Enhancing Learning through Immersive Technologies: Insights and Challenges from Educators in Wales

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ABSTRACT

This article examines the integration of immersive technology, specifically Virtual Reality (VR) in education, focusing on its potential to enhance student engagement, motivation, and learning outcomes. As VR technology becomes more accessible, educators are increasingly interested in its curricular applications. A scoping study with 26 teachers from diverse local schools assessed their familiarity with VR, its perceived benefits, and implementation challenges. Findings indicate that VR offers enriching experiences, fosters active learning, and promotes equity by addressing barriers in traditional education. However, challenges such as affordability, equipment access, and the need for professional development persist. This research contributes to the understanding and implementation of immersive technologies in education, aligning with the Curriculum for Wales' commitment to innovative pedagogy coupled with equitable and inclusive learning experiences.

Introduction

The use of immersive technologies, such as VR and Augmented Reality (AR), in education is rapidly evolving. Historically, the high costs and

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extensive training required for these technologies made them inaccessible to many institutions. However, as prices drop and innovation in pedagogy becomes a priority, there is a growing interest in incorporating immersive technology into education. Its relative affordability, ease of use, and accessibility have now made it a more practical option for educational settings (Brown and Green, 2016). Despite these advancements, the budget constraints in many schools have caused the education sector to fall behind in fully adopting these technologies (Lege and Bonner, 2020).

This scoping study seeks to explore teachers' perspectives on immersive technologies in local schools, focusing on their familiarity with and use of these tools. Following this exploratory phase, our next goal is to co-develop equitable and innovative learning experiences that allow schools to seamlessly integrate immersive technologies into their curricula. We will address the following research questions:

- How is immersive technology currently being implemented in classrooms, and in what ways?
- What impact, if any, does immersive technology have on student engagement and learning outcomes?
- What challenges do educators face when integrating VR and immersive technologies into their teaching practices?

Literature

Engagement and Motivation

Studies have shown that immersive technologies can significantly boost student engagement and motivation (Yousef, 2021; Tilhou et al., 2020; Pellas et al., 2019). Technology has long been integrated into classrooms (Bozkurt, 2020; Morel and Spector, 2022) to enhance learning by providing dynamic and interactive experiences. This hands-on approach can improve self-efficacy in ways that traditional teaching methods sometimes struggle to achieve (Fokides et al., 2019; Mayer et al., 2019; Asad et al., 2021).

VR also allows for authentic learning and assessment experiences that are often difficult to replicate in traditional classroom settings (Al-Ansi and Al-Ansi, 2020). For instance, VR can simulate work-related

scenarios or offer unique experiences that would otherwise be too costly, risky, or logistically challenging. By providing simulated environments, VR creates opportunities for reduced risk learning (Asad et al., 2021) where students can practice and hone skills such as critical thinking (Jesionkowska et al., 2020), without real-world consequences and build self-efficacy (Roberts and King, 2020).

The effectiveness of student learning is significantly shaped by the teaching and learning strategies employed in the classroom. While technology alone may not enhance learning, its integration into effective teaching practices can offer new opportunities for both students and teachers, enriching the educational experience (OECD, 2016). Immersive technologies, such as VR, can enhance pedagogical approaches by aligning with evidence-based teaching and learning strategies (Asad et al., 2021).

Supporting Inclusion

One of VR's key benefits is its ability to create low-stakes, immersive environments that support learners of all abilities. VR allows students to progress at their own pace, offering those with Additional Learning Needs (ALN) equitable opportunities for success. Molloy and Farrell (2024) emphasise VR's advantages for learners with ALN, such as neurodiverse learners, who could use VR to develop coping strategies for emotional regulation within a 'safe environment'. However, it's important to note that some learners may experience cybersickness with effects such as nausea when using VR (Rebenitsch and Owen, 2016) or cognitive overload (Makransky et al., 2019).

Barriers to VR Implementation

Despite its potential, there are significant challenges to the widespread adoption of VR in schools. Budget constraints remain a key issue, as the cost of VR equipment, while decreasing, can still be a barrier for schools with tight financial resources (Fransson et al., 2020). Additionally, there are costs associated with staff training to ensure effective pedagogical use of VR technology. This training ranges from basic equipment usage to integrating VR meaningfully into lessons. Infrastructure also poses a

challenge, as many schools may lack the network capacity or hardware to support VR equipment (Fransson et al., 2020; Ardiny and Khanmirza, 2018). Another limitation is the availability of relevant educational content. While VR resources are expanding, content specific to certain subjects may be lacking or require expensive subscriptions, limiting its usefulness in particular areas (Jensen and Konradsen, 2018).

