Bridging the Coursework-Placement Gap: Towards an AI-enabled VR Environment to Support Student Teachers' Experiential Learning

European Journal of Teacher Education

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Abstract

This paper explores the integration of Virtual Reality (VR) in an Initial Teacher Education (ITE) programme to enhance student teachers' learning experiences. Using a custom-built VR environment, the study examines how student teachers engaged in practice-based learning, self-reflection, and peer collaboration within the virtual space. The findings demonstrate VR's potential in fostering classroom readiness, enabling student teachers to experiment freely and engage in iterative practice in a low-risk setting. However, the study also highlights VR's limitations in replicating the complexity of real-world classroom interactions, particularly in relational and adaptive aspects of teaching. The research suggests that VR should serve as a complementary tool to authentic school placement experiences rather than a replacement. Implications for teacher education programmes include the focussed use of VR for refining specific teaching approaches and the importance of structured reflection in connecting learning from the VR environment with real-world classroom experiences.

Keywords

Virtual Reality, Artificial Intelligence, Initial Teacher Education, Experiential Learning, Micro Teaching

Funding Details: Dublin City University funded this research under the 'DCU AI for Societal Good' funding stream.

Disclosure

No potential conflict of interest was reported by the authors.

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Introduction

The use of online and digital technologies within initial teacher education (ITE) is not a recent development within the research field (Røkenes et al. 2014). Since 2020, however, this research agenda has amplified due in part to the COVID-19 pandemic (Fernández-Batanero et al. 2022). There has been a call for further research around the employment of digital and online technologies within ITE that moves beyond emergency interventions, alongside a rethink of ITE, given the opportunities that online technologies have provided in recent years (Carrillo and Flores 2020; Darling-Hammond and Hyler 2020). In tandem with this, the current exponential growth of artificial intelligence (AI) technologies has led to increased attention and calls for research around the opportunities and challenges that AI can bring to ITE (Salas-Pilco et al. 2022; Tiernan et al. 2023). With the emergence and advancement of augmented reality (AR) and virtual reality (VR) that has become increasingly accessible, alongside the rapid developments of artificial intelligence, there remains a dearth of research around the impact of how teacher educators can embed and integrate such technologies to support student teachers learning to teach (McGarr 2021; Tiernan et al. 2023). There has been a call within the field of teacher education for a research agenda that showcases how technologies can provide alternatives to traditional site-based learning (Cochran-Smith et al. 2015; Darling-Hammond and Hyler 2020). This research answers this call. This exploratory study showcases the design, implementation and evaluation of a custom-built VR environment to support student teachers' experiential learning. The paper flags how this environment supported student teachers to engage in employing a range of approaches and strategies within a VR environment that not only enabled them to engage in experiential learning but afforded opportunities for self- and peer-reflection. The perspectives of teacher educators are also captured, and the potential and limitations that such technologies can bring to teacher education pedagogy and practice are highlighted.

ITE in Ireland: Policy and Practice

The Republic of Ireland has undergone significant reforms in ITE over the past decade. A key catalyst for these reforms was the establishment of the Teaching Council of Ireland in 2006, which was tasked with setting policy for and accrediting primary and post-primary teacher education (Farrell 2021; Gorman and Furlong 2023). At the time of its establishment, significant reviews of ITE in Ireland were highly critical of the way in which ITE programmes lack linkages between the

placement and coursework components (Kelleghan 2002). The *Policy on the Continuum of Teacher Education,* published by the Teaching Council in 2011, introduced a series of changes that emphasised the importance of the practice-coursework relationship, resulting in ITE programmes being extended from three to four years at undergraduate level and to two years at postgraduate level. The Teaching Council positioned school placement as the fulcrum of ITE, and student teachers were required to spend significantly more time in schools, with school placements extending from 16 weeks to 30 weeks. The Department of Education in Ireland supported this move, critiquing the coursework-placement divide and positioning placement experience as essential for preparing student teachers, particularly in improving the teaching of literacy and numeracy in efforts to improve Ireland's standing in international educational performance rankings (Burke 2024; Solbrekke and Sugrue 2014). However, despite these reforms, recent research has found that newly qualified teachers exiting ITE continue to report difficulties in a range of areas, including the enactment of inclusive pedagogy (Hick et al. 2019) and classroom management and organisation (Uí Choistealbha and Ní Dhuinn 2021). These gaps suggest that while the additional time spent in schools has been valuable, it may not alone be enough to fully equip student teachers with the learning they need for diverse classroom contexts.

Virtual Reality in ITE

Consideration of the use of VR in ITE is well established on an international level (see, for instance, the recent systematic review by Huang et al. 2023). Villena-Taranilla et al.'s (2022, p. 2) definition of Virtual Reality as "technology that generates virtual immersion in a digital environment, thanks to a computer graphic simulation which allows users to immerse themselves in an interactive three-dimensional world in which different types of sensory and emotional experiences are encountered" highlights the immersive capabilities of more recent VR technologies (as opposed to earlier, 2D functionality, such as in Lee and Wong 2014). This immersiveness allows ITE to provide opportunities for learners in a way that they accept it as a natural environment, within which they can navigate and interact with objects or other avatars in the same way they would experience real-life situations (Ke et al. 2016). This allows for the design and development of environments that deal with the interaction between the user and avatars, and allow for the virtual simulation to present challenges and scenarios through a range of approaches, such as the behaviour of the avatars and how the virtual room is laid out (Huang et al. 2023). Such

developments have allowed for an increased level of realism, flexibility, and feedback (Kaufman and Ireland 2016), which can be achieved from the system that is the focus of the current paper.

