

Students' Acceptance of Mobile Augmented Reality Applications in School

Sri Setiawaty^{1*}, Khalsiah², Riska Imanda³, Isna Rezkia Lukman⁴, Arusyak Ivanyan⁵

^{1 2 3 4}Universitas Malikussaleh, Aceh, Indonesia

⁵ Northern University, Armenia

E-mail: sri.setiawaty@unimal.ac.id

rezkia.lukman@unimal.ac.id

riska.imanda07@unimal.ac.id

khalsiah@unimal.ac.id

Arusyak.ivanyan.1981@gmail.com

ABSTRACT

Augmented reality (AR) is an interactive experience that combines the real world and computer-generated content. AR is indicated as a usable educational technology that can be integrated into science classes to overcome the shortcomings of conventional teaching. Mobile applications with AR experience mode have the potential to be used in online, blended/hybrid, and in-person teaching, which is particularly important during recovery from learning loss. Furthermore, AR used to enhance natural environments or situations and offers perceptually enriched experiences. The aim of this research is to determine school students' acceptance of AR content in a commercial mobile application that can be used as a supplement in science teaching. A total of 90 students completed a Google Form-based questionnaire. The results showed that the majority of students perceived mobile AR applications as useful and easy to use, had a positive attitude, and expressed intention to use this educational technology if given the opportunity. The importance of prior evaluation regarding educational usability and performance is highlighted since technical quality had a positive effect on perceived usefulness and perceived ease of use. There were no statistically significant differences between female and male students, but students with prior experience with AR rated perceived usefulness higher. Despite the positive results, we need to raise concerns regarding the reliability of using mobile AR in science due to the lack of usable free content and the frequent cancellation of authoring tools and applications.

Keywords: Augmented Reality, Interactive Media, Students' Acceptance

1. INTRODUCTION

Digitalization in education is of great importance, especially in 21st century. The world of education has now entered the realm of Education 4.0 fit for Industry 4.0, where the implementation of education and learning processes is based on student-centered, learning journeys, individual learning paths, formative assessment, teachers as mentors, multidisciplinary learning spaces, and inclusive collaboration. The educational process can be carried out through learning activities. Learning is an activity that has a goal, namely to teach students to achieve the desired increase in competence (Surayya, et al., 2014; Setiawaty, et al., 2018). However, it is necessary to develop augmented reality (AR) technology in the field of education by conducting new research (Dalim, et al., 2017). Mobile applications with Augmented Reality (AR) experience mode have the potential to be used in online, blended/hybrid, and co-creation interconnected. AR can help in this direction, bringing a range of benefits in the field of education. Furthermore, AR is one type of interactive technology that combines two objects between virtual objects and real objects so that they can produce 3D objects on the screen. The use of AR technology allows users to interact directly through the digital world. The display of objects in the real world will be displayed virtually in the digital world, so that users can interact in the digital world as in the real world (Sin & Zaman, 2010; Papakostas, et. al, 2022).

For instance, when shopping in several outlets, people may use their mobile phones to scan barcodes or QR codes to acquire more information on a product. This technology provides mobile phone camera recognition of special signs and acquires information via the internet. As the name

implies, location-based AR is a technology designed for use in a specifically designated area, for example, in schools or other surroundings (Wu, et al., 2013). According to Lam, et. al. (2017), AR is one of the alternative tool that can be used in teaching and learning for fun learning. AR refers to a computer-generated visual that creates an object that is then added to a real-world scene. AR is a variation of the Virtual Environment (VE) or Virtual Reality, defined as a VE that combines real and virtual objects in a single interface. It has helped students improve their cognitive and behavioral thinking abilities.

