Perceptions of health professions students on the use of immersive virtual reality

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Background. Over the past decade, the utilisation of technology in education has undergone a rapid shift, which the COVID-19 pandemic has further accelerated. Students are the end users when introducing a new tool such as virtual reality (VR).
Objective. This study aimed to explore health professions students' perceptions of the use and application of VR in education.
Methods. A total of 18 participants were recruited for this semi-structured study. The study used qualitative research design, employing Braun and Clarke's six-step approach to thematic analysis. The research was conducted across various departments and schools within a South African university health science faculty.
Results. Although, for most participants, this was their initial encounter with VR, the experience was predominantly beneficial and enjoyable. The engaging and interactive nature of VR captivated the participants, facilitating a secure environment for learning. Furthermore, they were convinced that VR holds significant potential in anatomical and clinical education domains.
Conclusion. The study results present a positive reception of VR as a valuable educational tool by offering immersive, engaging and interactive learning experiences. Despite technical and financial hurdles, the potential of VR to enhance visual comprehension, provide safe and practical training scenarios, and align with curriculum goals, particularly during inaccessible clinical settings such as the COVID-19 pandemic, showcases its promising future in education.

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Virtual reality (VR) is currently receiving significant attention in health professions education.[1] However, to fully realise the potential of VR to improve education, it is necessary to better understand students' experiences and expectations when using this technology. Successful VR implementation depends mainly on students' acceptance of the teaching tool or method. Studies related to VR have indicated that fewer than half of medical students have experience with VR and online training.[2] Even those with experience have used it fewer than five times.[3-6] Research has shown that students generally prefer VR over more traditional practical training methods[2-6] owing to its benefits as a simulation programme that ensures patient safety.[6] Additionally, VR learning decreases the threat posed by lecturers and promotes engagement in the course.[5] Consequently, VR fosters a secure and conducive environment for health science student learners to thrive, as is supported by Klomp.[7]

VR can improve understanding, motivation and knowledge retention.[5] However, VR holds challenges such as the digital divide and technological competency. These are two significant issues in the use of technology. The term 'digital divide' refers to the gap between those with access to technology and those without access.[6] Even though the digital divide has improved with technology becoming cheaper and more accessible, the separation could be between physical and epistemological access;[8] it remains a challenge in developing countries owing to their lower socioeconomic status.[9] The results of various studies state a preference for VR over the current practice of education,[10-12] and articles seldom assess the use and acceptance of VR in health professions education (HPE). Moreover, every generation differs, and students' learning styles vary.[13,14] Consequently, learning is influenced by their upbringing, education and events they have experienced, which make them unique. Freina[15] discussed the generational cohort theory, which explains and explores reasons for the change in different generations. This explanation includes labelling the generations regarding distinct values, attitudes and behavioural traits. The present generation is also called Generation Alpha.[16] Their learning method is also different as they are more technologically savvy than the previous Generation Z, which could indicate that their acceptance of technology (such as VR) could be higher. Ziatdinov and Cilliers[16] contend that Generation Alpha does not want to be confined to boundaries; it wants quick access to information and learns through technology. Therefore, it is essential to consider the perception of each generation when introducing new technologies in the educational setting. While some students may be more open to VR applications, others prefer current teaching methods. Moss'[17] generational cohort theory suggests that people of the same age group tend to have similar attitudes and beliefs shaped by shared experiences, historical events, and cultural influences. These generation labels should not be 'one-size-fits-all' but a direction shift in understanding how they may wish to acquire knowledge. By understanding generational characteristics and preferences, educators can better tailor their teaching methods to engage and motivate students.

Exploring and understanding why or how students learn well or poorly can facilitate learning and eliminate possible challenges. Students' perspectives provide educators with first-hand information regarding the experience and expectations of their learning preferences. Giordano[18] suggests students struggle with different problems when learning with VR; these concerns included being unable to take notes while engaging in VR activity, image

quality sometimes is unclear, inability to pause and ask questions for clarity, uncomfortable headset (heavy and bulky) and cybersickness. Therefore, one must weigh the advantages and disadvantages of using and applying VR in learning and teaching. This study aims to determine the perceptions of health professions students in the use and application of VR.

