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Do Virtual Reality and Haptic Feedback Improve Safety Skills of Construction Workers?

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Abstract:	Emerging technologies are offering opportunities to address the gaps in traditional construction safety training. The idea of using interactive technologies such as virtual reality (VR) and haptic feedback (HF) has been gaining traction to provide targeted training experiences. Research from outside construction has shown VR to be an especially promising tool in enhancing learning experiences within occupational settings. However, there is no direct evidence that VR or HF supports learning outcomes when paired with existing safety training paradigms. In construction safety, most studies have used VR only as a test bed to measure safety performance, not as a learning platform for practicing safety skills. Therefore, this study tests whether combining VR and HF with traditional safety training approaches positively impacts the safety skills of construction workers. In an interventional experimental design, 221 employees from the construction industry were placed in a VR environment after receiving pre-recorded video-based safety training. Linear mixed model analysis suggests that VR experience paired with passive training can improve hazard recognition performance of construction workers. Surprisingly, the VR experience as designed and tested in this study had a negative effect on participants' hazard recognition skills. However, there were no statistically significant changes observed in workers' risk perceptions, risk tolerance, and safety-related decision-making skills post intervention. Additionally, the study did not find evidence showing HF improves learning outcomes within VR experience. Although VR remains a promising platform for learning in occupational settings, this study suggests that more research is needed to better understand the contexts where VR enhances adult learning achievements in occupational settings.
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