Given the ongoing development of virtual simulations in ITE, much potential has been seen in how this can enhance learning. McGarr (2021) identifies a range of factors. A significant draw to this approach is that it is considerably lower risk than facilitating experiential learning within schools, given the impact or potential issues where a student teacher experiences the placement shock as they transition into the classroom (Chen 2022). Such simulations can also enhance the learning experience within ITE coursework, offering a more interactive, diverse learning environment that is not typical of traditional campus-based teaching (Taggart et al. 2023). It also affords the opportunity for student teachers to adapt to the virtual simulations and demonstrate creativity in classroom design and teaching and learning that may not be possible in a traditional classroom environment (Huh 2020). The opportunity also affords more collaborative dialogue that may not occur on placement due to the geographical distance that arises when student teachers engage in traditional placement (Donlon 2019). Finally, high-stakes assessment can often be associated with placement, resulting in student teachers being reluctant to employ particular approaches. The use of VR simulations can allow student teachers to engage in a safe space that affords them the opportunity to experiment or make mistakes (Keane and Chalmers 2023).

The recent explosion of Artificial Intelligence (AI) has precipitated widespread disruption in all aspects of teaching and learning, including those relating to teacher education (Jamal 2023). Unsurprisingly, investigations have begun into the potential of integrating AI into VR technologies for the purposes of teacher education. For instance, Docter et al. (2024) argue ‘proof of concept’ for an Integrated VR and AI application that aims to develop classroom management skills among student teachers, with the AI integration enabling a “controlled and yet unpredictable environment” (p.1). More recently, Pitura et al. (2025) explore the use of a VR simulation with integrated AI for content knowledge application among pre-service English as a Foreign Language (EFL) teachers, and found that “the incorporation of AI-based interactions appears promising in enriching the VR teaching experience as these prompt deeper understanding and reflection on the target content, thereby improving teaching confidence and efficacy” (p. 100). As both VR (Wang and Li 2024) and AI (Suna et al. 2025) are topics of significant interest for teacher education at

the moment, it seems likely that further convergence and integration between these two technologies will continue into the future.

Theoretical Perspectives

This study is grounded in the theoretical framework of experiential learning (Kolb 1984; Kolb and Kolb 2017) and informed by contemporary understandings of classroom readiness (Klassen et al. 2021). Experiential learning theory was selected because it supports the study's focus on practice-based learning, offering a conceptual structure for understanding how student teachers make sense of their teaching through iterative cycles of action, reflection, and adaptation. The concept of classroom readiness complements this by framing preparedness for teaching as a multidimensional construct, encompassing cognitive, emotional, and motivational aspects, that develops through sustained engagement in authentic learning experiences.

In recent years, teacher education research has increasingly recognised that preparing teachers for the complexity of classroom life requires more than content knowledge or technical routines, highlighting instead the need to cultivate situational, authentic learning experiences that are connected with practice. (Cochran-Smith et al. 2015; Logan et al. 2025; Loughran 1997, 2007, 2009; McDonald et al. 2013; Jonassen and Strobel 2006). In this context, the concept of classroom readiness has moved beyond reductive framings of technical competence to reflect a more holistic, multidimensional understanding of what it means to be prepared for the realities of teaching. No longer viewed as a checklist of observable competencies, readiness is now widely understood as a multidimensional construct encompassing cognitive, motivational, and emotional domains, each of which interacts dynamically with experience (Klassen et al. 2021). Emotional readiness refers to a student teacher's ability to regulate affective states such as anxiety, fear, or overexcitement; feelings that frequently arise during early teaching experiences (Chen 2019). Motivational readiness captures the emerging sense of purpose, identity, and agency that student teachers develop as they begin to internalise the responsibilities of the teaching role (Watt and Richardson 2017). Cognitive readiness, meanwhile, involves not only the possession of pedagogical and content knowledge but also the ability to apply this knowledge adaptively in varied and unpredictable classroom situations (Paulick et al. 2016). Crucially, these dimensions of readiness do not develop in isolation or through abstract preparation, but through sustained, supported

enactment; pedagogical experiences that involve action, reflection, and iterative practice within authentic or approximated teaching contexts (Alexander 2018).

Recognising the complexity of classroom readiness has prompted a corresponding shift in teacher education pedagogy toward approaches that are more authentic, situated, and practice-rich (Cochran-Smith et al. 2015; Furlong and Gorman 2025; Loughran 1997, 2007, 2009; Jonassen and Strobel 2006). These pedagogies are characterised by a deliberate effort to move beyond theoretical isolation to learning environments where student teachers are actively involved in the work of teaching. This includes engaging in real-time decision-making, interpreting pupil responses, and managing emotional and behavioural dynamics (Cochran-Smith and Villegas 2015; Cochran-Smith et al. 2015; Loughran 2007). Such pedagogical approaches also foreground the importance of feedback, dialogue, and reflection as integral to the learning process, not as supplementary activities (Brennan and Gorman 2023; Brennan et al. 2024; Cochran-Smith et al. 2015; Doyle et al., 2024; Gorman and Hall 2024). Kolb's (1984) experiential learning theory offers a framework for designing and analysing these kinds of practice-rich learning environments. This posits that deep learning arises when learners cycle through four distinct but interrelated phases: concrete experience, reflective observation, abstract conceptualisation, and active experimentation. Learning, in this model, is not passive but cyclical and recursive, with each phase feeding into the next in a continuous process of refinement and sense-making (Kolb and Kolb 2017). In the context of teacher education, experiential learning provides a compelling rationale for pedagogical designs that immerse student teachers in professional action and support them in making sense of that action through structured reflection and experimentation (Williams and Sembiante 2022). Microteaching, a long-standing practice in ITE, represents an early attempt to enact experiential learning in structured, scaffolded ways (O'Flaherty et al. 2023). It typically involves student teachers preparing and delivering short segments of instruction, often to their peers, followed by observation, feedback, and discussion. This format activates all four stages of Kolb's cycle: the teaching segment as concrete experience; peer or tutor feedback as reflective observation; the identification of teaching principles or patterns as abstract conceptualisation; and the application of revised strategies in subsequent teaching as active experimentation (Donnelly and Fitzmaurice 2011). Studies have found that microteaching can build self-efficacy and encourage reflective practice, particularly when feedback is timely and dialogic (Arsal 2015;

