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Welcome, How Can I Help You? Design Considerations for a Virtual Reality Environment to Support the Orientation of Online Initial Teacher Education Students

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Abstract: Alongside the rapid and broad uptake of online learning in higher education, fully online students report feeling isolated and disconnected from their institutions. Although formal course content may be expertly designed to engage online learners, much of the information provided to support higher education students' orientation to the institution and to study is presented online in a written static form. Such presentations may not be accessible and engaging and may contribute to feelings of disconnection. Technologies such as virtual reality (VR) are being used in higher education to engage, motivate and connect students in their learning. This paper reports on the early design stages for a VR that aims to support initial teacher education students to connect and engage with key orienting information. The design of the VR was achieved by following a user-centred, iterative engineering design process and design principles of spatiality, interaction and narrative. The VR environment emulates the School of Education's physical, on-campus reception area to provide an immersive experience where students have a choice in the types and format of key study information they receive. This experience was designed to be utilised in online orientation but also throughout students' first year of study. Future research directions include collecting student responses to the VR to inform how students can be involved in enhancing the VR so that it supports their learning and sense of connection. Furthermore, future research can aim for the expansion of the VR inclusive of additional information, rooms and buildings and increased capabilities such as gamification and mobile access. This will enable the creation of a valuable teaching resource for online programs.

Keywords: virtual reality environment; initial teacher education; online learning; student experience; orientation; supporting student connection in online courses

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1. Introduction

The first fully online courses were introduced into higher education in the 1990s [1], and since then, the global growth in online learning has been remarkable. The data show that online learning provisions attract students from more diverse backgrounds than on-campus learning options [2], including mature-aged female students managing multiple life responsibilities such as work and dependent children [3]. Online study provides students with flexible, convenient, accessible and self-paced learning. Students generally find that online study is easier to manage than on-campus study [4–7].

Over the decades, as the expansion of online learning environments has informed developments in learning theory [8] and our understanding of the learners' needs has evolved, the quality of the online learning experience has changed [9,10]. The dynamics of online engagement have improved, and technological advancements have contributed to more engaging ways of learning. The need for digital transformations in learning to be based on sound foundations and represent best practices has been recognised as crucial

for universities that wish to stay competitive and provide effective and appealing learning environments [11]. An integral part of designing environments is to enable users to be participants, not passive consumers of static content, who utilise the environment to solve their individual problem or achieve a personal end [12]. One technology that is being utilised in higher education to achieve those ends is virtual reality (VR), and some positive impacts on student engagement and motivation are being observed [13]. Early studies indicate that students are supportive of these emerging approaches in education [14]; however, much more exploration is needed to fully understand the educational benefits and design considerations [15].

Fully online students continue to report feeling isolated and disconnected from their tutors, peers and higher education providers [16–18]. A study conducted by Devisakti and Ramayah [19] found that students' sense of belonging in an online environment can significantly impact their learning. One aspect of this, which has not been well examined in the research literature, is the way students are inducted into online study and supported with key study information. This is important given that poor study preparation for online learning has been linked with low retention rates [20]. Innovative approaches are needed that include the student voice, promote belonging and engagement and ensure effective communication, support and skills development. Designing digital environments that achieve all this is a challenge shared in higher education across local, national and global settings. The COVID-19 pandemic has underscored the necessity of giving more attention to the ways we support student engagement in the online space. While external factors such as this will add to the impetus for digital innovation, exploring and trialling ideas and projects must continue as part of continuing increased digitalisation of learning experiences. This paper describes one such project and how adopting an iterative design process that included ongoing collaborative review and testing by project team members and formative evaluation [21] contributed to the creation of the VR experience.

Background

In Australia, online initial teacher education (ITE) has seen enrolments grow at six times the rate of other online degree programs, with 25% of all ITE students studying fully online and approximately one-third of this cohort studying with a university that is not in their state or territory of residence [22]. Importantly, access to higher education provided by these online ITE courses aligns with the Australian Government's measures of quality higher education [23] and the goal of equitable access to higher education [24].

Students choosing to study ITE online are a similar but distinctive demographic within the general online higher education population. ITE students studying online do so from diverse geographical locations across Australia [25]. In common with online students generally, online ITE students are more likely than on-campus students to be mature-aged, female, in the paid workforce, residing in a regional or rural location, located in a lower socio-economic area and have various family commitments such as caring for dependants [9,26]. When considering the retention, engagement and success of students, meeting the needs of this large, diverse and distinctive cohort is essential.

