Chapter 5
Immersive Reality Technology-Based Gamification on Sustainable Education

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ABSTRACT

The Industry 5.0 concept for emerging sustainable education involves transforming every lesson into an interactive Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR) experimental gamification. By producing immersive and engaging experiences that were previously unthinkable, Extended Reality (XR) technology is transforming a number of sectors, including education. The present

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study investigated the domain of simulation-based learning, shedding light on its significance, challenges, and boundless possibilities in the context of health technology education. The paper advanced hi-tech educational technology adoption in the development of interactive educational pedagogy in Society 5.0 and Education 5.0 by describing the technological underpinnings, guiding principles, essential values, and key components of Industry 5.0 in education. The study adopted Actor-Network Theory (ANT) model to explore the implication of technological pedagogy content knowledge (TPCK) model instruction design for immersive education technology.

INTRODUCTION

The rapid evolution of digital technologies have transformed the educational landscape, yet many institutions continue to rely on traditional, didactic teaching methods that fail to meet the needs of 21st-century learners(Ugochukwu Okwudili Matthew, Kazaure, Kazaure, Hassan, et al., 2022). While immersive technologies such as Extended Reality(XR), Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR) offer promising avenues for experiential and personalized learning, their integration into mainstream education remains fragmented and under-theorized(D. Oyekunle, Claude, Waliu, Adekunle, & Matthew, 2024). This disconnect between technological potential and pedagogical practice presents a critical problem: how can immersive tools be meaningfully embedded into educational systems to enhance learning outcomes, foster ethical awareness, and support sustainable development?. One of the most pressing issues is the lack of a cohesive framework that links immersive technologies with established educational theories and assessment models. Educators often struggle to align these tools with curriculum goals, resulting in isolated or superficial applications that fail to leverage their full potential. Moreover, existing pedagogical models are not always equipped to handle the dynamic, interactive nature of immersive environments, leading to challenges in instructional design, learner engagement, and outcome measurement. Another significant problem lies in the assessment of learning within immersive contexts. Traditional evaluation methods such as standardized tests and static rubrics are ill-suited to capture the depth of understanding, emotional intelligence, and real-time decision-making that immersive experiences can cultivate. Without adaptive, competency-based assessment tools, educators are unable to measure the true impact of immersive learning or provide meaningful feedback to students(Qin, 2024).

Accessibility and inclusivity also remain major concerns, in addition to high costs, technical complexity, and limited infrastructure that prevent equitable access to immersive technologies, particularly in under-resourced educational settings(Jatto & Aladesusi, 2025). This digital divide risks exacerbating existing inequalities