Methodology

Research design

The qualitative study used an interpretive research paradigm to explore the perception of using VR by health professions students.

Study participants

The study utilised purposeful sampling. Data saturation was reached after 18 participants.[19,20] The study included 18 first- to fourth-year full-time undergraduate health sciences students. It excluded departments and schools that did not have any undergraduate teaching and those departments of schools that are not related to health science education.

Data collection method

The participants were placed in three VR scenarios, after which a semi-structured interview (Appendix A) was conducted to explore their perceptions and experiences. Below are the three applications that were used in the demonstration:

1. The Body VR: Journey Inside a Cell – Steam VR (about 15 minutes)
2. ShareCare You VR – Steam VR (about 10 minutes)
3. Ghost Productions: Wraith VR Total Knee Replacement Surgery Simulation – Steam VR (about 8 minutes).

The interview schedule was crafted following Bearman's method,[20] which advocates a practical approach to devising a semi-structured interview. After the initial development, a pilot study was conducted to refine the interview schedule further. The feedback obtained from the pilot study was invaluable; it highlighted potential issues and allowed adjustments to be made to the interview schedule before it was administered in the larger study.

Data analysis

During the interview, participants answered questions about their experiences and perceptions of VR in health education. Participants shared their experiences of being immersed in VR as a health professions student. This approach provides insight into their first experience and provides information on how VR could be set up and used in HPE. The researcher and assistant transcribed the interviews verbatim. The study utilised Braun and Clake's six-step thematic analysis.[21]

Quality assurance

The present qualitative study emphasised transferability, dependability, and peer debriefing to ensure trustworthiness. To enhance transferability, the authors provided detailed descriptions of the research contexts, participants and methods, along with thick descriptions of the data, allowing readers to assess the applicability of our findings to their specific situations.[5,19] The authors maintained dependability by documenting their research design, data collection, and data analysis procedures and by keeping an audit trail, enabling external reviewers to examine our process.[10] All interviews were audio-recorded and transcribed verbatim. Data were securely kept, and participants were often consulted during analysis to validate the emerging themes.

The present study (ref. no. HS22/6/55) sought consent from the participants, whose responses were kept confidential throughout the study.

Results

Demographics and background

The average age of the participants recruited (N=18) for the study was 22 years, ranging from 19 - 26 years. Guest *et al.*[21] recommends either 15 participants or more or when saturation is reached; in the present study, saturation was reached after 18 participants. The participants comprised students from the School of Natural Medicine (SoNM) (44%; n=8), Physiotherapy (17%; n=3), Nursing (11%; n=2), Occupational Therapy (OT) (11%; n=2), Dentistry (11%; n=2) and Sport, Recreation and Exercise Science (SRES) (6%; n=1). From the data, three themes emerged: (1) experience of VR, (2) benefits of VR, and (3) curriculum alignment.

The experience of virtual reality

The participants in this study stated that they had not had much experience with VR before; for those who had, it was mainly watching videos and recreational exercises.

> **Participant 13** (OT): 'I don't know if you've seen those VR games. But that was the first time I have seen VR.'
>
> **Participant 1** (Physio): 'I used it for recreational purposes … like watching YouTube and concerts … but nothing educational.'

This theme materialised as all participants had yet to experience immersive VR. While a few participants were aware of VR, they had limited knowledge about its applications in education, making it a novel experience for them.

Furthermore, participants indicated that their involvement in this study significantly influenced their comprehension of VR and its potential to enhance teaching and learning processes. For those who have not used VR before, their perspectives were all related to the immersiveness of VR.

> **Participant 3** (SRES) said, before experiencing VR: 'I've heard something like, you are going into another world through technology. We had a party where there was VR involved.'

Participants then expressed their impression of VR after experiencing it first-hand.