Orientation programs have been positively linked to retention, engagement and academic achievement [27]. To be effective, they need to be systematic across general academic and administrative functions, as well as tailored to the student cohorts [28]. Marshall [29] reports that first-time online students who participated in tailored online orientation were found to have higher levels of academic success, retention and persistence in comparison to those who did not participate. As an identifiable cohort, online students require specific information about how to access their learning materials and experiences, how to interact with tutors and peers to enable social constructivist learning and how to navigate assessment task presentation and submission [17,18]. Furthermore, continued, tailored guidance and support beyond the initial orientation is required at point-of-need. While static and generalised impersonal information is available, it may not be the most

effective way to provide the crucial engaging start to online studies that sets students up for success.

New understandings about technology-enhanced teaching and learning coupled with insights into how learners respond and contribute to their own learning in powerful new ways [30] highlight factors critical to the effectiveness of online learning environments. These include using accessible and appropriate technologies, providing timely instructor feedback and employing purposeful instructional design [26,31,32]. With the growing number of geographically dispersed online students, it is imperative to explore innovative ways to help new students settle more quickly into university study.

In recent years, VR technologies have been increasingly used in education to enhance and innovate learning and teaching approaches. Yu [33] undertook a meta-analysis of VR technologies and their effect on educational outcomes. The analysis revealed that VR can contribute to improvements in learner confidence and to learning outcomes and achievements. Dubovi [34] reported that VR had instructional affordances such as emotional engagement, and the review conducted by Raja [35] identified that using VR could reduce instructional communication barriers. However, VR equipment can cause cybersickness [36], the environment itself can be a distraction to learning [37] and it can be costly to develop [35]. Although research in VR is occurring, much more examination of VR and its impact is needed. That examination must include the reporting of processes and challenges involved in designing VR environments [38].

This design project arose from the disjuncture between online students' needs and the university's capacity to meet those needs within its existing structures and practices. The project's objective was to design a VR environment to communicate key study information. The broader aim of the VR is to support students' orientation and study management and help them build connections with the university and staff. This paper reports on the design of the VR with the broader aim being addressed in the next phase of the project.

2. Materials and Methods

The design of the VR project was enabled through a summer internship program for university students offered by the university's Hub for Immersive Visualisation and eResearch (HIVE). The Hub's program provided a 10-week full-time internship for a student to collaborate on the project with the university's School of Education project team. The School of Education project team comprised senior, mid-career and two early career researchers and a learning technologies support staff member. The intern worked collaboratively and iteratively as a member of the design project team to create the VR, while the Hub for Immersive Visualisation and eResearch and School of Education provided the required technology resources, discipline support and supervision. The project was advanced using Schjerlund et al.'s [39] design principles for VR and engineering design stages [40], with attention to user-centred design [21].

2.1. Setting

The School of Education, where this research is situated, has embraced the rapid rise in the uptake of online higher education. It is a major provider in Australia (AITSL, 2018), with approximately 5000 students studying at least one ITE unit fully online. Over 2000 students have graduated from the school's fully online ITE courses [9].

Key information about the university's learning environment that is intended to guide students to enact their roles as self-directed learners is generally presented in written and/or visually static forms. This presentation may not be engaging, accessible and digestible for all students and has typically not been designed in collaboration or consultation with students or prospective students. The development of a VR experience was designed to address this challenge.

2.2. Design Principles

The design of the VR environment considered three dimensions, as explained by Schjerlund et al. [39], with the first being the spatiality, or the environment, that the user interacts with. The VR environment was the School of Education building and specifically the reception and attached meeting rooms. The second dimension was interaction, which included high-level interaction options of select, explore, elaborate and connect. Students were given options for choice about information type, format and length, with links to related and extended information. Narrative, the third design dimension addressed, involved ensuring that the information provided to students in the VR was accurate and would support them in their studies.

