Integrating Virtual Reality into Science Education: A Study on the Impact of VR Ecology Courses on Junior High School Students' Learning

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Abstract

This study investigated the impact of virtual reality (VR) ecology courses on junior high students' learning motivation, effectiveness, and preliminarily evaluated long-term benefits. Using a quasi-experimental design, 135 students (grades 7-9) from five classes were divided into Group A (three classes, cross-grade comparison) and Group B (one class, longitudinal comparison with tests in 8th and 9th grade). Pre-post VR course learning performance was analyzed. Results showed VR courses significantly enhanced learning motivation: two Group A classes and Group B achieved high effect sizes; one Group A class showed medium-to-high. VR's immersive interactivity effectively stimulated motivation. Learning effectiveness also significantly improved: two Group A classes achieved high effect sizes, and Group B data confirmed a cumulative positive impact of sustained VR use, especially on knowledge application and transfer. The study validated VR's short-term efficacy and, from Group B's longitudinal data, first proposed a "dual-track model" for long-term benefits. This model posits that technological adaptability and content iteration can offset novelty decay for sustained educational impact. In conclusion, VR ecology courses boost short-term motivation and outcomes, with sustained use aiding knowledge internalization. Future work should optimize differentiated design, teacher training, interdisciplinary use, and conduct further longitudinal studies to maximize VR's educational potential.

Keywords: learning motivation, learning effectiveness, immersive learning, novelty effect, dualtrack model