> **Participant 6** (SoNM) said, after experiencing VR: 'I feel mind blown because I'm just so impressed that people could actually think these things up and execute them so well.'
>
> **Participant 7** (Physio) said: 'Personally, I'm going to be honest; I am very against technology; I don't necessarily enjoy it. I hate being on my phone. I feel like you lose touch with reality and interactions with people. For me, that's the most important thing. But I'm willing to give it a try. But that's just my view.' However, after the experience, the same participant commented: 'We should use it. It gets you to be way more interactive. I know many young people in the new generation may enjoy it a lot more. Engaging things through screens and VR could be useful.'
>
> **Participant 14** (Dentistry) said that VR posed some challenges: 'It's nice. Don't get me wrong. It's nice. But I have a problem with technical glitches. I have no control. And it affected me quite a bit. It is a major challenge because it frustrates the person if you don't get it right.'
>
> Another challenge was stated by **Participant 16** (Nursing): 'I don't know how to use the controller. And I didn't know what they were for. This was the trigger on the controller. The one controller was not orientated. Other

than that, it was fine. It was pretty interactive and worked pretty quickly. So, it was all good.'

Participant 5 (SoNM) was scared of the dark environment: 'It was dark, and things were moving. I was scared and wanted to take off the headset.'

Participant 3 (SRES) also discussed their concerns about the devices' cost: 'If you're talking about how, you want the university to buy [VR]. How much will each set cost per student? How much will the equipment cost? So, cost-wise, we need to consider that.'

Participant 17 (SoNM) added: 'I think it's really useful. It's such a game-changer. I think it's a bit impractical to get all this equipment for individual students, and students sometimes are playful. Lord knows what will happen to these things [VR headsets]. I worry that it might be only for the esoteric people who can afford it or the very good people (using technology).'

The above results express that VR is a good tool, and students are excited to use it to learn; however, this is not surprising because students are interested in new ways to learn. VR makes the learning experience fun and exciting for students, while obtaining knowledge.

Benefits of VR

Participants consistently expressed that the entire research endeavour was advantageous.

Participant 4 (SoNM) said: 'Physically being there really does give you a better understanding of it. And you could see it right in front of you.'

The benefits they perceived from VR included enhanced visual comprehension, immersive learning environments, and opportunities for exploration. These elements contributed to participants' enjoyment and overall experience. This was apparent in several participants' responses.

Participant 1 (Physio) said: 'So that comes into your life, and you could see your being is part of it.'

Participant 15 (Dentistry) said: 'It [VR] will work. We (the dentistry students) use different tools, handpieces and foot pedals. So maybe with the seat, we could sit down and do an extraction or filling; it would be better. I remember when we had a practical, I was so scared, scared to mess it up. But then, if I did this [VR] first, I would be much more confident. And in VR, I don't mind messing this up. If you're going to do it on a normal person, if I mess it up, it's done. You can't redo it. So, it's better to learn without being by somebody to get the basics physically.'

Participant 12 (OT) added: 'And you get to go back after messing up. So, patient safety.'

VR allows the user to interact with the object and environment; this includes rotation, zoom in and out, and highlight view.

Participant 8 (SoNM) reported: 'This one [VR application] is better because you can zoom into the organ and walk around. You get to see the full organ, zoom into the veins. It is nice doing quizzes. Prepare yourself for quizzes, practicals and exams. I would kill to have this [VR application] because this is 10 times more interactive.'

As VR is more fun and engaging, it could stimulate students to want to explore more, so improving motivation for learning.

Participant 3 (SRES) said: 'It [VR] makes you want to learn more; it makes you want to go in depth. It's perfect because it's more than the average. You've got more information at your disposal; it makes it even more interesting. And that environment stimulates learning.'

The use of VR in education

This theme refers to how students foresee the integration of VR into their curriculum and how it could be aligned with their studies. Most participants referred to spoke of anatomy education and clinical education. The two categories are core modules for health professions students throughout their study years.

Participant 11 (Physio) reported: 'It could be used in Medical Bioscience (a first- and second-year anatomy module) and practicals. When they're showing you how the muscles work, how the bones work, etc., these are actually in a lab. And they could use VR instead of the cadaver. Whereas my practicals are actually in a clinical setting. So, learning the [clinical] examinations.'

The participants commented on clinical education.

Participant 1 (Physio) said: 'You could for testing for chest investigation in physiotherapy, the movement of your legs, and how you're supposed to move them, whether it's lateral and how the person is supposed to lie (practical). Next is in our clinic, where we do physical therapy and massage. So, you can get used to learning the technique, the skills, the movement of hands, how you're supposed to apply the hands, and which region you're supposed to palpate for any abnormalities in the patient. It will be used to understand the physical, just looking, assessing, and even assessing the work. Our main component when we're dealing with patients is the first thing that we do is assess. So, if we can visualise how the normal person will work, then you can see when a patient is abnormal.'

