Chapter 1
A Systematic Review of the Challenges and Limitations of VR in Education

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ABSTRACT

The recent decades have been characterised by significant technological advancements, resulting in the creation of innovative products and services. These developments have sparked numerous new inventions and discoveries that were previously unimaginable. Virtual reality has emerged as a promising technology in the field of education, offering immersive and interactive experiences that can enhance learning outcomes. However, several challenges and limitations need to be addressed for its effective integration into educational environments. The purpose of this chapter is to investigate the challenges and limitations associated with the integration of virtual reality technology in educational settings by examining the existing literature and conducting a systematic literature review. Additionally, it seeks to propose viable solutions to address these challenges and enhance the effectiveness of virtual reality applications in education. A systematic literature approach was employed to identify, analyse, and synthesise thirteen studies on its challenges and limitations in education. The initial learning barriers, lack of virtual reality-specific pedagogy, financial costs, technical skills and resources, the

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effectiveness of virtual reality technology and applications, as well as computer quality, reduced human interaction and communication, users' readiness and attitude towards virtual reality technology and teaching in virtual environments were identified as educational challenges. The limitations consisted of design, health issues, technological and accessibility, cognitive demand and unfulfilled promises. Based on the findings, recommendations were provided for educators, developers, and policymakers to be equipped with the necessary knowledge to make informed decisions and tools to effectively integrate virtual reality into educational settings. By addressing these challenges and limitations, virtual reality has the potential to effectively revolutionise education and enhance learning experiences for students.

1. INTRODUCTION

Recent decades have been characterised by significant technological advancements, resulting in the creation of innovative products and services. These developments have sparked numerous new inventions and discoveries that were previously unimaginable (Wani & Ali, 2015). Among these remarkable innovations, virtual reality (VR) stands out as a significant achievement. LaValle (2023) posits that VR is a powerful technology that promises to change people's lives, unlike any other. It is like a waking dream that could take place in a magical cartoon-like world or could transport people to another part of the earth or universe (LaValle, 2023). The VR technology market has been expanding in tandem with its rapid advancement, with a projected global market size surge from US$ 7.3 billion in 2018 to US$ 120.5 billion in 2026 (Fortune Business Insights, 2019). Compared to 2019 statistics, the analysis of the VR market 5 years later reveals that it is projected to grow significantly in the coming years (Mordor Intelligence, 2024). With an estimated market size of USD 67.66 billion in 2024, it is expected to reach USD 204.35 billion by 2029. This growth is attributed to a compound annual growth rate (CAGR) of 24.74% during the forecast period of 2024-2029 (Mordor Intelligence, 2024). VR is being increasingly utilised in the field of education, not just for gaming and entertainment purposes (Wohlgenannt, Simons & Stieglitz, 2020). The authors argue that it is commonly used for corporate training as well as for university students and in schools and various companies, such as VR Immersive Education and Google Expeditions, which have introduced VR applications specifically designed for classroom use. These applications cover a wide range of subjects, including anatomy, geography, history, physics, and chemistry (Wohlgenannt et al., 2020). Hence, Lege and Bonner (2020) point out that educators have witnessed the progression of VR as a practical tool in classrooms worldwide through various innovations. These computer-generated spaces, known for their immersive and interactive features, present a different ap-