Ericsson 2008; Fernández 2005; Griffiths 2016; He and Yan 2011; McDonald et al. 2013; Ramesh 2013). However, despite its potential, traditional microteaching has been critiqued for its lack of authenticity (Mikulec and Hamann 2020). Teaching peers, who tend to be overly compliant or perform supportive roles, fail to simulate the unpredictable, emotionally charged, and relationally complex nature of real classroom interactions (Mikulec and Hamann 2020; Zhang and Lin 2014). As such, while microteaching supports technical rehearsal and reflection, it may be too removed from the realities of live teaching to foster deeper emotional or cognitive readiness. This limits its capacity to serve as a truly situated or transformative learning experience.

VR offers a promising evolution of the microteaching model by enabling simulated yet authentic enactments of classroom practice (Ledger and Fischetti 2019). VR allows for the deliberate design of environments that approximate classroom complexity while preserving safety, control, and reusability. Within VR, student teachers can engage with avatar pupils who display different engagement levels, practice classroom management, move around simulated spaces, and deliver instruction in scenarios that feel both immediate and consequential (Ledger and Fischetti 2019). That said, McGarr (2021) cautions that while VR offers low-stakes opportunities to explore classroom scenarios, it can also reinforce reductive assumptions about pupil behaviour, limiting deeper reflection. VR should therefore be seen not only as a space for practice, but as an object of reflection, prompting student teachers to critically examine the assumptions it embeds.

Project MiTeachVR

Drawing on the theoretical perspectives outlined in the preceding section, the MiTeachVR project was designed to operationalise experiential learning (Kolb 1984; Kolb and Kolb 2017) and support the development of classroom readiness (Klassen et al. 2021) through immersive learning within a purpose-built VR classroom environment. This initiative emerged from a cross-disciplinary collaboration between the Faculty of Education and the Faculty of Computing and Engineering at the authors' university. It involved an iterative process of translating classroom scenarios into interactive VR experiences.

MiTeachVR Development

The initial stage of the project involved reviewing existing micro-teaching modules in the authors' university. These modules spanned ITE at Primary, Post-Primary, and Further Education levels. The project team identified the common fundamental teaching approaches within these micro-teaching modules and proceeded to map these to features in the VR environment, which could be developed to help student teachers track and improve in each specific area (see Table 1).

Insert Table 1 near here

Once decisions had been made on the micro-teaching approaches to focus on and the feasibility of addressing these in a VR environment, work on developing the classroom began in earnest. Development of MiTeachVR took place from January 2023 through November 2023 and comprised three key phases: design stage, alpha stage, and Beta stage.

Design Stage

The design phase focussed on establishing the initial classroom layout(s), configuring the system infrastructure, and embedding the functionality outlined in Table 1. In order to provide student teachers with a varied virtual micro-teaching experience, the project team designed multiple classroom layouts for student teachers to practice in (e.g. figures 1 and 2 below). Each design also featured a teacher's desk, a whiteboard, and a projector screen, as well as multiple classroom artefacts to give the environment a 'natural' feel. System infrastructure involved a complex interplay between individual VR headsets and a secure online server that allowed two-way communication: classroom layout and environment data was transmitted from the server to each headset; individual VR session data (head tracking, teacher movement, audio recording) was transmitted from the VR headset to the server. Once classroom designs had been created, system infrastructure had been implemented, and functionality created, the project team moved to the alpha phase.

Insert Figure 1 near here

Insert Figure 2 near here

Alpha Stage

The alpha phase was concerned with testing the features and functionality established in the design phase. This phase used a rudimentary version of the classroom and virtual students (see Figure 3 and 4) to facilitate testing with the project team and student teachers. Throughout this phase, the team confirmed design decisions such as the scale of the room and the positioning of various artefacts. This phase also facilitated testing the system architecture and the ability to record participants' voice, position within the virtual space, head tracking and hand movements (more details on the data capture are provided in the following section).

Insert Figure 3 near here

Insert Figure 4 near here

Beta Stage

Following confirmation of the design, features and functionality in the alpha phase, the team moved to implement a more realistic virtual classroom. These changes included the addition of avatars, the redesign of the classroom, and the incorporation of various artefacts and images (see Figures 5 and 6 below). The version was again tested by the project team and invited student teachers to ensure features and functionality were intact.

Insert Figure 5 near here

Insert Figure 6 near here

Data collection and AI-readiness

One of the key innovations of the MiTeachVR project is its AI-readiness. The VR features which have been mapped to micro-teaching practices (see table 1), such as head tracking, gaze tracking, teacher movement in the virtual space, voice recordings, and hand movement, are recorded and stored in JSON format. JSON is a lightweight, transferable data format that allows information to be processed by a multitude of software applications with relative ease. In the context of MiTeachVR, this allowed the project team to store data on a per-student and per-session basis, meaning information could be directly related to student teachers' experiences in the virtual

classroom. Harnessing the power of AI, MiTeachVR has made initial steps to use this data to make recommendations to student teachers based on their micro-teaching delivery in the virtual classroom. The power of AI in data visualisation will be key. For example, AI will be used to analyse student teachers' location in the virtual classroom, display this information in a user-friendly manner, and make suggestions to the student regarding their placement and movement around the room. Similarly, AI-powered voice analysis tools will be used to visualise the student teachers' pace of speech, pitch and timbre, and key word emphasis. These visualisations will help student teachers understand different elements of their voice and make recommendations to the student based on the analysis. While these features are currently under construction, the first crucial steps have been made in making the data available, categorising and storing information on a per-student and per-session basis, and in mapping out the ways in which AI will be used to analyse this data and make recommendations to student teachers