The Ministry of Education and Culture's policy of “Merdeka Belajar” and “Kampus Merdeka” inspired researchers to support the program through innovation of the science learning mechanism applied in the form of a mobile application and can be accessed by gadgets, be it PC, laptops, tablets, or smartphones. In this research, the AR developed can be applied using mobile devices (smartphones or tablets). Using mobile devices to integrate AR content in in-person or remote educational settings is more accessible and less expensive than with other types of AR hardware (such as smart glasses, headsets, AR projection systems, etc.). Thus, Sharoff (2019) agrees that in the age of information and communication technology, teachers must be creative and innovative to educate students. Teachers are hesitant to incorporate digital or technological tools into teaching and learning due to a lack of technological knowledge, skills, and experiences (Ganapathy, 2016). As a result, teachers must adapt pedagogical aspects as well as technology in the teaching and learning process for students (Kaimara, et. al., 2021; Setiawaty, et. al., 2022).

Still, in order to successfully organize technology-enhanced learning solutions, such as creating active hands-on learning activities, teachers need to have skills in using digital tools, as well as a certain level of smart pedagogical competences (Daniela, 2021). AR applications provide a new perspective on the experimental activities performed in laboratories, which hold an important place in science education (Yilmaz, 2021). Pointed out mobile AR applications as affordable and sustainable for massive adoption in different education areas. AR is a learning medium that was developed with Assmblr EDU software for students to increase cognitive learning outcomes of the science concepts presented, because when doing these exercises. The use of this medium, in addition to creating a sense of joy in learning, is also expected to help gain knowledge and understanding of the subject matter. Prior research reveals that AR enhances students' learning outcomes, offering significant pedagogical affordances when used in the tutoring of different domains, such as science or natural environments.

2. RESEARCH METHOD

In this research, AR was developed with Assmblr EDU software and used an adjusted and shortened version of the AR Acceptance Mode (based on a modified Technology Acceptance Model) proposed by Cabero Almenara, Barroso Osuna and Llorente Cejudo (2016), consisting of the four core constructs and extended by two external variables, namely playfulness and quality output, in order to consider both pedagogy and technology. The population that participated in this research includes 180 senior high school students in Syamtalira Aron sub-district, North Aceh district, Aceh, Indonesia. On the basis of the used research TAM model (Figure 1).

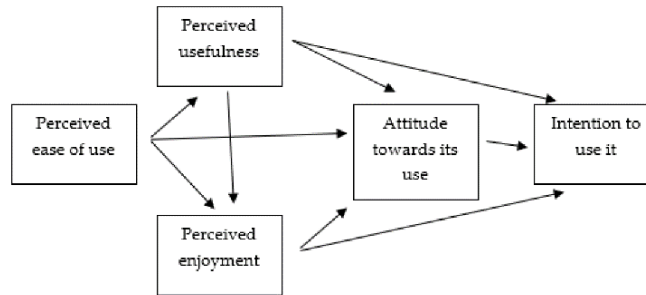


Fig. 1. Technology Acceptance (TAM) Model

3. RESULTS AND DISCUSSION

User experience is important for the effective use of AR in education. It provides further evidence on how to best design and organize learning activities and apply the right pedagogy. Here we present the mean scores and standard deviations obtained with both tools, starting with those reached with the TAM instrument. So that a correct interpretation, readers must bear in mind that the answer scale ranged between 1 (extremely unlikely/I disagree) and 7 (extremely likely/I agree). (Table 1).

Table 1. Means and standard deviations obtained with TAM

	MR	
	M	SD
(1) Perceived usefulness (PU)		
1.1. The use of this AR media could enhance my learning in the classroom.	6.65	0.65
1.2. The use of this AR media during classes would make it easier for me to understand certain concepts.	6.38	1.16
1.3. I think the AR media is useful when one is learning.	6.30	1.17
1.4. The use of this AR media would improve my learning.	6.40	1.14
(2) Perceive ease of use (PEU)		
2.1. In my opinion, the AR media is user-friendly	5.72	1.41
2.2. Learning to use and operate the AR media was not a problem for me	5.18	1.61
2.3. It will be easy for me to be skillful in IT when using AR	5.23	1.16
(3) Perceived enjoyment (PE)		
3.1. Utilizing the AR media was fun for me	6.82	0.39
3.2. I enjoyed myself using AR media	6.63	0.70
3.3. In my view, the AR media allows you to learn while playing	6.31	0.89
(4) Attitude towards its use (AU)		
4.1. Using the system makes learning become more joyful and interesting	6.62	0.55
4.2. In my opinion, using AR media in the classroom is a good idea	6.58	0.81
(5) Intention to use it (IU)		
5.1. I would like to use these AR media in the future if I had the chance	6.65	0.71
5.2. I would like to use the AR media to learn both about the topics that were presented to me and about others	6.63	0.62
TAM Global Values	6.30	0.89

