

How Does Virtual Reality Facilitate Students' Learning? A Comparative Study Conducted In a Food Microbiology Laboratory Class

Fei Xue¹, Dr. Luxin Wang²

University of California, Davis

Abstract

With the growing popularity of immersive virtual reality (IVR) systems in education, it is important to better understand students' perceptions of such systems and their impact on students' learning outcomes compared with conventional teaching methods, such as PowerPoint slides (PPT). In particular, their impact on the teaching of laboratory classes, in which both declarative and procedural knowledge are crucial for students to gain, is needed.

In this study, we compared students' declarative knowledge learning outcomes of IVR, desktop virtual reality (DVR), and PPT through evaluating their knowledge retention scores, visual attention, perceived immersion experience, and study motivation. Our results showed that students exhibited the highest perceived immersion experience, motivation, and visual attention in IVR ($P < 0.05$). Although all three instructional methods (IVR, DVR, and PPT) showed no significant difference when evaluating students' short-term knowledge retention ($P > 0.05$), students enrolled in the IVR group had the highest long-term knowledge retention scores ($P < 0.05$).

Our study highlighted the positive impact of IVR on students' learning outcomes. We further examined the benefits and challenges of using different instructional methods for learning. While IVR and DVR increased learning engagement, technological access and lacking non-linear structures are still major challenges faced by current VR education. Lastly, we reflect on our findings and provide new insights to the future design and incorporation of VR in college teaching.

Keywords: Virtual reality, Educational technologies, E-learning, Food Microbiology education, Laboratory instruction