Cynefin & Cymraeg

In the Curriculum for Wales, 'Cynefin' refers to the historical, cultural, and social environment that shapes and influences a community (Welsh Gov., 2024). The curriculum encourages schools to create a curriculum that reflects their community's unique identity while connecting it to broader global perspectives (Donaldson, 2015). Immersive technology can significantly enhance this Cynefin concept fostering a sense of belonging and helps students better understand their place in the world and the diversity within their community (Chapman et al., 2020).

Using VR to develop the Welsh language in both English and Welsh-medium schools present a dynamic and immersive approach to language learning (Parmaxi, 2020). Through VR, pupils can explore virtual Welsh-speaking environments—such as towns or historical landmarks—where they can practice conversational Welsh in authentic contexts. Gamified language learning can boost motivation by incorporating challenges and rewards (Peterson et al., 2021), while role-playing scenarios enable students to assume various professional and everyday roles, requiring practical language use. VR also enhances cultural immersion by allowing students to experience Welsh culture through virtual events, such as the Eisteddfod, or by visiting historical Welsh villages, thereby deepening their connection to the language.

Methods

Sampling

The convenience sampling approach leveraged existing relationships from previous university-school collaborations. Participants were selected

based on their accessibility, placing their insights at the core of the data collection process (Bryman, 2012). To reduce bias, the sample was expanded to include local schools unaffiliated with the university, resulting in 26 respondents completing the survey. The sample included primary and secondary schools from both English and Welsh medium contexts.

Data Collection

This scoping survey, as the first phase of a tri-phase project, adopted a mixed methods approach, incorporating both closed and open-ended questions to combine the strengths of qualitative and quantitative research. This approach provided a comprehensive understanding of the research problem within different school contexts (Maxwell et al., 2016). The survey explored the opportunities and barriers to using VR in local classrooms, setting the stage for detailed, context-specific planning in the next phase.

To mitigate potential power dynamics due to close working relationships between researchers and participants, anonymity was ensured, (BERA, 2024). However, participants had the option to provide contact information for future participation in the second phase, a sequential exploratory study. This second phase will involve semi-structured interviews and the trialling of co-created VR content.

Data Analysis

Twenty-six respondents completed the survey, which consisted of 10 questions, 3 of which were qualitative. These qualitative questions allowed respondents to elaborate, providing deeper contextual insights and became the focus of detailed analysis:

1. Have you considered using immersive technology/VR in your educational setting?
2. What areas of education do you believe immersive technology/VR could enhance in your setting?
3. What challenges do you foresee with the use of immersive technology/VR?

A series of deductive themes were established prior to analysis, based on existing literature and researcher experience. Inductive analysis was also conducted to identify emerging themes and patterns specific to different educational contexts (Patton, 2002). The data was coded to provide deeper insights into participants' perceptions and experiences. Qualitative findings were used to contextualise the quantitative results (Braun and Clarke, 2017). Multiple researchers coded and cross-referenced themes to minimise bias and improve the reliability of the analysis (Cole, 2023).

Ethics

Prior to the study, ethical approval was secured in accordance with established university guidelines. Participants were informed of the voluntary nature of their involvement through an electronic survey, which clearly outlined the study's objectives and ethical considerations, as recommended by BERA (2024). Key ethical principles, such as anonymity and the right to withdraw up until survey submission, were emphasised. While participants had the option to provide identifiable information, such as email addresses for follow-up research, any such data was excluded from the analysis to ensure the confidentiality and integrity of the findings.

Results and Discussion

The findings identified through analysis revealed both teacher perceptions and experience of VR in their setting. This section is structured around the following key themes identified, which will be addressed individually.

- Affordability
- Enrichment Experiences
- Engagement and Motivation
- Pedagogy
- Equity

Affordability

The affordability of VR in education remains a significant barrier, particularly for schools with constrained budgets. Nearly all (92%) of respondents identified cost as a key challenge to using VR in their schools. Interestingly, however, 19% of respondents reported already owning headsets, and 38% had either experienced or observed the use of VR. While VR presents innovative learning opportunities, the high costs associated with equipment, software, and the necessary infrastructure can be prohibitive (Fransson et al., 2020; Ardiny and Khanmirza, 2018). Additionally, ongoing expenses related to maintenance, updates, and teacher training add further complexity to its adoption (Jensen and Konradsen, 2018). To make VR more accessible, targeted funding, subsidies, or partnerships will be crucial in supporting its broader implementation. This will be a primary focus in the second phase of the project. Furthermore, 86% of respondents expressed interest in participating in the second phase of the project, signalling strong enthusiasm for VR integration—provided that the existing barriers, such as cost, are effectively addressed.

Enrichment Experiences

Integrating VR into the curriculum not only enhances engagement but also provides innovative ways for students to connect with the content. Importantly, VR helps bridge geographical and experiential gaps, allowing all students in Wales—regardless of location to access global experiences. Nearly half (47%) of respondents identified the potential to enrich student experiences as a key factor in considering VR for their classrooms. Additionally, 27% highlighted the opportunity to offer otherwise inaccessible experiences, such as exploring the Moon or practicing welding, as positive aspects of VR. Lege and Bonner (2020) explain that VR allows educators to take learners into both real and imagined environments, benefiting students with limited mobility by ensuring they are not disadvantaged.