2.3. Design Process

The overall aim of the project was to design a VR for students to tailor information inputs to suit their needs [13] within the immersive and recognisable space of a VR environment. To achieve this, "a user-centered design approach with iterative development and evaluation" ([21] p. 3) was adopted in conjunction with the engineering design process of defining the problem, followed by a systematic approach to establishing the solution and then the modelling and analysis of the solution to produce a prototype that was effective and usable [40]. The design project team met weekly and at times bi-weekly throughout the 10-week internship program to follow the design process.

2.3.1. Defining the Problem

The core problem addressed in this project was how to design a VR to enhance orientation and support for all new online ITE students to become successful and effective learners. Specifically, we considered how to design a VR to achieve the following:

- Provide information to meet the needs of a diverse group of students studying online. The challenge is to ensure that all students can access important orienting information and guidance about how to manage studies. Students' engagement with learning management systems (LMS) posts, emails or messages sent through the official communication channel can be variable. Presenting such information in another format addresses the recommendation by Kift et al. [28] to comprehensively and systematically address the first-year experience.
- Connect with online ITE students in ways that bridge the disconnect often experienced with digital media; are engaging; and use accessible and familiar technologies. The VR aims to provide an accessible opportunity for students to interact with information within their own timeframes and in ways that build connection. This adds to the complementary asynchronous learning opportunities as advocated by Anderson [16].
- Provide opportunities to address areas or topics that may be outside formal unit content but are crucial to successful study and the development of ITE graduate capabilities. Finding space in a crowded curriculum to engage students explicitly in learning about their own development can be difficult. The VR provides an opportunity outside of formal learning to present information and ideas about capabilities that help students succeed in their studies.

2.3.2. Establishing the Solution

In alignment with the design needs and principles, and considering available project resources, it was determined that a VR needed to parallel the on-campus environment and student experience. The decision was made to replicate the School of Education's reception area and attached meeting rooms since this was both a physically distinctive space and a regular destination for on-campus students seeking assistance. Thus, this VR would become the platform for students to enter to gain key study information. The VR could be accessed during the online orientation program and through the LMS in each of the first-year units (eight units) so that beginning students (approximately 1200 students) had continuing access for the duration of their first year of ITE studies. The ITE programs are the four-year

(full-time equivalent) undergraduate Bachelor of Education Early Childhood, Primary and Secondary Education courses. The first-year units involve introductory education units including technology in education, educational psychology, professional contexts and curriculum units.

The scope and resourcing of the design project could not accommodate all key study information being built into the VR environment, so two key areas were prioritised. These were (1) how to commence studying once enrolled and (2) how to approach assessments. Specifically, these information pathways were posed as the questions (1) "I have just enrolled, now what do I do?" and (2) "What do I need to know about assessments and the feedback I can get?" An information tree for each of these was created using multiple-choice question prompts to help target the needs of each student.

The first information pathway prompted by the question, "I have just enrolled, now what do I do?" was proposed to support students in becoming active and self-directed learners. The information included the transition to student life; key unit information; study skills and planning; approaching assessments; maintaining health and a balanced lifestyle; and accessing student supports and provisions. To help students navigate to the information they were seeking, the following questions were posed: "Would you like an overview about how to study the unit?", "Would you like to know how to access the learning materials?", "Would you like to know how to access your assessments?", "Would you like to know what academic integrity is and why is it so important?", "How do I manage my study and life?", "Would you like to know what study supports are available to you?" and "Would you like to know how your learning may be accommodated?". Scripts of the responses to these questions were devised by the project team along with the identification of links to supporting information. Videos were created by the School of Education's learning technologies support team to assist the students in accessing further study information, navigating the LMS and following the advice given.

The second information pathway prompted by the question "What do I need to know about assessments and the feedback I can get?" covered the following topics: how to approach assessments; types of feedback and how this supported learning; seeking feedback; interpreting rubrics; linking feedback to the unit learning outcomes; using the feedback to improve their own work; and student supports and provisions. The multiple-choice questions asked were "Would you like an overview about how to approach assessments?", "Would you like to know how to access the assessment information?", "Would you like to know how to use a marking key or rubric?", "Would you like to know how to reference?", "Would you like to know what feedback you can get?", "Would you like to know how to use the feedback you get?" and "Would you like to know what supports are available to you?". The same process as before was followed in that the project team developed answers to the questions and identified links to further supporting information and videos to assist students to follow the advice given.

