

Virtual Reality-Enabled Immersive Learning: Bridging Accessibility and Experiential Education for Diverse Learners

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ABSTRACT

Immersive virtual reality can support experiential learning when the task requires spatial judgment, repeated practice, or access to settings trainees cannot safely enter. Effects in higher education are positive on average and highly variable. A 2025 meta-analysis of augmented- and virtual-reality interventions estimated $d = 0.98$ across 21 studies and 41 interventions, with wide prediction intervals implied by cost and implementation differences (Kumar & Gorai, 2025). Systematic reviews find concentration in medicine and science, short interventions, and weak reporting on learners with disabilities (Luo et al., 2021; Radianti et al., 2020; Stracke et al., 2025). This article specifies an accessibility-first design for a Nigerian college of education: shared headsets, a desktop fallback, captions, seated experiences, and outcomes that include learners with low prior attainment and limited device access. The cognitive affective model of immersive learning (Makransky & Petersen, 2021) guides the claim that presence helps only when it does not overload working memory. Experiential education is bridged by simulation of classroom incidents and laboratory procedures, not by novelty.

Keywords: *virtual reality, immersive learning, accessibility, universal design for learning, teacher education, Nigeria*

INTRODUCTION

Experiential education asks learners to act in a setting, receive consequences, and reflect (Kolb, 1984). Colleges of education often cannot place every trainee in a rare classroom incident, a science laboratory, or a practicum site at the moment the topic is taught. Virtual reality (VR) offers a substitute environment. It also excludes students when headsets are few, motion sickness is ignored, or content assumes sight, hearing, and uninterrupted power.

At Edo State College of Education, Igueben, the design problem is how to use immersive learning without making the headset the only path. This article reviews verifiable evidence and states a design that treats accessibility as a primary outcome, not as an add-on after the technology has been chosen.

Literature Review

What immersive VR is

Dalgarno and Lee (2010) distinguished representational fidelity and learner interaction as affordances of 3-D virtual environments. Jensen and Konradsen (2018) reviewed head-mounted displays in education and found promising skill outcomes alongside cybersickness, cost, and instructor workload. Radianti et al. (2020) systematically reviewed immersive VR in higher education and reported a surge of applications, mostly prototypes, with evaluation often limited to usability. Luo et al. (2021) reviewed K-12 and higher-education studies from 2000 to 2019 and concluded that findings were conditional: VR helped some knowledge and skill outcomes and was inconclusive for others.

Stracke et al. (2025) reviewed immersive VR in higher education and again found uneven methodological quality. Sümer and Vaněček (2025) reviewed virtual and augmented reality in higher education across 95 articles and noted heavy use in medical courses and simulation as the dominant pedagogy. Teacher education appeared in only a small share of experimental and survey studies.

Effect sizes

Merchant et al. (2014) meta-analysed virtual-reality-based instruction and found positive effects on learning, larger for games and simulations than for virtual worlds in some contrasts, with novelty a plausible confounder. Kumar and Gorai (2025) synthesised 21 higher-education studies and 41 AR/VR interventions and reported $d = 0.98$ (95% CI [0.77, 1.20]), describing post-test improvements of up to 26.42% in included studies. That estimate mixes AR and VR and should not be read as the effect of headsets alone. Large average effects coexist with implementation failure when hardware does not scale.

Learning mechanisms

Mayer's (2014) cognitive theory of multimedia learning limits how much visual and verbal material working memory can handle. Makransky and Petersen (2021) proposed the

cognitive affective model of immersive learning (CAMIL): presence and agency can raise interest and self-efficacy, but extraneous cognitive load can cancel the gain. Makransky et al. (2019) found that an immersive lesson increased presence and interest yet produced worse transfer than a desktop version when the immersive display added load. The design implication is restraint. A seated, short, single-goal simulation is more defensible than an open world.

Accessibility and diverse learners

Universal design for learning asks for multiple means of engagement, representation, and action (Meyer et al., 2014). VR research under-reports disability, language, and connectivity (Radianti et al., 2020). Cybersickness disproportionately removes some learners from the treatment (Jensen & Konradsen, 2018). A bridge between accessibility and experiential education therefore requires a non-headset path that teaches the same decision, captions and audio description where speech carries content, seated modes, and time-on-task limits. Diversity in a Nigerian college also includes prior attainment, gender, and whether the student shares a phone. Those variables belong in the analysis plan.

Conceptual Framework

Kolb's (1984) cycle, concrete experience, reflective observation, abstract conceptualisation, and active experimentation, structures each module. CAMIL (Makransky & Petersen, 2021) specifies when the concrete experience should be immersive. Universal design for learning (Meyer et al., 2014) specifies the fallback. Diverse learners are defined operationally as students in the lower prior-attainment quartile, students reporting no personal smartphone, and students who opt out of the headset for comfort or disability.

Proposed Method

Intervention. Two modules in a teacher-education course: managing a classroom disruption, and a basic science demonstration that is unsafe or impractical to repeat live. Each module lasts one session of at most 12 minutes in the headset, plus a structured debrief. A desktop 360 version carries the same decisions and feedback.

Design. Within-college comparison of headset VR, desktop fallback, and ordinary case discussion, assigned by tutorial group. Target N of at least 90. Pre-test, immediate post-test, and a two-week transfer task (a written practicum judgment).

Measures. Multiple-choice and short scenario scores; a three-item presence scale; a cybersickness checklist; time-to-completion; an accessibility log of who used the fallback and why. The primary equity outcome is the interaction of condition with prior attainment.

Analysis. Mixed models, Hedges' g against the case-discussion control, and a pre-specified subgroup analysis. Headset and desktop will not be pooled in the primary contrast.

Ethics and practicality. Shared headsets cleaned between users, a motion-sensitivity warning, the right to the desktop path without penalty, and college research-committee approval. A small headset pool can support one implementation cycle. It does not cover a campus-wide laboratory. No local results are reported here because fieldwork has not been completed.

Synthesis of Published Results

Reviews agree that immersive VR is used more as a prototype than as a scaled curriculum (Radianti et al., 2020; Stracke et al., 2025). Medical and engineering courses dominate, with teacher education a minority of field studies (Sümer & Vaněček, 2025). Meta-analytic averages are positive (Merchant et al., 2014; Kumar & Gorai, 2025) and do not by themselves justify headset mandates. Presence can raise interest while hurting transfer if load is unmanaged (Makransky et al., 2019; Makransky & Petersen, 2021). Accessibility evidence is thin, which is itself a finding: a college project that measures fallback use and subgroup gaps fills a reported hole rather than repeating a medical-simulation study.

DISCUSSION

A small stand-alone headset pool, offline content, and facilitator time can support a first cycle. Ongoing power and replacement costs sit outside a short award and should be stated as a limitation. Experiential education is bridged only if the simulation requires a decision a teacher will face and if reflection is assessed. A tour of a virtual classroom is not experiential education. Diverse learners are included only if the desktop path is a designed condition, not a consolation, and if cybersickness withdrawals are analysed rather than dropped.

CONCLUSION

Virtual reality can support experiential teacher education when sessions are short, decisions are authentic, cognitive load is controlled, and a non-immersive path teaches the

same outcome. At Edo State College of Education, Igueben, the contribution is an accessibility-explicit comparison, not a claim that headsets close equity gaps by themselves.

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