual reality technology implementation which have proved pivotal in the creation of the Three F Key concept pedagogical model which has the potential to be used by other institutions to assist academic staff when considering incorporating virtual reality and 360 videos into their curriculum.

Conclusion and recommendations

In conclusion, as technology continues to advance and develop at a rapid pace (Health Education England & Royal College of Nursing, 2019; Topol, 2019), educators must embrace alternative teaching strategies (Council of Deans of Health, 2022). Virtual reality technologies could be seen as one possible answer as they are considered a good, supportive, flexible, and affordable alternative to running and facilitating repeated simulated sessions and bridging the theory-to-practice gap (Smith & Hamilton, 2015: Ulrich et al., 2014; Schleicher, 2019). However, new technologies, such as 360o videos, are not easily implemented and present challenges and complexities which academics need to circumnavigate. To assist educational establishments to evolve and expand their teaching repertoire and to enhance

the student experience when integrating virtual reality technologies, the findings from this research study and the Three F pedagogical model will hopefully provide a suitable framework for other institutions to utilise to circumnavigate some of the challenges that can be found.

It would be beneficial to assess the effectiveness of this teaching approach in incorporating virtual reality technology into various fields of study. This can help enhance the existing evidence on the challenges that arise and determine whether the model needs to be customised for different professions or if it can be widely implemented in higher education institutions.

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