VR can also support key aspects of the Welsh Curriculum (Welsh Gov., 2024), particularly the goal of fostering enterprising, creative contributors. Immersive environments can inspire creative thinking by allowing students to engage deeply with their surroundings. For instance,

students can create products in VR or AR and manipulate them within the environments for which they were designed. This hands-on interaction fosters creativity and innovation.

Additionally, VR offers students the chance to create their own content using 360 cameras, promoting independence and creativity. This opportunity allows learners to capture and explore their local areas, supporting the concept of Cynefin by focusing on local histories and environments. The importance of this aspect was highlighted by 12% of respondents, who recognised the value of using immersive technology to support this culturally significant initiative.

Engagement and Motivation

VR can greatly enhance engagement and motivation among school pupils by transforming traditional learning experiences into immersive adventures (Liu et al., 2020) making education more enjoyable, subsequently fostering a deeper connection with the curriculum (Di Natale et al., 2020; Makransky and Lilleholt, 2018). However, when responding to how VR might be utilised within their educational context, only 12% of participants cited engagement and motivation as a leading factor. This suggests that greater awareness and professional learning could significantly impact practitioner understanding and use of immersive technology to support teaching and learning (Fransson et al., 2020; Ardiny and Khanmirza, 2018).

Additionally, by incorporating a 360-degree camera, students can actively participate in the planning and creation of educational content, cultivating a sense of ownership and creativity. This approach aligns with the Curriculum for Wales's emphasis on a student-centred, ground-up methodology, where learners are not merely passive recipients of information but active contributors to their education (Roberts and King, 2020). Such engagement enhances motivation, promotes collaboration, and develops critical thinking skills, resulting in a more meaningful and personalised learning experience.

Interestingly, 27% of respondents identified engagement as a key factor in their consideration of VR for classroom use. However, with targeted training and increased familiarity with VR's capabilities, this percentage is likely to rise as educators become more aware of its transformative potential.

Pedagogy

Active and experiential learning can thrive in interactive environments where students explore, experiment, and engage with content. This hands-on approach not only boosts retention but also deepens understanding by allowing students to apply concepts in dynamic, real-world scenarios, thereby fostering critical thinking and problem-solving skills (Jesionkowska et al., 2020). Notably, one-third (33.3%) of respondents indicated that they had considered incorporating VR in the classroom to enhance their pedagogical practices. Collaborating with teachers in the project's second phase will support the development of effective, research-based teaching methods, enhancing learning while sharing best practices and contributing to the evolving research landscape.

The Curriculum for Wales places a strong emphasis on equity and inclusion, aiming to ensure that all learners, regardless of their background, have equal opportunities to succeed. To achieve this, there must be a commitment to understanding equity in education and recognising the importance of learner well-being (Partneriaeth, 2022). In terms of access to experiences, both within classrooms and externally, immersive technologies can help reduce individual and social barriers, providing equitable learning experiences for all. Qualitative data revealed that one-fifth (20%) of respondents believe that immersive technology can serve as a vehicle for equity and inclusion. They cited opportunities for learners to 'see places they would not otherwise be able to see', benefit from 'concrete, real-life examples in 3D to support learning', and have virtual experiences to gain a better understanding in contexts where opportunities are limited.

However, while technology offers numerous benefits, potential barriers remain for schools concerning access and affordability. Financial constraints can hinder the acquisition of equipment, and upskilling staff through professional development presents additional time and cost challenges. This is underscored by survey results, with 92% of respondents identifying cost as a barrier, 84% pointing to access to equipment, 80% citing training needs, and 53% noting time constraints. It is important to note that many respondents selected multiple options when reflecting on the anticipated challenges associated with implementing immersive technology and VR in their settings.

Conclusion

In conclusion, the integration of immersive technologies, particularly VR, into educational settings presents a transformative opportunity to enhance student engagement, motivation, and learning outcomes. Our scoping study highlights the significant potential of VR to create enriching experiences, foster active and experiential learning, and support equity and inclusion within the classroom. Despite the enthusiasm from educators and the clear benefits of VR, challenges remain, particularly concerning affordability, access to equipment, and the need for professional development.

Phase 2 of our project will focus on co-developing equitable and innovative VR learning experiences by collaborating with schools who have demonstrated a desire to utilise VR as part of their curriculum. This collaboration aims to share best practices, facilitate professional learning, and explore strategies for overcoming barriers to access. By leveraging existing resources and experiences, we hope to create a supportive environment that allows all learners in Wales to benefit from immersive technologies, thus aligning with the Curriculum for Wales' commitment to equity and inclusion.

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