Practical Implementation of MiTeachVR

In advance of using the MiTeachVR system, student teachers were given the opportunity to familiarise themselves with VR and specifically with the MiTeachVR classroom. Over the course of four sequential sessions, student teachers then used the MiTeachVR software to explore and refine core teaching approaches. Each session followed a cyclical structure grounded in experiential learning theory (Kolb, 1984), combining VR simulation and guided reflection. Following each simulation, student teachers were prompted to review their recorded teaching performance either individually or in small groups using playback via headset or external display. These reviews were scaffolded using a reflective protocol, which included a range of prompts and questions (see Table 2), which were informed by Kolb's experiential learning cycle (1984). Critically, student teachers had the opportunity to re-teach a concept, but adapt their pedagogical approaches across sessions, or teach a different concept in each session. Student teachers were encouraged to make this decision in light of their reflection and peer discussion. For example, after identifying limited movement around the classroom in Session 1, a student might deliberately prioritise purposeful movement in Session 2. This iterative design element, enabled by the affordances of VR, represents a key pedagogical divergence from traditional microteaching, where constraints on time, space, and peer availability typically limit repetition and variation.

Methodology

Given the focus on the design, implementation, and evaluation of a custom-built VR environment to support student teachers' experiential learning in ITE, this study was guided by the following research question:

How does Project MiTeachVR support student teachers' experiential learning within ITE?

To address this question, the study explored how student teachers engaged in practice-based learning through structured VR sessions informed by experiential learning theory (Kolb 1984; Kolb and Kolb 2017) and the construct of classroom readiness (Klassen et al. 2021). This research yielded rich and contextually grounded data (Creswell and Creswell 2017) that informed both the evaluation of MiTeachVR and its potential future development. The principles of an action-oriented case study shaped the research design. This type of case study is designed not only to understand a phenomenon but also to promote practical interventions that could improve educational practices (Stake 1995). The study took place in one undergraduate ITE programme in Ireland (approximately 50 student teachers enrolled). We sought 15 volunteers in the third year of the programme as the student teachers were on campus for the full semester when the research took place (all other year groups had a placement block during this period); 12 student teachers volunteered and participated in the four sessions and the subsequent interviews. All had completed two school placements prior to the study. Participation was voluntary, and VR sessions were scheduled during the student teachers' free periods to minimise disruption to their existing academic commitments. Three tutors (full-time HEI teacher educators) also engaged in the sessions and follow-up interviews to explore the pedagogical affordances of the platform and to inform future integration into the programme.

Data collection was carried out through semi-structured interviews with both student teachers and tutors. The interview protocol was developed to explore participants' views on the effectiveness of the VR environment in supporting teaching practice, confidence, reflection, and professional learning. Influenced by Kolb's (1984) experiential learning cycle, several prompts invited participants to comment on how the sessions supported iterative cycles of action, feedback, and adaptation. Informed by classroom readiness (Klassen et al. 2021), the interview questions also explored whether and how student teachers developed confidence in using new strategies,

compared them with previous school placements, and the extent to which the experience felt authentic. Other prompts explored collaboration with peers and the role of tutor feedback in shaping the sessions. Tutor interviews focussed on the use of VR for observation, feedback, and mentoring, as well as perceived limitations in preparing student teachers for real-world classroom complexities. As outlined in Table 3, both interview schedules included open-ended questions to encourage reflection and generate suggestions for improvement, consistent with the study's exploratory and developmental focus (Brinkmann 2013). While the project was intentionally small in scale, the interviews provided important insights into the use of immersive technology to support practice-based learning in ITE. The study's limitations, particularly this scale, single-site context, and sample, are discussed further in the concluding section of the paper.

Insert Table 3 near here.

The data collected from the interviews were analysed using reflexive thematic analysis (RTA) (Braun and Clarke 2021). It was chosen because it allows for both inductive and deductive analysis, whereby themes emerged from the data with connections to the overarching research question. The RTA process involved the following six steps: familiarisation with the data; generating initial codes; searching for themes; reviewing themes; and defining and naming themes. Table 4 provides illustrative examples of the range of codes, categories and the three themes that emerged during the RTA process: 'Practising Teaching Approaches in a Low-Stakes Environment', 'Fostering Peer Collaboration and Reflection', and 'Tutor Feedback and Mentorship'. Throughout the process of data collection and analysis, attention was paid to the ethical principles of the authors' university when conducting this research. Ethical approval was obtained from the authors' research ethics committee (REC2023/066).

Insert Table 4 near here

Findings

Practising Teaching Approaches in a Low-Stakes Environment

One of the most notable advantages of the VR platform was its ability to provide student teachers with a safe space to experiment with and practice a wide range of teaching approaches. Sarah

expressed that “the VR classroom gave me the space to try out different strategies without the fear of things going wrong - if something didn’t work, I could just reset and try again”. This ability to revisit scenarios, test out new ideas, and immediately apply the learning was valued by the student teachers. Emma shared, “the ability to keep practising the same lesson, with different approaches each time, was something I wouldn’t have had in a real classroom. It allowed me to focus on perfecting my delivery”.

While the VR environment was praised for providing opportunities for iterative practice, it also revealed some limitations. Participants pointed out that while the VR environment offered useful practice opportunities, it lacked some of the nuances and complexities of real classroom interactions. For example, Liam noted: “it was great for getting the basics, but there’s something about the real classroom that you just can’t replicate”. Participants also mentioned the limitations of the VR avatars. While the avatars were able to simulate basic classroom interactions, many felt that the lack of real emotional responses reduced the realism of the experience. Megan commented, “it is great to practice pacing and tone, but the virtual kids don’t respond in the same way as real kids do”. The absence of real-time emotional and cognitive feedback from the avatars made it difficult for student teachers to adjust their teaching based on children’s needs, a crucial part of teaching and learning.