Once the VR location, questions and information trees were decided, the project team, in accord with the design principles, considered how the students would access the information within the VR so that it felt realistic for the user. This resulted in the decision that the VR would commence with the student entering the School of Education building and being directed to approach the welcome desk in the reception. There, they would be greeted by a virtual staff member and asked to indicate their information needs—how to commence studying or how to understand assessments. From this selection, they were directed to another virtual staff member where the multiple-choice questions would then be posed. Once the student made their choice, an answer was provided by the virtual staff member. Acknowledging the role of student agency in determining the accessibility of information, the project team established that all responses to questions would provide users with a choice about information type, format and length, as well as links to related and extended information. At this point, the student could continue to interact or to exit with a supporting statement. There was also the opportunity to walk through the neighbouring

rooms, such as the student meeting rooms, to heighten the accurate experience of the school's reception area.

3. Results

The results section details the modelling and analysis as outlined in the methods sections, which is the production of the VR. This includes responding to user feedback and data throughout the development process. Unity was chosen to create the VR because it is a standard software for interactive and VR development and was supported by the internship program (Unity, 2019). The created virtual environment needed to be convincing in its construction to support the aims of the project and required substantial 3D modelling work. Maya and Unity Probuilder package (2019) were chosen for this as they have a good user-friendly user interface. During the iterative development phase, testing and improvements were incorporated on a weekly, and at times bi-weekly, basis with the project team and the internship program Hub team. This occurred across the 10-week project where at weekly one-hour project meetings, the project team member who was responsible for the programming demonstrated the current version of the VR to the team. The programmer additionally signaled issues and suggested enhancements. This project team analysis ensured that bugs or glitches were remedied and that enhancements to the environment and features could be incorporated. Initially, a 3D VR was developed that required a VIVE Headset. Testing of the 3D VR occurred with project members utilizing the VIVE Headset in the University's (HIVE) or in the School of Education meeting rooms.

The creation of the VR environment commenced with modelling of the School of Education reception and attached meeting rooms using a scaled version of the building floor plan. The room and the walls were created using cubes and planes that were then manipulated to the desired shapes using a variety of modes: vertices, edges and faces. The position of the walls, windows and doors followed the floor plan and, along with the furniture in the environment, were created in Maya 2019 or free asset packages from the Unity asset store. Shape manipulation for a few sections proved to be quite complex due to some wall sections having sharp turns and a few areas where parts of the wall were extruded. This issue was raised during the second-week meeting where the programmer tested the developing VR and demonstrated this complexity. The project team decided to create the complex shape turns using the extrude option in Probuilder.

To ensure a realistic setting and environment, the texture setting and the lighting were investigated in depth. Texturing required testing a broad range of different values to obtain optimal graphic realism. Through trial analysis in developing the VR, issues with the floor and wall texturing were identified. The issues were that each face of the wall and floor are duplicates of one picture and that some textures became blurry while others looked stretched. In the third week of the project and at a meeting, the programmer demonstrated the issue. The project team decided that in order to overcome these issues, changes to the tiling values found in the material component attached to the object, maps and rotation of the UV maps would be used to create a more random-looking pattern. The terrain of the VR environment was also addressed in the modelling with the design goal of enhancing the sense of presence for the students. While the terrain of the surrounding School of Education could not be fully recreated within the scope of the pilot project, the base for this future improvement was laid.

Lighting was a critical factor in creating a realistic environment. The main source of light for the entire scene was the directional light combined with flare effects that simulated the sun. The lights in the reception area were point lights with adjusted colour, intensity and range. However, through the trial analysis of the VR, the point lights proved to have a flaw. When baked, the point light source did not provide sufficient lighting for the scene and failed to present realistic lighting. During the week four project meeting, the developing VR was tested. The programmer also demonstrated the issue with the lighting. The project team arrived at the solution of inserting multiple point lights between the floor and the roof with lower intensity and higher radius values. Finding the optimal values

for light baking required analysis through much trial and error. In the end, both processes helped in achieving realistic environment replication. Figure 1 is a screenshot via the user (student) interactive VR environment, which shows the reception welcome desk. Figure 2 is a screenshot via the user (student) interactive VR environment, which shows the recreated meeting room off the foyer that students can move into and explore.

Figure 1. Screenshot of the VR environment reception welcome desk.

