

Students' Perceptions of Using Augmented Reality as Learning Tool

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Abstract

The development of the latest technology has reshaped the entire education system that provided great support for teaching and learning. Augmented Reality (AR) is a new technology with tremendous potential and high pedagogical value that provides new educational techniques. AR can be a hook to increase students' interest in teaching and learning. The greatness of this technology allows students to experience interacting with virtual and real-time applications. The focus of this paper is to identify students' perceptions of the use of AR as a learning tool and users' perceptions of AR content as a learning tool. The studies were conducted using the AR application Storybook. The data was collected using a questionnaire and analyzed using the Statistical Package for Social Sciences (SPSS). The results indicated that most of the participants had positive perceptions toward the use of augmented reality applications and accepted AR as an effective learning tool.

Keywords: Augmented Reality, Student Perception, Learning Tools.

1.0 Introduction

The development of education has been influenced by the advancement of ICT (Haziana and Nor Suhani, 2019). The learning process, environment, teachers, and students are influenced by the rapid development of educational technology in today's world (Hakan Tekederea & Hanife Gokera 2016). According to Zare, Sarikhani, Salari & Mansouri (2016), ICT provides opportunities in the education sector, especially in the teaching and learning process. This method aims to replace the traditional face-to-face teaching environment in the twenty-first century with a more technology-based learning environment (P V Fernandes & S Caeiro, 2019, Haziana & Nor Suhani, 2019). According to Mona Alkhatabi (2017), more innovative forms of learning methods can be implemented through the use of technology in education. As an effect, new approaches are needed in line with the use of ICT tools in the learning process (Mat-jizat et al., 2017). Innovative technology can increase the level of confidence and improve the learning process of students, where the latest innovations in the field of immersive technology enable access to AR via smartphones (Martin-Gutierrez et al., 2017).

Various AR applications have been developed in the fields of medicine, military, shopping, entertainment, and games, as well as in the field of education, where AR is used as a method of learning at all levels (Billinghurst et al., 2015; Daniela & Lytras, 2019; Martin-Gutierrez et al., 2017; Ivan et al., 2018; Mat-jizat et al., 2017). AR has been introduced as one of the technologies that produce active learning and encourage creative and innovative thinking. He also states that; AR can provide a unique and interactive experience to students as well as can help improve understanding of abstract problems. Joanna et al., 2020, prove that, AR technology can enhance their learning experience and be fun. Modern educational institutions have begun to implement technology in the process of learning in an effort to enrich learning practices more harmoniously, sensual and tangible rather than limiting them to abstract thinking only (Hesham Ahmed 2017).

Besides that, AR can improve users' perception of the real world through the enhancement of virtual information with a combination of multimedia elements such as computer graphics, sound and animation; compared to traditional teaching methods, the main advantage of AR is

that students can see and hear additional digital information (Fotis and Eike 2010). Therefore, one of the goals of this research is to measure students' perceptions of the use of AR as a learning tool for which this application incorporates the use of engaging audio visuals in an effort to help improve students' understanding and produce more effective learning materials (Mat-jizat et al., 2017).

1.1 Augmented Reality Technology

Augmented Reality is defined as the display of an interactive reality-based environment with a combination of interactive display, audio, text, and navigation capabilities to enhance the user's real-world experience (Hesham Ahmed et al., 2017, Nouredine, 2019). According to Mona Alkatabi 2017, Hamada et al., 2018, Augmented Reality systems support the interaction of real and virtual surroundings and allow the use of interface metaphors for object manipulation. It was reported that the features of Augmented Reality are: a camera captures the marker and then the system augments a virtual object on the top of the marker and displays the image in 3D; a basic AR system includes a camera, computation unit, and display (Terrance Chandike, 2016, Nazatul Aini et al., 2014). According to Hamada (2018), due to the progress seen by technology over the past few years, researchers have proven that AR is the best user interface technology and provides a better learning environment that helps in terms of the learning process.

1.2 Augmented Reality as a Learning Tool

Technology has been adopted in the education sector and has brought positive changes to learning styles (Nor Farhah, Noor Dayana & Noraffandy, 2015). To complement the traditional form of learning, according to Yasak et al., 2010, Fotis and Eike 2010, the use of technology is believed to complement the learning process better. A study conducted by Muhammad Saleem et al., 2021, Ibili et al., 2020 and Nor Farhah et al., 2015 stated that, the combination of technology is also a method used to increase student engagement in the classroom. Irfan Sural, 2018 also mention, the use of ICT in the classroom has apparently increased, in order to provide interactive equipment and technology, many efforts have been implemented. A new technology introduced with

potential to be implemented in the education industry is Augmented Reality (AR) technology (Irfan Sural 2018, Nor Farhah et al., 2015), and the effectiveness of this technology can be evidenced through the increasing number of studies on AR.