From the tutors' perspective, the VR environment offered significant advantages in terms of allowing student teachers to rehearse and refine teaching strategies. Mark, a tutor, explained, “the VR is excellent for letting them practice basic techniques - things like giving instructions clearly or pacing their lessons - but the lack of real pupils limits their ability to practice responding to unexpected questions or managing complex group dynamics”. The tutors emphasised the need for VR to be seen as a complementary tool rather than a replacement for real-world practice. Karen, another tutor, remarked, “VR is a great tool for preparing them for the basics of the classroom, but it should be used alongside real classroom experiences. Nothing can substitute the real energy of the school”.

Fostering Peer Collaboration and Reflection

School placements can often result in fragmented or limited peer feedback, as student teachers can be geographically dispersed across different schools and classrooms. Karen, a tutor, observed, "the VR sessions opened up opportunities for peer feedback in ways that school placement doesn't. The fact that they're all in the same room means they can provide very specific feedback". The VR environment allowed for a shared, collaborative space where student teachers could observe each other's teaching, provide feedback, and engage in reflective discussion after their VR teaching sessions. Niamh explained, "talking through the VR experience with my classmates made me realise there were different ways of presenting a topic. I got new ideas from hearing how others approached their lessons". By observing how their peers handled similar situations, student teachers were exposed to diverse approaches, which they could then incorporate into their own practice. However, while the VR environment facilitated peer collaboration and reflection, it also introduced some limitations. Several participants noted that, while peer feedback was useful, it sometimes lacked the depth to make significant improvements. As Aoife reflected, "we would focus on the same things, but we weren't really diving into more complicated aspects of teaching because they weren't real children". Without the unpredictability of real classrooms, the scope for deep, critical reflection was reduced.

Tutor Feedback and Mentorship in the VR Environment

The VR environment also enabled tutors to provide immediate, structured and targeted feedback to student teachers. Several student teachers commented on the importance of the tutor in the VR setting. Cian reflected, "Having my tutor watch my VR sessions and give feedback was really helpful. They could see exactly how I was doing and offer advice that I could apply right away in the next session". The ability to quickly address areas for improvement and try new strategies within the same environment was particularly beneficial. For example, Megan explained, "the feedback from my tutor made a huge difference. They noticed small things that I wouldn't have realised on my own". Tutors also recognised the value of being able to provide focussed, targeted feedback in the VR environment, free from the usual distractions of a live classroom. Mark, one of the tutors, noted, "in the VR setting, I can focus on the student teacher's performance without having to visit a school all the time, and that is helpful in so many ways". However, while the VR platform allowed for in-depth, real-time feedback, it also had its limitations. One significant limitation was, again, the absence of real-life complexity and unpredictability in the simulated

environment. While tutors could offer feedback on teaching strategies, areas such as classroom organisation in the virtual environment limited their ability to assess how student teachers would cope with real-life classroom challenges, such as classroom organisation, a common concern for student teachers. Mark noted, "VR is great for honing techniques, but we need to be careful. Real teaching is about connecting with children and being adaptable, and I'm not sure VR can fully replicate that".

Discussion

This discussion draws together the thematic findings and theoretical frameworks of experiential learning and classroom readiness to offer a more nuanced understanding of MiTeachVR's pedagogical value, particularly in relation to experiential learning in ITE. One of the clearest findings from the study is that MiTeachVR enabled student teachers to engage in structured, repeatable practice in a low-stakes environment. Participants consistently valued the opportunity to rehearse core teaching components, such as giving instructions, modulating tone, or moving purposefully around the classroom, without the immediate pressures of a live school setting. This reflects Kolb's (1984) experiential learning cycle, where concrete experience and active experimentation are followed by reflective observation and conceptualisation. MiTeachVR offered multiple cycles of enactment and revision, allowing student teachers to apply feedback and refine their approach, a form of iterative learning rarely available in traditional placement or time-bound microteaching formats. VR thus expanded the temporal and spatial possibilities for practice, offering greater autonomy and opportunities for purposeful experimentation. At the same time, the data make clear that while student teachers appreciated this safe space to "get the basics right," the avatars lacked the social complexity and emotional responsiveness of real pupils. Consequently, MiTeachVR supported cognitive aspects of classroom readiness, such as instructional clarity, voice modulation, and movement, but was less effective in cultivating emotional and relational readiness, where the unpredictable dynamics of classroom life play a critical role (Chen 2019; Klassen et al. 2021). As Alexander (2018) notes, readiness is not a fixed endpoint, but an evolving set of capacities that must be developed across varied, authentic teaching contexts.

The shared nature of the VR sessions also supported a collaborative layer to experiential learning. Unlike the isolated structure of school placement, MiTeachVR created a communal, co-present

space for peer observation, feedback, and shared meaning-making. These interactions represent an extension of Kolb's reflective observation phase, enabling student teachers to examine both their own and others' teaching through a collective lens. Niamh's reflection on gaining new ideas from peers illustrates the dialogic nature of such learning. However, as noted in McGarr and McCormack (2016), reflection is not inherently critical, and without intentional scaffolding, peer discussions can remain focussed on surface-level behaviours rather than deep pedagogical reasoning. Recognising this, tutors were prompted to adopt a more structured approach to post-session debriefs. While not always consistently applied, the inclusion of scaffolded reflective prompts aimed to help student teachers move beyond technical appraisal and engage with more interpretive questions. Drawing on McGarr's (2021) emphasis on guided reflection, tutors were encouraged to help student teachers connect the VR experiences with prior classroom encounters, particularly in relation to inclusion, engagement, and classroom responsiveness (see Table 5). For example, when student teachers noted the avatars' lack of responsiveness, these observations were deliberately reframed as opportunities to consider how real learners might express disengagement and how pedagogical strategies, content accessibility, or even language choices could better support diverse needs. In this way, MiTeachVR was positioned not simply as a space for rehearsing discrete teaching acts but as a setting in which assumptions could be surfaced, decisions interrogated, and practice reimagined.

