The Implementation of Augmented Reality in Increasing Student Motivation: Systematic Literature Review

Nur Farah Syuhada Mohamad Saadon, Ibrahim Ahmad, Ahmad Naim Chee Pee @ Che Hanapi
Fakulti Teknologi Maklumat dan Komunikasi, Universiti Teknikal Malaysia Melaka,
Email: nursyuhada0907@gmail.com, ibrahim@utem.edu.my, naim@utem.edu.my

Abstract. The purpose of this article is to analyze the implementation of augmented reality in increasing student motivation. A systematic literature review was conducted in March 2018 and updated in January 2019. This paper includes a literature review of relevant research of motivation in augmented reality since in year 2013. The object of research is the augmented reality, and the subject is the student motivation. As a result of the study, it has been found that augmented reality gives a positive result in increasing student motivation. The study show that augmented reality has a potential to have a significant demand to increase student motivation in learning and therefore the need to develop an appropriate tool to keep up student motivation in learning at schools and universities. Results have shown that students that used augmented reality is more confidence and show higher learning motivation in learning.

1. Introduction
Technology plays an important role in fostering a love for learning through design and production [1]. Nowadays, technology has become part of our life. With changing times, technology has also developed, and the way humans work, and thinking are different from the past. One of the developing technologies that has been achieved is Augmented Reality (AR). AR is a combination between real and virtual objects in a real environment; it is run interactively in three dimensions (3D) and in real-time [2]. AR provides an opportunity for educators to diversify their teaching techniques. Student can apply learning that involves the outside world without having to leave the classroom. AR is not limited to a specific technology, it can be applied to many different existing technology such as head-mounted display (HMD) [2], smartphones, computer & tablet [3].

Motivation is defined as the psychological process which activates, directs and maintains goal-oriented behaviour [4]. Motivation is divided into three category which is intrinsic motivation, achievement motivation and extrinsic motivation. Intrinsic motivation is where someone does something that they like or want for their own sake. Achievement motivation is a competition feeling where something is done to show the better performance. Lastly is extrinsic motivation which this type of motivation is a condition when a person do something in order to get some future value [5].

Learning can be done in many forms and one of them is by using AR technology. The technology has brought the learning style to be more interactive and attractive. Bringing students to learn and interacting with this world mostly is not easy. But with the capabilities of AR, teachers now have an option of bringing students to learn about the world without any hesitation. AR justifies the use of media with two-dimensional technology in education and this technology is flexible, easy to use, cheap and
affordable [6]. There is so many type of AR. Table 1 shows the types and categories of augmented reality [7]:

| Category       | Type                        | Characteristics                                                                 |
|----------------|-----------------------------|---------------------------------------------------------------------------------|
| Triggered      | 1a. Marker-based: Paper     | Paper marker activates stimuli.                                                 |
|                | 1b. Marker-based: Object    | Most objects can be made into markers.                                          |
|                | 2. Location-based Overlay   | Overlay of digital information on a map or live camera view. GPS may activate    |
|                | 3. Dynamic Augmentation     | Meaningful, interactive augmentation with possible object recognition and/or      |
|                | 4. Complex Augmentation     | Augmented dynamic view and pull internet information based on location, markers  |
| View-Based     | 5. Indirect Augmentation    | Image of the real world augmented intelligently.                                |
|                | 6. Non-Specific Digital     | Augmentation of any camera view regardless of location.                         |
|                | Digital Augmentation       |                                                                                 |

Most of the reason in academic nowadays is student lack of motivation in the meantime they need more academic activities [8]. This statement is supported [9] where some of the academic strategies do not achieve student requirements. To achieve the target in learning process, a few factors should be taken care of and one of it is motivation. Motivation is one of the important factors that help the student performing their academic achievement and work productivity [10].

This study aims to explore the contribution of Augmented Reality application in increasing student motivation by investigating the effects of using Augmented Reality application in increasing student motivation.

2. Method
This study presents a systematic review of research examining the motivation in augmented reality. This systematic review included the research question, the selection of journals, the inclusion and exclusion criteria, the search strategy and databases, the data collection instruments and methods and the criteria for the analysis of the results which followed the recommendations of the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement [11]. The declaration from PRISMA is the global and approved revised version of the declaration from QUORUM (Quality of Meta-analysis reporting). The review question was: “How student motivation can be increased by using augmented reality application?”

The search and the analysis of the paper identified in the first search conducted by two researchers. Data were organised in tables containing year, author, sample characteristics, method and main outcomes. Literature search was conducted using the following online database ScienceDirect, Google Scholar and Scopus Full Text. Publication year was restricted: it is covered the period from 2013 to 2018 and limited to studies written in English. Table 2 shows the Inclusion and Extraction Criteria:
Table 2. Inclusion and Exclusion Criteria.

| Criteria            | Eligibility                             | Exclusion                                           |
|---------------------|-----------------------------------------|-----------------------------------------------------|
| **Literature Type** | Indexed Journal (research articles)     | Non-indexed journals, Systematic review journals, chapter in book. |
| **Language**        | English                                 | Non-English                                        |
| **Timeline**        | Between 2013 – 2018                     | Less than 2013                                     |

3. Results

To identify some published article describing representative development in augmented reality and motivation area, a systematic review was conducted. The search has focused on motivation in augmented reality.

Two studies had been conducted in Taiwan [11, 14], two in Spain [13,12] and two in Malaysia [15, 8]. In relation to sample and outcomes, three samples is from college students [11,13,15], 1 from specific programme students [13] and 2 from primary schools [8,14]. Table 3 shows the paper reviewed from 2013-2018 in the field of motivation in augmented reality.