Many researchers and educators have started to introduce and strengthen AR into the educational environment starting two decades ago (Che Samihah et al., 2017). Augmented Reality (AR) is a technology that enables students to better understand learning content through a new educational approach (Muhammad Saleem et al., 2021; Irfan Sural, 2018). AR technology is a modern tool used in the classroom by using smartphones and digital tablets during the learning process (Chiang, Yang, & Hwang 2014; Bicen and Bal 2016; Irfan Sural 2018). Hesham Ahmed et al., 2017, Fotis and Eike 2010, also mention that, in today's mobile computing, a growing technology is AR, where this application can convert images that have been captured through the device's camera into other images. According to Che Samihah et al. (2017), in the education sector, the use of AR is getting higher and more vigorous. AR technology has been growing rapidly and is being practised whether it is expensive, head-mounted equipment, large or small equipment that can be held like a smartphone.

Soo Kyun et al. (2017) explained that the most common method used to access AR content is to use a smartphone or tablet. According to Fotise and Eike (2010), the use of AR in learning gives the main advantage over traditional learning. Students can see and listen to additional digital information. Studies and evidence from researchers state that visuals are the best method for memorising compared to reading or listening (Terrence Chandike, 2016). Students can get a lot of ideas through images. Studies have shown by Che Samihah et al. (2017) that Augmented Reality can improve teaching and learning methods in the educational field. Augmented Reality applications are a current learning technology that helps students learn faster in a virtual classroom (Muhammad Saleem et al., 2021; Ibili et al., 2020).

AR content delivery methods help improve students' learning and motivate students' desire to learn (Chia et al., 2022). The study, conducted by Nazatul Aini (2014), proved students accepted AR mobile phone applications for the subject of computer

organization. The findings of the study by Saleem et al. (2021) prove that students' acceptance of the use of AR applications as learning tools is very positive where the study of behaviour and attitudes significantly influences students' acceptance of the use of the application in learning. Also, the AR application is enjoyable and attractive. Noorudeen 2019, Lopez et al., 2020 study has also proven that the use of AR as a learning model can meet the needs of 21st century students. The results of the study by Chia et al., 2022 showed that students who learned using the AR-based Cosmos Planet Go Application showed better performance than students who used the narrative teaching method. The study, conducted by Bernie M. Garrett (2018) and Ivan et al. (2018), also proves that the use of AR in learning has a very positive effect. The study shows that students accept and are comfortable with the features available through AR technology. Cakiroglu et al. (2022) have produced a map concept using AR for the topic of lunar and solar eclipses for the subject of Science and Technology. The results of the study show that using AR to create map concepts is more effective and students' actions are more positive in learning through the use of AR. Irfan Sural's (2018) claimed that teachers' use of augmented reality (AR) as a teaching tool found that AR could be used to make good teaching materials.

2.0 Methodology

This study was carried out specifically to evaluate user perception towards the use of Augmented Reality as a learning tool. The topic used for this study is An Augmented Reality Storybook-The Curious Rabbit. The augmented reality application was produced using Unity software. An application produced based on markers, Vuforia is used to create markers. Once developed, this application will be installed into an android mobile phone.

2.1 Data Collection and Analysis

A random sample collection method was used in this study involving 31 students ($n = 31$), consisting of those under 10 years old ($n = 7$), and those over 10 years old ($n = 24$). A set of questionnaires have been created and distributed in order to gain feedback, knowledge, and perception about the Augmented Reality Storybook as a learning tool. The questions are divided into demographic information, knowledge of augmented reality technology, attitude, perception of the AR content, and perception of AR as a learning tool. The questionnaire is developed and measured using a five-point Likert scale range. 1-strongly disagree, 2-disagree, 3-neither agree, 4-nor disagree, 4-agree, and 5-strongly agree. The data obtained is translated into specific codes that will represent the variables as in the questionnaire. Data was analyzed using descriptive analysis methods such as frequency, percentage, and mean. The data was analyzed using the SPSS statistical package. Quantitative data was used to analyze the data obtained from the questionnaire.