Insert Table 5 near here.

As McGarr and McCormack (2016) argue, critical reflection must be deliberately structured. Indeed, this study reinforces the point that tools like VR are only as pedagogically powerful as the practices surrounding their use (McGarr 2021). The tutor-led reflective prompts and discussions used here were designed to nudge student teachers to bridge their virtual scenarios with real-life classroom practice and complexity. The AI-readiness of MiTeachVR further extends these possibilities. While the study did not yet implement AI-generated feedback, the system captured data on gaze, movement, and vocal patterns, offering a future means of visualising practice. In theory, such data could support metacognitive reflection, giving student teachers tangible feedback on their teaching stance, vocal delivery, or classroom positioning. However, the findings suggest a clear caution: data alone cannot prompt learning. For AI analytics to enhance critical reflection,

they must be situated within tutor-guided dialogue that supports interpretation, sensemaking, and next-step planning. As one tutor aptly noted, “real teaching is about connecting with children and being adaptable”; a reminder that algorithmic feedback must never supplant pedagogical judgement but rather inform it.

In this light, MiTeachVR’s value lies less in its technological novelty than in its capacity to support an enriched form of experiential learning when embedded in well-sequenced, tutor-facilitated cycles of action and reflection. Its core contribution is not the replication of classroom complexity, but the creation of a focussed, intentional space in which experiential learning can unfold incrementally. By enabling student teachers to rehearse, receive feedback, observe peers, and critically reflect within a shared space, MiTeachVR offers a viable complement to traditional approaches, particularly when real classroom access is limited or logistically constrained. Thus, its greatest value may lie not in what it replaces but in what it complements: a pedagogical space where core practices can be safely trialled, collectively discussed, and critically reimagined.

Limitations, Implications and Conclusions

This study was designed as a small-scale, exploratory project supported by seed funding, and as such, several limitations should be acknowledged. The research was conducted within a single undergraduate ITE programme at one university, involving 12 student teachers and 3 tutors, thus limiting the generalisability of the findings. All participating student teachers had already completed school placements, which likely shaped how they engaged with the VR environment. Including student teachers earlier in their programme, particularly those who had not yet undertaken a placement, might have yielded different insights into how VR can support the development of foundational teaching competencies. In addition, although MiTeachVR was designed with AI-readiness in mind, the study did not evaluate AI-driven feedback, focusing instead on tutor-facilitated reflection. However, these limitations reflect the intentional design of the project as a proof of concept. Within the context of limited funding and infrastructure, the project successfully demonstrated what is pedagogically possible when immersive technologies are used purposefully within ITE. The findings offer a strong foundation for future, larger-scale studies that incorporate mixed methods and broader participant cohorts to evaluate the longer-term impact and scalability of MiTeachVR.

In terms of implications, this study highlights the need for teacher education to shift from surface-level engagement with digital tools to the intentional design of immersive, practice-based experiences that are pedagogically rich. If student teachers are to develop the capacity to integrate technology meaningfully into their future classrooms, ITE must model such pedagogical use explicitly and purposefully within its own practices (Moynihan et al. 2023). VR should be embedded within intentionally sequenced learning cycles, with each session contributing to the development of core instructional practices. Activities should be explicitly developed with opportunities for reflective analysis (McGarr 2021), which connect the VR-based teaching episodes to real classroom experiences. Supporting teacher educators in facilitating structured, reflective dialogue, where student teachers interrogate their practice and connect VR experiences to real classroom contexts, is therefore essential (McGarr and McCormack 2016; McGarr 2021). Crucially, institutional and policy-level support must recognise that the success of such initiatives does not lie in the tools themselves, but in the pedagogical understanding required to use them well. Supporting teacher educators to develop this capacity is essential if student teachers are to benefit from learning experiences that are both technologically rich and educationally meaningful.

At a theoretical level, this study contributes to reimagining experiential learning in ITE by exploring how enduring pedagogical frameworks can be enriched, rather than displaced, by technological innovation. It responds directly to Carrillo and Flores's (2022) call to engage with meaningfully and sustainably with technological advancements in teacher education, beyond the reactive adaptations prompted by the pandemic. Drawing on empirical insights from the purpose-built MiTeachVR environment, this study illustrates how cycles of enactment, feedback, and tutor-guided reflection within immersive settings can deepen student teachers' experiential learning in structured, low-stakes contexts. Rather than treating immersive technologies as substitutes for school-based experience, the study positions them as complementary. As technology gains increasing prominence in ITE, its pedagogical value will depend not on its novelty, but on how thoughtfully it is integrated into theory-informed practice. This study contributes to that agenda by illustrating how experiential learning can be enacted through thoughtfully designed virtual environments.

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Acknowledgments

We gratefully acknowledge the support of Dublin City University for funding this project. We wish to thank Jitesh Jhawar for his integral role in the development of the platform. Special thanks are also due to Dr Maura Coulter (Associate Dean for Research) for advancing this research within the Institute of Education, and to Dr Shirley Coyle (DCU School of Electronic Engineering) for her insightful guidance at key stages. Finally, we are deeply grateful to Professor Alan Smeaton (Insight Research Ireland Centre for Data Analytics, DCU) for his consistent support, engagement, and generous advice throughout the research.