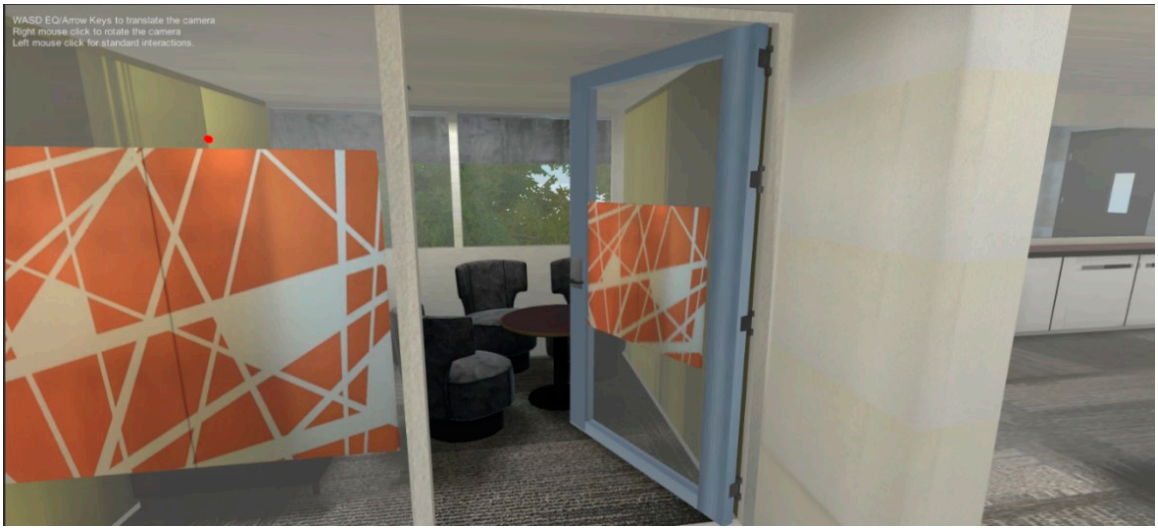

Figure 2. Screenshot of the VR environment meeting room.

Following the creation of the building, light and terrain, the interaction and ways of movement features were introduced, and a draft implementation was created. During the week four project meeting, as part of the iterative analysis approach [21] adopted for the VR development, the project team made the decision to introduce three NPCs into the environment to enhance the immersion experience. One of these can be seen in Figure 1. Additionally, following testing of the developing VR, the project team raised concerns about first-time users who may have issues with navigation because they were unfamiliar with such technology. To address this, the project team decided a help section located where the student enters would be created in the VR. The help section included a demonstration video of VR usage. Figure 3 is a screenshot via the user (student) interactive VR environment, which shows the help section.

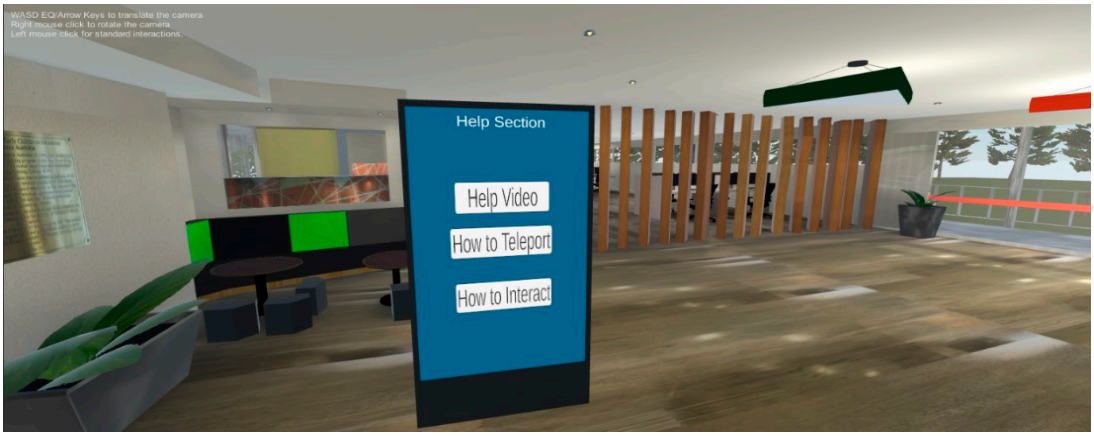

Figure 3. Screenshot of the VR environment help section.