3.0 Result

3.1 User Demographic

A random sample collection method was used in this study involving 31 students consisting of under 10 years old and over 10 years old. From the data, it was found 32.3% of the sample are male and 67.7% of the sample are female. The table 3.1 shows the demographic of respondents.

Table 3.1: The demographic information

Factor	Categories	Percent
Gender	Male	32.3
	Female	67.7
Age	Under 10 years old	22.6
	Over 10 years old	77.4

3.2 The Users Knowledge on Augmented Reality Technology in Education.

Table 3.2 shows the respondents knowledge of Augmented Reality technology. Candidates mostly have knowledge about Augmented Reality technology (45.2%). These result show that, 35.4% equivalent to a mean of 3.5 respondents have skills in using Augmented Reality applications. A total of 61.3% equal to a mean of 3.7 agreed related to Augmented Reality helping in the learning process.

Table 3.2: The Users Knowledge on Augmented Reality Technology

Item	The Users Knowledge on Augmented Reality Technology	SD %	D %	NA %	A %	SA %	MIN
1.	I know about Augmented Reality (AR)	3.2	9.7	12.9	45.2	29	3.9
2.	I'm skilled at using Augmented Reality (AR) application	6.5	9.7	29	35.4	19.4	3.5
3.	I use Augmented Reality (AR) for getting learning information	3.2	9.7	25.8	48.4	12.9	3.6
4.	Augmented Reality (AR) help me in the learning process	0	12.9	12.9	61.3	12.9	3.7

* SD - Strongly Disagree, D – Disagree, NA - Neither, A – Agree and SA – Strongly Agree

3.3 The Users Attitude and Passion on The Augmented Reality Learning Method

According to the result analysis from the table 3.3 on item 1” I am very interested to learn educational content using Augmented Reality (AR)”, most respondents indicated agree 42% and 38.7% strongly agree (mean 4.2). 41.9% of the total respondents strongly agreed that Augmented Reality (AR) application in learning was interesting and pleasant to use (mean 4.2). It was noted that 48.4% of the students were agreed and 38.6% strongly agreed with statement on” Augmented Reality (AR) helps me improve in understanding the learning” (mean 4.1). The mean score was 4.4 for item 5 “Learning using this method does not bored me” 54.6% respondents strongly agreed and 39% agreed. On item 8 “I’m feel comfortable using Augmented Reality (AR) in learning” result on the analysis found

that 48.4% agreed, 35.5% strongly agreed and 0% respondents disagreed. Mean score of 4.2.

Table: 3.3: The Users Attitude and Passion on The Augmented Reality Learning

Method

Item	The Users Attitude and Passion on The Augmented Reality Learning Method	SD %	D %	NA %	A %	SA %	MIN
1.	I am very interested to learn educational content using Augmented Reality (AR).	0	3.2	16.1	42	38.7	4.2
2.	Augmented Reality (AR) application in learning was interesting and pleasant to use.	0	3	16.1	39	41.9	4.2
3.	Augmented Reality (AR) helps me improve in understanding the learning.	6.5	0	6.5	48.4	38.6	4.1
4.	The used of Augmented Reality (AR) make me more interested in learning session.	3.2	3.2	6.5	41.9	45.2	4.2
5.	Learning using this method does not bored me.	3.2	0	3.2	39	54.6	4.4
6.	This method of learning (Augmented Reality) can make me more creative.	0	6.5	12.9	29	51.6	4.3
7.	Augmented Reality (AR) is very useful for me in learning.	0	9.7	9.7	45.1	35.5	4.1
8.	I'm feel comfortable using Augmented Reality (AR) in learning	0	0	16.1	48.4	35.5	4.2
9.	Augmented Reality (AR) application increase my focus during learning process.	3.2	0	12.9	48.4	35.5	4.1

* SD - Strongly Disagree, D – Disagree, NA - Neither, A – Agree and SA – Strongly Agree

3.4 The Users Perception on the An AR Storybook-The Curious Rabbit Content

The mean scale 4 to 5 were calculated to identify the level of student perception on the Augmented Reality content. The analysis found on the table 3.4, shown item 1, 3 and 4 has the highest level of perception with mean 4.4. 54.8% respondents indicated agreed and 41.9% strongly agreed for the item “This content helps in the process of understanding the storybook”. “The graphic used in the storybook are interesting and exciting” mentioned for item 2, most responded 51.6% strongly agreed and 32.3% agreed and the mean score is 4.3. The mean score 4.4 for item 3 and 54.8% respondents strongly agreed, 32.3% agreed on the statement “I think the Augmented Reality (AR) concept in the storybook is really fun and exciting”. Using audio element in the Augmented Reality application as a content material get a good feedback from respondents whereby 48.4% strongly agreed and 38.7% agreed on the item 6 “The use of audio elements in Augmented Reality (AR) really helps with the understanding the content” mean 4.3.