Table 1: Mapping micro-teaching practices to VR features

Micro-teaching practice	**VR feature**
Eye Contact	Head tracking / gaze tracking Student focuses on different virtual students Students will raise / lower hands
Hand gestures	Hand / Controller tracking
Teacher movement	Teacher movement around virtual space
Teacher voice	Audio recording for reflection
Varying the stimuli	Teacher presentation, use of whiteboard, use of 'handouts'
Teacher confidence / Fluidity	Overall use / Practice

Table 2: Reflective prompts and questions following each session

Micro-teaching practice	**VR feature**
Concrete Experience	• What stood out to you during the experience today?

	• Describe a specific moment that felt particularly significant or challenging.
Reflective Observation	• Looking back on the session, what did you notice about your teaching decisions, classroom presence, or interactions?
Abstract Conceptualisation	• How does this experience relate to theories or strategies you've learned in your coursework? • Did it confirm or challenge any of your assumptions about teaching?
Active Experimentation	• Based on this session, what changes or strategies would you like to try in your next VR session or future teaching placements? Why?

Table 3: Sample of Interview Questions

Participants	**Sample of Questions**
Student Teachers	● Can you describe your overall experience using the MiTeach VR? ● Did you feel more confident in your teaching abilities after practicing in the VR environment? Why or why not? ● Did MiTeach VR allow you to apply the theories you learned in your course? ● Did you feel that the MiTeach VR provided authentic teaching experiences? If not, what was missing? ● How did the opportunity to practice teaching in MiTeach VR compare with your previous placement experience? ● Can you describe any collaborative experiences you had with your classmates while using MiTeach VR? ● In what ways did MiTeach VR encourage you to reflect on and improve your teaching strategies? ● Did the feedback from your tutor during VR sessions help you refine your teaching? ● Were there any aspects of the tutor's feedback that were more impactful in the VR environment compared to feedback that you might have received on placement? ● Were there any limitations of MiTeach VR that you felt didn't fully prepare you for real classroom teaching? ● What aspects of MiTeach VR would you improve to make it more effective for student teachers? ● If you could add or change one thing about the VR teaching experience, what would it be?
Tutors	● In your opinion, how effective was VR in helping student teachers develop their understanding of teaching and learning? ● What there any areas you saw improve in student teachers after using MiTeachVR? ● Was providing feedback in the VR environment different from providing feedback on placement? ● Did the VR platform provide you with adequate opportunities to observe and mentor student teachers? Why or why not? ● What do you consider to be the main limitations of MiTeach VR, or VR, more broadly, in preparing student teachers for the realities of classroom teaching? ● What changes or improvements would you suggest for future iterations of MiTeach VR to enhance student teacher learning?

Table 4: Codes, Categories and Themes

Theme	Category	Code	Anchor Example
Practising Teaching Approaches in a Low-Stakes Environment	Emotional Safety	Managing anxiety in VR	'The VR classroom gave me space to try out different things without fear of things going wrong.' - Sarah
	Repeated Practice Opportunities	Ability to practice lessons multiple times	'The ability to keep practicing the same lesson with different approaches made me focus on imrpving my lessons;- Emma
	Building Confidence	Building confidence through iterative practice	'I felt more confident in my teaching because if something didn't work, I could just reset and try again.' - Sarah
	Testing Various Pedagogical Approaches	Testing different approaches in VR scenarios	'I could try different techniques in the VR without worrying about failing.' - Emma
	Lack of Real-World Complexity	Limited unpredictability of classroom challenges	'It's great for practice, but real classrooms on placement come with much more pressure.' – Liam
Fostering Peer Collaboration and Reflection	Peer Feedback	Providing feedback after VR sessions	'We could give each other feedback on things we might have missed during the lesson.' - John
	Reflective Discussions	Reflecting on VR teaching experiences	'Talking through the VR experience with my classmates made me realise there were different ways of presenting a topic.' - Niamh

	Observation and Shared Learning	Learning from peers' VR sessions	'Watching others teacha similar topic gave me new ideas.' - John
	Increased Peer Support	Increased peer support through shared experiences	'We worked together on how to improve the lesson plan and try new techniques.' - Sarah
	Critique: Limited Depth in Reflection	Shallow reflection due to lack of authentic classroom dynamics	'The discussions were ok because it was virtual kids weren't behaving like real ones.' - Aoife
	Collaboration on Teaching Strategies	Collaborating on refining teaching strategies	'Sharing our experiences helped me develop new approaches to teaching.' - Niamh
Tutor Feedback and Mentorship	Targeted Feedback	Feedback on teaching performance	'Having my tutor watch my VR sessions and give feedback was really helpful.' - Cian
	Real-Time Feedback	Receiving feedback after VR sessions	'The feedback I received after the session helped me in my lesson planning.' - Emma
	Critique: Lack of Complex Student Responses	Limited emotional and behavioral responses from virtual students	'The avatars didn't react like real kids, so it was hard to get genuine feedback.' - Megan
	Supporting Teaching Strategy Development	Improving lesson delivery through feedback	'The feedback on my pacing really helped me improve.' - Sarah

Table 5: Sample of Prompt Questions for Tutors

Sample of Prompt Questions for Tutors
• What kinds of pupil behaviour were included in the VR session? • Did any behaviours feel oversimplified or exaggerated? • Were some types of pupils or classroom situations missing? • How were pupils portrayed? • How did you respond to classroom management issues - and why? • What was going through your mind when pupils were distracted or disengaged? • If this happened in a real classroom or on placement, what else might you have considered? (Prompt - different learning needs, additional needs?