Table 3. Paper Reviewed from 2013 - 2018 in the field of Motivation in Augmented Reality.

| Paper  | Sample | Method                  | Outcome                                                                 |
|--------|--------|-------------------------|------------------------------------------------------------------------|
| Paper 1 [12] | College students in their second year (aged 18-20) (13 males & 20 females) : 63 | Pre-Test, Post-Test, Experimental-Control Group (CG) required to attend classes using traditional outdoor instruction methods, where they were provided with a textbook. Experimental Group (EG) instructed to use mobile smartphones containing our proposed system to learn the same course materials in a real-world setting outside of the classroom. Questionnaire | Students who learned with the proposed system showed higher learning motivation and had better learning performance. Confidence was the most highly rated motivational factor among student. Because they felt surer of their knowledge and performance. |
| Paper 2 [15] | Second year engineering students from La Laguna University (41 male, 22 female, mean age 21.30 years with a standard deviation of 2.69): 63 | Experimental, Questionnaire | Intrinsic Motivation Inventory results (all values above 4.0 over 7.0) indicate that AR with tablets is a motivating activity for students. Motivation and usability research with AR conducted in this experiment shows that this is a technology that can be implemented in formal teaching to facilitate and motivate the students’ 3D understanding of the terrain represented with traditional. |
Paper 3 [13] VET program of car’s maintenance student. 100% male students. 23% aged 14-16 years old, 63% aged 17-19 years old, 9% aged 20-22 years old, 3% more than 25 years old: 35

- Experimental – Students used the application for 20 days as a learning process.
- Questionnaire

- Mobile AR applications that are able to capture the interest of the students and increase their time on the learning activities, are the applications that better support student motivation.

Paper 4 [16] Fifth grader from four classes: 111

- Pre-Test
- Post-Test
- Experimental - EG learned with the AR operating guidance system and discussions in class. CG guided by the teacher to finish the science project, worksheet and have discussions in the class.
- Questionnaire - 20 minutes interview, 5 students from experimental group, 5 students from control group.

- With the help of the AR guiding mechanism, the students learning achievements, learning motivation, critical thinking tendency, and group self-efficacy were significantly improved.

Paper 5 [14] First-semester social science undergraduate, with a mean age of 19.5 years: 120

- Pre-Test
- Post-Test
- Experimental- EG were allowed to use the learning application on their mobile phones. CG used a similar application on the desktop computer.

- Mobile augmented learning tool can be used as a learning application to help students learn anywhere, anytime, by capitalizing the mobility of mobile devices.
- The effective use of such a novel tool may be mediated by several factors, such as gender.

Paper 6 [9] Students in primary school (7 years old), 1 Indian male, 2 Malay male and 3 Malay females: 5

- Observation-To observe the motivation level that the participants shown during the lesson.
- Semi-structured Interview- To confirm the results derived from the observation.

- Year one students perceive augmented reality (AR) pop-up book as being motivational through the attention, relevance, confidence, and finally the feeling of satisfaction as a result from the learning session.
4. Discussion
Motivation is the most important concept in human behaviors [17]. Motivation is the factor that keep student achieve the learning target and one of the main factors that keep students want to learn [18]. Motivation in learning is divided into two type which is Intrinsic (internal) motivation and Extrinsic (external) motivation [10]. Extrinsic motivations concern the drive of the utilitarian purpose [19], such as receiving benefits and rational function analysis while intrinsic motivation refers to an individual's motivation and the pleasure derived from the task itself or the sense of satisfaction in completing or working on the task itself [10][20].

In 1984, Keller has created a model to improve motivational attractiveness of teaching materials which is ARCS model [10]. According to Keller [21], there are four conceptual categories of human motivation for the ARCS model which are: (i) Attention, (ii) Relevance, (iii) Confidence and (iv) Satisfaction. All this four categories of motivation are needed and require deep understanding to bring an effective, efficient and attractive AR [22].

Students have been exposed to various technologies and some of them are attached to technologies. As an educator, they always need to think the best way to give the best learning experience to the students because the main objective for every educator is to make sure students understand what they are learning. Teacher must use appropriate methods to stimulate the interest of students and encourage them to develop a positive attitude towards an effective learning outcome [23].

AR gives students the opportunity to explore the world in a more interactive way [3]. Besides with imagination, now with the presence of AR students can be imaginative. Although technology is developing, not everyone can adapt to the advancement of technology that is fast growing. There are some people who still love to read books physically though there is a plenty of online book such as watt pad, eBook etc. According to [24], research show that some people still prefer physically existing because they love the physicality, transportability, robustness, flexibility etc. Following that, the interesting thing that arises in this technology is AR textbooks [6]. AR textbook is a combination of AR technology and textbook. A webcam is pointed to the normal printed book to bring the visualizations and interactions [6]. AR is not just a focus on one use of technology, but it involves a touch on the real thing.

In the course of AR activities, the interaction of learners with learning materials is increased without any environmental constraints or hazards, and this has a positive effect on their extrinsic motivation [9][25].

5. Conclusion
In this paper, a systematic literature review was reported. In conclusion, the result of existing study has showed that augmented reality application is a suitable application in increasing student motivation. Augmented reality success to increase student motivation through ARCS model which is attention, relevance, confidence and satisfaction. Results have shown that students that used augmented reality is more confidence and show higher learning motivation in learning.

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