Table: 3.4 The Users Perception on the An AR Storybook-The Curious Rabbit

Content

Item	The Users Perception on the An AR Storybook-The Curious Rabbit Content	SD %	D %	NA %	A %	SA %	MIN
1.	This content helps in the process of understanding the storybook.	0	0	3.2	54.8	41.9	4.4
2.	The graphic used in the storybook are interesting and exciting.	0	3.2	12.9	32.3	51.6	4.3
3.	I think the Augmented Reality (AR) concept in the storybook is really fun and exciting.	3.2	3.2	9.7	32.3	54.8	4.4
4.	I am satisfied with the information obtained.	3.2	0	9.7	41.9	48.4	4.4
5.	The use of animation element in Augmented Reality (AR) is very attracting and exciting.	0	3.2	6.5	35.5	51.6	4.3
6.	The use of audio elements in Augmented Reality (AR) really helps with the understanding the content.	0	3.2	6.5	38.7	48.4	4.3

* SD - Strongly Disagree, D – Disagree, NA - Neither, A – Agree and SA – Strongly

Agree

3.5 The Users Perception on the Augmented Reality as a Learning Tool

Table 3.5 shows the respondents perception on the Augmented Reality as a learning tool. Out of total 54.8% agreed and 41.9% strongly agreed about their skilled at using Augmented Reality (mean 4.4). The average score was 4.0 for item 2 “I am very interested and comfortable using Augmented Reality” result of the analysis found that 51.6% respondents agreed and 29% strongly agreed. Only 9.7% respondents disagreed. 51.6% strongly agreed, 32.3% agreed and the mean score is 4.4 showing that respondents give the positive result on the item 4 “The use of Augmented Reality (AR) is one of the ways to attract users to use the application in learning”. The use of audio and animation elements

as teaching material in the Augmented Reality application was well received by the respondents. This is proven by 51.6% of respondents strongly agree and 35.5% agree on the item 5 “The use of animation element in Augmented Reality (AR) is very attracting”. This analysis revealed that 38.7% agreed and 48.4% strongly agreed on the item 6 “The use of audio elements in Augmented Reality (AR) really helps with the understanding and enjoyable”. Only 3.2% respondents not agreed. The mean score for those items is 4.3.

Table 3.5: The Users Perception on the Augmented Reality as a Learning Tool

Item	The Users Perception on the Augmented Reality as a Learning Tool	SD %	D %	NA %	A %	SA %	MIN
1.	I am very skilled at using Augmented Reality (AR).	0	0	3.2	54.8	41.9	4.4
2.	I am very interested and comfortable using Augmented Reality (AR).	0	9.7	9.7	51.6	29	4.0
3.	It is easy learning using Augmented Reality (AR).	3.2	3.2	9.7	58.1	25.8	4.0
4.	The use of Augmented Reality (AR) is one of the ways to attract users to use the application in learning.	0	0	16.1	32.3	51.6	4.4
5.	The use of animation element in Augmented Reality (AR) is very attracting.	3.2	3.2	6.5	35.5	51.6	4.3
6.	The use of audio elements in Augmented Reality (AR) really helps with the understanding and enjoyable.	3.2	3.2	6.5	38.7	48.4	4.3

* SD - Strongly Disagree, D – Disagree, NA - Neither, A – Agree and SA – Strongly Agree

4.0 Discussion and Conclusion

The study was conducted to identify students' perceptions towards the use of AR applications as a learning method. Based on the results of this study, respondents agree with the use of AR as a learning tool. The study found that the use of elements such as audio, animation, and text helped the respondents understand the learning materials. The results of the study also showed that most respondents have a positive attitude and passion for the use of AR. Additionally, the number of respondents shows that this application is very interesting and enjoyable to use. The overall conclusion from this study is based on the respondents' perception of the acceptance of the use of augmented reality as a learning tool with positive results. The use of AR is one of the strategies and methods used in the various methods of the learning process.

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