Figure 1: Sample of Classroom Design A

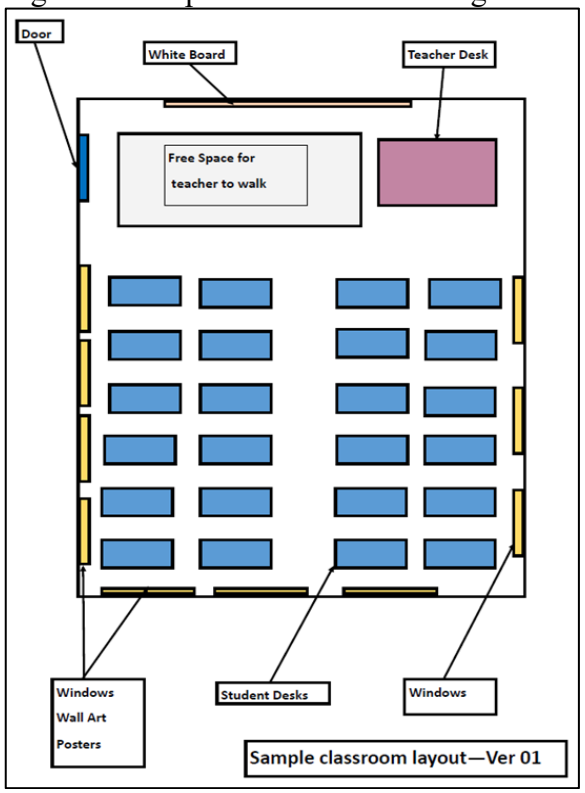

Figure 2: Sample of Classroom Design B

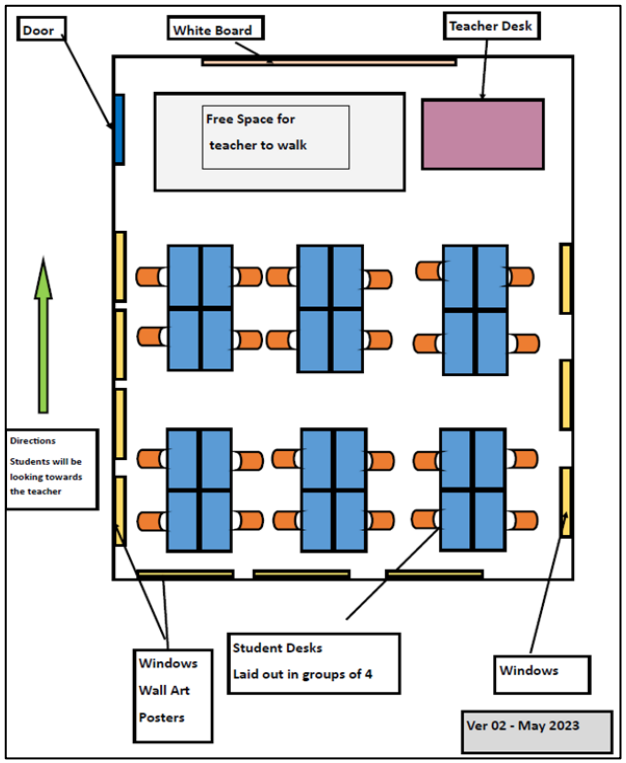

Figure 3: Sample of Virtual Students A

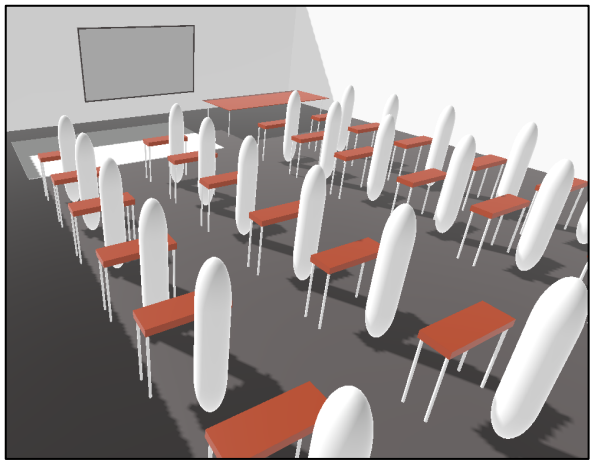

Figure 4: Sample of Virtual Students 5

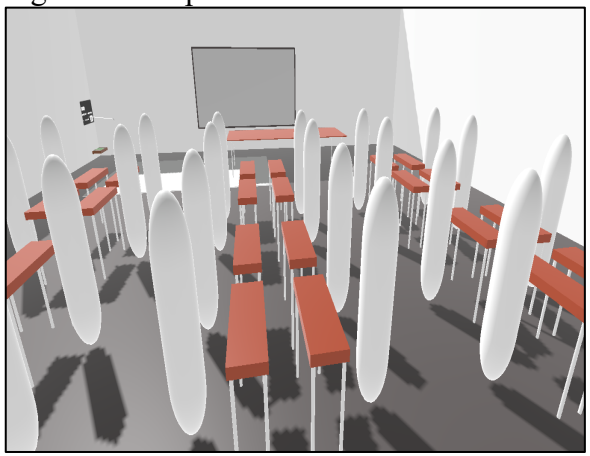

Figure 5: Classroom Design A

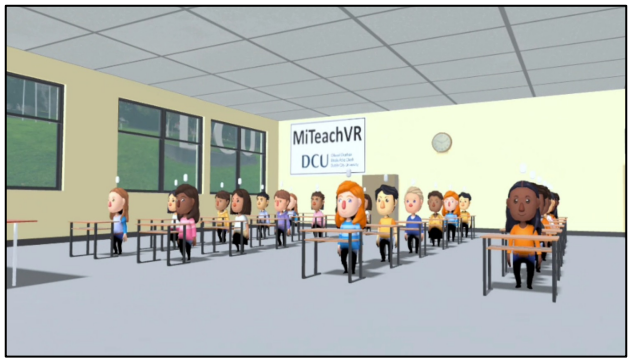

Figure 6: Classroom Design B