EVALUATING A MOBILE AUGMENTED REALITY APPLICATION FOR TEACHING AUTOMOBILE ENGINE MECHANISMS TO ADVANCED LEVEL ENGINEERING TECHNOLOGY STUDENTS IN SRI LANKA

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Abstract

Automobile mechanism teaching for Advanced Level (A/L) Engineering Technology students in Sri Lanka depends mainly on textbooks and lectures. Rural and upcountry schools lack engines and laboratories, so students struggle to understand how an engine works and to visualize its internal mechanism. This study developed a markerless mobile Augmented Reality (AR) application using Unity 3D that runs on both Android and iOS. Students place a 3D engine on any flat surface, switch between exterior and interior views, and adjust engine speed (RPM) while the piston animation and engine sound change together. It needs no printed markers. A quasi-experimental pre-test and post-test control-group design was conducted with 36 A/L students from a selected school, who were randomly assigned to an AR group (n = 18) or a traditional instruction group (n = 18). Both groups were taught how the engine works in a single two-hour session, with the AR group using the application and the traditional group receiving conventional classroom instruction. Learning was measured with a 20-item multiple-choice test, and usability with the System Usability Scale (SUS) and a five-item user experience questionnaire. The groups did not differ at baseline ($p = .24$). The AR group achieved a higher mean learning gain ($M = 4.89$, $SD = 1.23$) than the traditional group ($M = 2.17$, $SD = 0.79$), $t(28.9) = 7.91$, $p < .001$. An ANCOVA controlling for pre-test scores confirmed this advantage, $F(1, 33) = 66.82$, $p < .001$. The mean SUS score was 80.0 ($SD = 3.74$), and the mean user experience rating was 4.46 out of 5. These findings suggest that markerless smartphone AR can strengthen students' understanding of engine mechanisms and offers a low-cost option for schools without laboratories. Extending the study to multiple schools will help confirm how widely these results apply.

Keywords: Augmented Reality, Mobile Learning, Engineering Technology Education, Automobile Mechanisms, Inclusive Education