The next stage in the creation of the VR environment was to finalise core movement and interactions. During this stage, more attention was given to the student experience and usability of the environment, particularly around the response to the questions. During the week five project meeting and testing of the VR, the project team identified issues with the usability of the VR. This resulted in the project team proposing the creation of a tablet that snapped to the student's (player's) hand, which enabled the student to perform all interactions anywhere in the environment. All video, audio and text were designed to be accessed through the tablet that appears in the student's left hand once the user has interacted with the prompt on the reception welcome desk. Most of the interactions were based on button clicks to play audio, video or toggle texts in response to the learning pathway and answers to the multiple-choice question or identifying that help was needed to navigate the VR. In week six of the project, the audio for the NPC was recorded by academic staff members, and the corresponding text was also added into the environment. During the week seven project meeting and testing of the developing VR, the project team identified the potential for students to be overwhelmed by video, text and audio playing at the same time. The solution to ensure that this did not occur was for each of the button clicks to be changed to only activate one interaction at a time and deactivate all other interactions.

Not all plans for the environment resulted in successful implementation. Initially, the plan was that as the student walked towards the staff member (NPC) at the reception welcome desk, this would trigger the staff member to turn their head towards the user, but testing of this showed that the head turn trigger was very unstable. Through testing and analysis of usability during the week eight meeting, this instability, combined with a lack of focus on the student by the reception welcome desk staff member, led to the decision by the project team to remove that function and replace it with a full body turn. The trigger was also replaced with a button-click play animation. In the week nine meeting, the testing of the VR included discussion on the movement within the environment. As the VR environment reception area mimics the actual size of the School of Education reception and attached rooms, and the VR play area would most likely be a regular room size, walking was found not to be a viable option for movement across the room. Teleporting is a very common method of movement in VR, and the decision by the project team was to utilize this to overcome the issue. The teleporting was achieved using the prefab and scripts provided by the SteamVR package from the Unity asset store.

In the week nine project meeting, the testing and analysis of the VR identified potential accessibility issues. With the assumption that many students would not have access to a VIVE Headset, a 2D version of this application was also developed for regular desktop computer usage to achieve a reasonably similar experience. Changes that were made included the navigational tablet being attached to the wall rather than in the student's hands and movement around the environment managed by using arrow keys. Methods of interaction were also changed to utilise the mouse. The remaining content progression was

the same as the VR experience, with the aim of ensuring that there was no loss of quality for either version.

Formative evaluation of the prototype [21] in both the 3D and 2D versions was undertaken by the project team in week ten. The testing of the developed VR did not result in any further changes. Although VR enhancements and student testing were identified as being needed to further develop the VR, within the scope of the project and timeframe, it was not possible to achieve. However, the project team established a plan for addressing this in the next stage of VR development and testing.

4. Discussion

The digital revolution has greatly affected the way people learn and access information. In many areas of higher education, online learning has been embraced and more recently has been seen as essential because of the global COVID-19 pandemic [41]. Research shows not only that online learning attracts a broad demographic of students whose expectations need to be met but also that shared needs such as a sense of belonging and adjusting to the higher education learning environment require alternative strategies and approaches than those typically relied on for on-campus students. Utilising technologies in an innovative manner is an important avenue for improving the experience for online students and facilitating their successful engagement in higher education. Furthermore, remaining open to designing and trialing innovations may be key to institutions positioning themselves as appealing to students [11]. VR is one technology that has the potential to improve the student experience and is increasingly being explored as a support to student learning and engagement (e.g., [14]), particularly if feedback cycles from users can be included in design considerations.

This project sought to design a VR to provide key orientation study information to online initial teacher education students. This initiative was a novel approach for the School of Education, where previously, methods of orientation for online students were relatively traditional. The application of VR in educational contexts is evolving, with research to date indicating that there is potential to better engage and empower students in their learning [42]. It is also noted that online education is arguably best positioned to benefit from and grow through the use of VR technologies [43], which could contribute to bridging the divide between on-campus and online learning experiences [44], and to pursue VR was a step towards a mode of orientation that could be more experiential, immersive and interactive [44,45]. This was at the forefront of considerations throughout the design process.

