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Safeguarding Student Privacy in Educational Virtual Reality: Emerging Challenges and Multi-Stakeholder Solutions

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ABSTRACT

Virtual reality (VR) technology has emerged as a powerful tool in educational contexts, offering immersive experiences that can enhance learning across various domains. However, as VR adoption in education accelerates, significant data privacy concerns have surfaced that require careful consideration. Research indicates that VR systems collect unprecedented amounts of sensitive personal information through their inherent design, capturing non-verbal data including user movements, biometrics, and behavioral patterns that far exceed the data collection capabilities of traditional digital platforms (Garrido et al., 2024; Giaretta, 2024). Studies have demonstrated that adversaries can identify and profile VR users with minimal telemetry data, potentially inferring information ranging from physical characteristics to medical conditions, while the real-time nature of data sharing in VR educational environments further amplifies privacy risks compared to conventional web-based learning platforms (Cao et al., 2024; Garrido et al., 2024). To address these challenges, researchers have proposed several approaches, including algorithms to de-identify developmental profiles, implementation of robust parental controls, and the development of comprehensive privacy frameworks specifically designed for VR educational applications, emphasizing the need for a multi-stakeholder ecosystem to establish effective privacy protections for learners in VR environments (Skulmowski, 2023; Cao et al., 2024).

Keywords: biometrics, confidentiality, immersion, pedagogy, telemetry