The Effects Of Design-Based Learning In Teaching Augmented Reality For Pre-University Students In The ICT Competency Course

Ahmad Alif Kamal, Syahrul Nizam Junaini

Abstract:— Recent advances in learning approaches and technology made the teaching and learning process became more complex. While many researchers have examined the capabilities of empowering student learning and AR for the purpose of teaching and learning, quantitative evidence for its impacts is still scarce. To contribute to filling this research gap, we applied a two times post-test and collected an instructional materials motivation survey with 280 participants at a pre-university center to measure the effectiveness and motivational impact of design-based learning approach on acquiring practical AR knowledge in an immersive learning experience. We hypothesized that students gained more knowledge and interest on AR by participating in DBL. The theoretical rationale for our hypothesis is that DBL experiences promote higher order thinking skill and informal learning to happen. The empirical results we obtained show that students performed better academically and provided positive feedback in terms of motivation and interest.

Index Terms:— classroom technology practices, computer education, immersive participation, learning strategies

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1   INTRODUCTION

Augmented reality (AR) is mainly known in the field of entertainment. This emerging technology is proven to be advantageous in the education field. The potential of incorporating AR into teaching practices had been studied in detail by researchers [1]. Implementing AR in education increases in the level of academic achievement [2], [3], by facilitating the teaching and learning process [4] as well as ensuring fun in learning [3], [4], [5]. However, the number of studies to examine the effect and impact of AR in education has yet to be suffice in embracing the age of Industrial Revolution 4.0 [6]. The full potential of AR in education is yet to be discovered, with the amount of study and research being scarce [7]. Other than that, there are issues arises in the suitability of content to be incorporated with AR to align with curriculum and pedagogy, as well as whether it is worth it to convert the content and invest into AR [8]. It is also reported that there are difficulties in terms of technicality in implementing AR for teaching [9]. The aim of this study is to measure the effectiveness and impact towards motivation in learning AR of a learning approach named design-based learning. From this, we come up with a hypothesis, that is can the teaching and learning method stated above, that is design-based learning, has a significant effect on pre-university students in learning and applying AR technology? To test this hypothesis, two research questions were raised, 1) what is the effect of design-based learning method in teaching augmented reality, AR for the pre-university students in the ICT Competency course, and 2) what is the impact of design-based learning towards students' motivation and interest in learning augmented reality technology as a part of the ICT Competency course?

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• *Ahmad Alif Kamal is a lecturer at Centre for Pre-University Studies, Universiti Malaysia Sarawak, Malaysia. Email: kaalif@unimas.my*
• *Syahrul Nizam Junaini is a senior lecturer at Faculty of Computer Science and Information Technology, Universiti Malaysia Sarawak, Malaysia. Email: syahruln@unimas.my*

The remainder of this paper is as follows. First, a literature review on the background of AR and design-based learning. Next, the methodology which includes the research design and instruments is outlined. Then, the findings are recorded and analyzed. Finally, the summary of implications of the study and opportunities for further potential research.

2 LITERATURE REVIEW

2.1 Teaching of STEM courses

Issues have always been raised on how to improve the effectiveness in teaching science, technology, engineering and mathematics (STEM) courses. One issue highlighted on STEM is the difficulties in not only to attract but also retain the human capital [10]. The retention of STEM students' motivation is one of the challenges faced when they move from school into higher education especially in Malaysia [11]. Student-centered learning such as problem-based learning (PBL) is one of the many methods studied and employed to overcome some of the issues. PBL is stated to empower the process of learning by promoting motivation and creativity among learners [12], the key to attract future generations to pursue their studies in STEM fields. In addition, PBL have many other forms such as case-based learning, inquiry-based learning and many more in which an instructor can select the most suitable method accordingly [13].

2.2 Augmented reality in education

AR can strengthen teaching and learning process in universities. It is studied that the process of learning becomes highly satisfactory with the implementation of AR [14]. Due to its attractiveness, implementation of AR in educational activities is growing in popularity. This technology also offers exploration and simulation activities and its interactive nature can increase motivation, encourage active learning, provide beneficial experiences and promote student-centered learning [15]. A more innovative way of implementing AR is by making it a part of blended instructional strategies [16]. With the advancement of technology, the usability of AR into mobile devices especially smart phones has become easier, enabling more innovative techniques and tools to be implemented in teaching and learning process, but there are still more