Participant 11 (Physio) also reported: 'So for clinics, of course, for rehab situations, and also the procedures of what they say you need to know, do similar things, or procedure-wise is also important.'

Participant 14 (Dentistry): 'It is also essential to consider the student's year level, as some applications were not applicable, so not necessarily right now. Maybe the higher [year] level I go, the more I need it.'

Analysing the responses from both themes, VR allows a sense of visual understanding for both anatomy and clinical education. This could be useful when the clinical platforms are inaccessible, costly, or too dangerous for students to visit – for example, being exposed to the clinical setting during the COVID-19 pandemic or treating a patient with highly drug-resistant tuberculosis.

Discussion

This study aimed to explore health professions students' perceptions of using a VR application. The study findings suggest that students can benefit from VR owing to its engagement and interactive, fun and explorative properties. These benefits could play a role in both anatomy and clinical education. Kyaw[23] concurs with these findings, noting that VR offers visual learning and promotes safety for students and patients. VR allows students to practise and obtain the skill and technique before assessing or treating patients in the clinical setting, thus improving (1) students' confidence, (2) patient safety and (3) assessment and treatment quality.[19,23,24]

The participants generally had a positive experience with VR and the applications, although this was accompanied by challenges such as it being scary, the impracticality and the cost. Nevertheless, other participants

inquired about implementing VR sooner rather than later, which could indicate that students are excited to have VR and want to use it for learning. Cooper *et al.*[25] and Makransky *et al.*[26] studies also demonstrated that students might be drawn to VR because of its novelty, which could have affected the study results. The novelty of VR contributed to its appeal among participants, as it represented an unfamiliar approach for many students at the institution.

However, VR offers an immersive potential that traditional learning tools (e.g., videos, PowerPoint presentations, websites and audio) do not provide. Retnanto *et al.*[27] support this assertion, stating that VR offers a sense of immersion and a feeling of 'being there'. This immersive quality enhances the learning experience for students using VR, allowing them to explore and interact with the object and environment. Liu *et al.*[28] support this finding, with their results indicating that the experimental VR group had better test results as VR offered immersion and interaction, which were the two factors that influenced these results.

Although focused more on the VR experience than learning, the study found that VR allowed students to engage better with the content than current education methods. However, this does not indicate that VR will yield better academic results than current education methods. Despite VR's potential to bring innovative changes to HPE, it has received little attention. The challenge may lie in the limited exposure to this type of intervention. This study highlighted several key benefits of engaging with VR. It demonstrated that an educational intervention was successfully accepted by students in the Health Science faculty within a higher education institution.

The study explores participants' experiences with VR in education. Initially, most were new to educational VR, finding it novel and enriching. They saw VR as immersive, boosting visual understanding and practical scenario simulations, particularly in anatomy and clinical education. VR's interactivity made learning engaging, although technical issues, controller complexity, and equipment cost were concerns. Overall, participants embraced VR for safe, hands-on training, especially during the COVID-19 pandemic when traditional methods were inaccessible or costly.

Study limitations

This was a stand-alone project that needed to integrate academic activities or grading. A more accurate reflection might have been achieved if VR had been piloted within the curriculum. Future researchers should consider using a different HTC VR headset model with external tracking to address lagging and motion delay issues and a wireless headset. Despite these limitations, this study successfully identified potential student perspectives on VR in HPE.

Conclusion

Even though students can use common technology such as smartphones, tablets and laptops for learning, more advanced tools such as VR headsets still need to be made available. Nonetheless, students recognise the benefits of incorporating VR into their learning systems, especially when tailored to their health profession and aimed at achieving specific outcomes. Universities and their staff, including IT and health professions educators, should provide an environment where students can easily access technology for learning without having to troubleshoot issues. Only then can they truly benefit from such technology.

Declaration. I, Tak Wing Yu, the author of this article, hereby declare that the work presented in this article is original and has not been previously published in whole or in part, nor is it under consideration for publication elsewhere.

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