Chapter 7
Empirical Study Outcome of Augmented Reality Technology for Solving Engineering Problems in UNITEN

ABSTRACT

In this chapter, the preferences of UNITEN students in using augmented reality technology user interface applications to solve selected engineering problems are compared. Cross sectional study design and Wilcoxon-Signed Rank Test approach were adopted to analyze the difference in the rankings of the engineering applications. Within a controlled environment, this research further applies "trials within the same session but with breaks between tasks," an affirmed reliable method in measuring learnability that has been rarely explored by any related works locally. The results were captured through descriptive statistical analysis. The findings provided reliable evidences that multiple function user interface (MFIT) is more effective than the tangible user interface (TUI) for engineering students. Simultaneously, this research also presents evidences that MFIT is better than TUI in the engineering problem solving statistically.

DOI: 10.4018/978-1-7998-0465-9.ch007

INTRODUCTION

As defined in the literatures, "*AR is the digital overlay on top of the real world, consisting of computer graphics, text, video and audio, which is interactive in real time*" (Azuma, 1997; Billinghurst et al., 2014; Papagiannis, 2017). The technology can be interacted with and experienced through many electronic devices such as the computer, tablet, smartphone or AR eyewear equipped with the software and camera. In the educational and human computer interaction studies, many researchers have shown that AR can assist and improve learning as compared to traditional/conventional methods (Kerawalla et al., 2006; Chang et al., 2010; Lee, 2012). Although Lee (2012) stated that students may acquire knowledge and skills through different modes of instruction that include classroom lectures with textbooks and computers, AR is put to practice through different interfaces and the interaction between human and computers depends on computer interfaces. However, when using technology to address a particular educational material, user interaction is one of the highly debated areas. Many instructional designers in the past found that the user interface of a particular software hinders users from learning the contents effectively because the users are provided with too much of information and need to focus more on the interface rather than the contents (Jameson, 1995; Alpert et al., 2003; Ziefle & Bay, 2006; Georgiev & Georgieva, 2009; Wong, 2017). The same problem was also experienced by instructors and students in UNITEN to calculate and analyze the Four-Bar Linkage (4BL) mechanism problems because the problems are basically accomplished with diagrams, equations, charts, texts and formulas. The poor user interface makes it even more difficult for them to focus on the contents. Other researchers have also developed software tools to solve the 4BL mechanism problem but failed to engage the user in the learning and visualization process (Oleg, 2000; Kihonge et al., 2002; Manjit 2003; 2008; 2009; Huber and Dietmajer, 2010). In AR technology the two user interfaces debated in the literatures are the Tangible User Interface (TUI) interaction technique and the multiple function interaction technique (MFIT) as used in mobile applications, where the latter is frequently quoted to be an enhancement to TUIs disadvantages. In general both user interfaces have close relation to usability issues in the field of Human-Computer Interaction (HCI). Therefore, both are frequently compared and evaluated using usability measures. This research highlights the recent works done in the field of TUI vs. MFIT competitive study. Besides,