The approach for this project was to adopt [39] design principles to ensure that the key elements determining the VR utility were addressed. The design of the VR was framed by the engineering design process to produce a VR that was effective and usable [40]. This was complemented by the use of Schjerlund et al.'s [39] iterative analytical approach for working through the VR design process. Importantly, this ensured the process was developmentally progressive, meaning that iterative elements of testing and analysis of the VR were built-in and problem-solving along the way was not regressive. The team found that adopting these approaches proved efficacious for the creation of a VR that met the design brief. The experience highlighted how ongoing collaboration was a critical element in the success of the design process [46], and a factor that must be kept in mind for future iterations. The design project undertaken has broader implications for the online learning space, particularly in terms of ongoing priorities relating to enhancing student engagement and learning outcomes. The process and considerations detailed here may provide guidance for colleagues who are seeking to pursue similar innovative projects. In terms of student engagement, VR presents opportunities for inviting students into the higher education learning environment in a participatory way and facilitating their sense of connection, belonging and preparedness [13,33,34]. There are opportunities for creative, context- and community-specific and consultative approaches to be undertaken, which may contribute to building and sustaining a strong sense of engagement and supporting students in their learning and achievement [33,42,47,48]. These could be provided as part of the orientation or first-year experience or could be applied throughout their higher education

experience with a focus on sustaining engagement and enhancing achievement throughout the course life cycle. In pursuing innovative methods in the online learning space, there is opportunity to move beyond traditional models utilized in higher education and to explore responsive and transformative approaches that centre student experience, participation and connectedness. It is essential that these approaches continue to evolve and embrace ongoing reflection, re-thinking and adaptation to best serve and support students.

The substantial investment of time by the VR creators, and therefore the cost [35], highlighted the importance of having a high-value issue or problem to be addressed, clear objectives, a robust plan and a VR context that could support expansion or enhancement as required. The enhancement and development of the VR environment in this project will require a more convincing sense of immersion in the environment. The team will need to determine whether the project should now explore options for enhancements using the same software. Additionally, there is the prospect of expanding the VR environment to other floors of the School of Education building, including classrooms, for the purpose of accessing some course learning materials. With a view to student engagement, there is also the potential for an interactive gamified experience [49], which reportedly enhances student experience and engagement. Alternatively, consideration could be given to utilising different software that will create a more realistic environment wherein student users feel that they are more present.

Although there are extensive opportunities for the expansion and development of the VR, the usability of this continues to be a focus. As many students utilise mobile phone devices for many hours a day [50], including for their learning, adaptions of the VR program to mobile devices should be explored. With these devices and desktop computers, the program could be adapted to accommodate accessible and widely available VR hardware. Throughout future expansion and development of the VR, technological issues will need to be considered. These may include limitations posed by the lack of standardization of VR, hardware and software requirements [42], system glitches and safety hazards [51] and the impact of technological obsolescence [52]. To mitigate against technological obsolescence, continued development to ensure currency will be essential [52]. Technological issues such as these are a key consideration for educators pursuing innovations in this space.

5. Conclusions

This paper reported on the VR design project, which was supported by the university student internship technology program Hub for Immersive Visualisation and eResearch. It charts the design principles [39] and design process [21] that resulted in the creation of a 3D and 2D VR environment of the School of Education reception area and attached meeting rooms with two learning support pathways. In doing so, this paper contributes to the guidance available to educators seeking to pursue VR innovations, which can mitigate challenges faced when navigating new and experimental approaches [45]. The created application aims to bring a sense of belonging and presence for online ITE students while they access and receive key study information. More broadly, the use of this application intends to enhance the orientation experience for fully online students and to support them during the initial study period to become independent and successful learners. As a design project, it demonstrates that VR has utility for the problem it was intended to address and also brings into focus the nature of the design process and the challenges presented. At this time, there is anecdotal feedback about the student experience of the VR that is promising. Further comprehensive and formalised surveys and interviews with students will preface continuing development of the project, and consideration will be given to increased student design involvement and additions and enhancements of the VR. This is crucial in realizing the student experience aims of the VR in its exploration and use. Future research projects will also continue to focus on the sociocultural dimensions of higher education such as developing student identity, agency and self-regulation of learning. This would be something of broad and continuing value.

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