

An Investigation of Driving Safety Awareness and Behavior Using an Interactive Virtual Driving Simulation–Based Training Program

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Abstract:

Driving safety performance remains highly vulnerable to human error despite continuous advancements in infrastructure and regulatory control, highlighting the need for more effective driver-centered training interventions within transport systems. While prior research has largely emphasized enforcement measures and engineering solutions, limited empirical attention has been given to the effectiveness of interactive virtual driving simulation-based training programs in enhancing safety awareness and driving behavior. This study provides one of the first rigorous empirical evaluations of an interactive virtual driving simulation-based training intervention in the Thai transport context. A convergent mixed methods design was employed to examine driving safety awareness, risk perception (subjective evaluation of hazard likelihood and severity), and situational awareness (perception, comprehension, and projection of dynamic environments) among Thai drivers ($n = 150$), who were randomly assigned to an experimental group ($n = 75$) receiving simulation-based training and a control group ($n = 75$) receiving conventional training. Quantitative analyses, using ANOVA and independent t-tests, were complemented by qualitative evidence derived from simulation-based training assessments and structured reflections. The findings demonstrate that the simulation-based training significantly enhances drivers' situational awareness and promotes safer behavioral responses, although variations across experience levels remain limited. Qualitative insights further underscore the critical role of immersive, experiential learning environments and continuous behavioral reinforcement in fostering adaptive safety behaviors. The findings provide practical implications for the design of technology-enhanced driver training

programs and evidence-based safety policies in transport systems. This study advances logistics safety management by introducing a novel, human-centered simulation-based intervention that shifts from static credentialing toward dynamic capability development, thereby contributing to more resilient, adaptive, and proactive transport safety governance systems.

Keywords:

Driving safety, simulation-based training, risk perception, situational awareness, driver behavior.