Based on table 1, the analysis of the preceding table allows us to focus on two aspects: the degree of acceptance of AR technology can be regarded as very high and additionally quite uniform amongst all students, as shown by the low standard deviation values obtained. The high average value reached in the dimension “intention to use it” (6.64) and “Perceived enjoyment” (6.59) also deserve to be stressed. Furthermore, AR can positively affect students’ achievement learning because students with prior experience with AR rated perceived usefulness higher.

According to, Almenara, et. al (2021), mobile AR applications can be incorporated into university teaching; remember that the experience was carried out within a real classroom environment, and in our specific case, focused on teaching. In line with Yoon, et. al (2017) described that AR is believed to improve understanding of abstract concepts.

AR learning media is designed using Assemblr EDU or Assemblr Studio Web by paying attention to content and learning outcomes as well as review results and input from teachers and validators. Next, the media is presented using cards designed through Canva. In the following figure the AR card display and its content are presented.

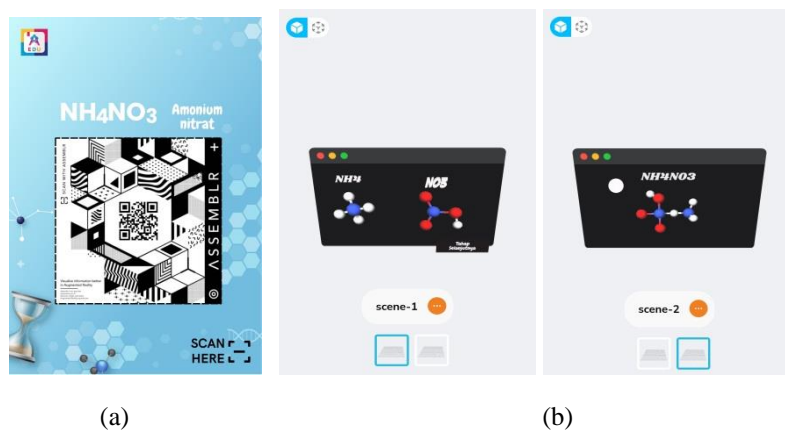


Fig. 1. (a) Display of AR card, (b) Display of contents of AR learning media

Normally, students can use visual tools such as pictures, videos, or animation to learn about the physical structure and properties of a chemical element. So therefore, AR is better presented as new subject content, while students welcome the visual objects. Furthermore, learning media-based technology is effective in enriching the teaching and learning experience, improving spatial cognition abilities (Irwanto, et al., 2022), reducing cognitive load (Allagui, 2019), and making it easier for students to understand context-specific skills and knowledge (Sugiyarto, et al. al., 2019).

4. CONCLUSION

Based on the research results, it can be concluded that AR learning media, which was developed using Assmblr EDU has student acceptances which are included in the qualifications and is very suitable to be used as a learning medium to improve students' digital abilities and learning outcomes. Because of that, media can be used as an innovative technology to teach abstract subjects when there is no opportunity to make direct experiences, and AR as a learning medium combines the virtual world, which can increase students' imagination, with the real world directly. Furthermore, it is hoped that there will be improvements to the learning media that researchers have carried out by optimizing the use of media widely. AR media also significantly influences the perceived usefulness and ease of use. The results imply that AR utilization has positive effects on the science teaching-learning processes in chemical structure from the students' perception of their mastery of technology.

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