Implementation of Augmented Reality (AR) android based in learning

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Abstract. Augmented reality is a technology that offers the ability to combine the virtual content with the real world. Augmented reality is divided into two, which is desktop based and mobile (android) can be used as a media in learning. The presence of augmented reality is a solution for abstract and complex learning. We are collected several journals related to augmented reality from a variety of sources, and acquired as many as 57 articles in the span of eight years between 2010 and 2018, and 28 of them in accordance with this research topic. We found a variety of research methods used to obtain the data for the implementation of augmented reality as a learning media, methods used include observation, questionnaires, surveys, pre-test and post-test, interview, video recording, and documentation. The resulting impact also varied, ranging from student motivation, student performance, student understanding, and the effectiveness of learning.

1. Introduction
The development of instructional media has started in the middle 20th century [1]. Learning media is very helpful to delivering learning content [2], one of the media that is in demand by students is the Augmented Reality (AR) and give a different contribution to student learning experiences and they are attitudes [3]. Augmented Reality is part of the development of instructional media that utilize Information and Computer Technology (ICT) [1]. Augmented Reality is application can projected digital images to the real world [4]. Augmented Reality is a technology that can be applied in by several area including education [5], by utilizing the incorporation of virtual and real content, AR can help provide an understanding of learning methods to children with disabilities [6]. AR offers to the users or to the students closer to the real world of things to be learned about [7].

With offers between the virtual world and the real world then AR can provide solutions for students in the learning of abstract and complex [8]. Augmented Reality development in recent years has been examined empirically in the laboratory development [4]. Augmented Reality is growing very rapidly and is widely used in several fields of science such as construction, engineering, field management, making AR the right choice for the learning process [9]. Potential of AR is able to change the way people interact and understand the environment around [10], but we as educators cannot always rely on computer applications in terms of providing learning material because it will affect the development of students’ cognitive abilities [7].

Research on the use of Augmented Reality learning media in schools can have a significant impact on the ability of students to understand the concept of learning science as students learn to use instructional media Augmented Reality [11]. Augmented reality proved to be more suitable for use in
learning have a higher degree of difficulty than the use of paper in the learning process is evidenced by the results obtained by students 'learning and students' ability to complete the tasks assigned [12].

The purpose of this study is to describe the types of research methods used to obtain the data for the implementation of augmented reality as a medium of learning, as well as to provide information about the impact that appears after using augmented reality as a learning medium.

2. Theoretical framework

2.1. What is Augmented Reality

Generally Augmented Reality can be defined on three main features: (a) combining of real objects and virtual objects; (b) with Augmented Reality can interact with real-time; (c) provide accurate images with three-dimensional projection [13]. In another study Augmented Reality is defined as the state in which the real context coated dynamically in the context of virtual information [14]. Augmented Reality adds, supplement or improve the existing realities, by adding elements of computational results obtained from the input data that can include audio, video, graphics or GPS data [15,16].

2.2. Features, systems and applications Augmented Reality

Developed of augmented reality can be used software display, input and tracking devices, and computer [17]. These types of screens that can be used is a head mounted displays (HMD), mobile devices (Android, Tablet PC). Augmented Reality System is divided into the image display system and location-based systems [18]. Augmented Reality-based images are subdivided into two categories: marker-based and marker-less base tracking.

Marker based Augmented Reality requires a special label, such as Quick Response Code (QRC), to position the 3D object in the drawing. While the marker-less augmented reality, every part of the picture can be used as a target to place virtual objects [19]. At this time, along with advances in technology, increased use of AR applications developed based on Android [17].

3. Method

Articles were identified by literature review exploring the Web of Science database, Taylor and Francis online, Google Scholar, and Science Direct. By entering the keyword "Augmented Reality in Education". As a result, gained as much as 57 articles in the span of eight years between 2010 and 2018. Of the 57 articles were obtained and then read and filtered again really related to Augmented Reality in education and learning process. From 57 we obtained 28 articles. Of the 25 articles analysed and coded using a spreadsheet.

![Figure 1. Research approach: Data collection.](image)

3.1. Coding scheme

Coding using four main categories of approaches in the analysis of the article is as follows:

- Basic data: author, year of publication, journals, place of study.
- Methods: research approaches, methods, themes, data collection techniques, methods of analysis, research.
• Content analysis: Learning Media, Augmented Reality, AR media influence on the motivation and decision-making. How to design Android-based Augmented Reality media on subjects in school.
• Discussion: The results obtained in the study, a solution of acquired research and guidance in the future.

4. Result and discussion

4.1. Data collection methods used
The method is often used to obtain research data on the implementation of augmented reality in learning is observation, questionnaire, survey, pre-test and post-test, interview, video recording, and documentation. The method used to obtain the data in the implementation of augmented reality adjusted with the aim of the researchers, observation and surveys are used to obtain initial data that describes the conditions in which augmented reality will be implemented [20]. Questionnaires are mostly used to obtain data on the response of the user augmented reality [21]. Pre-test and post-test was used to look at learning outcomes before and after implementation of augmented reality in the learning [22,23]. Interviews can be used to obtain the data after the implementation of augmented reality, the interview can be done to the students and teachers [24]. The video recording was used to observe the student's attitude during the implementation of augmented reality for teaching and learning activities [25]. And documentation used to obtain data such as pictures or video during the implementation of augmented reality in the teaching and learning activities [26].

4.2. The impact that come from implementation of AR in learning
In this section discusses the impact that caused as a result of the implementation of augmented reality. The impact of implementation of augmented reality in learning related to the motivation of learners [27], performance of learners [28], understanding learners [11], effectiveness of learning [29] and many more. not all studies produce significant impacts, sometimes when the use of augmented reality in research does not show a significant impact on learning [30].

5. Conclusion
Augmented reality in its development is now divided into two categories, namely augmented reality-based desktop and mobile-based augmented reality (android). In lessons, augmented reality is often used as a learning medium in order to help students to understand the material that is abstract and complex. During implementation, many of the methods used by researchers to obtain the desired results, ranging from interviews, to documentation. Using method must be adjusted to the type of research, both qualitative and quantitative research. The results of the study found that the impact of the application of augmented reality for learning was very positive, although in some aspects no impact was found

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References
[1] Martin-Gutiérrez J, Fabiani P, Benesova W, Meneses M D and Mora C E 2015 Augmented reality to promote collaborative and autonomous learning in higher education Comput. Human Behav. 51 752–761
[2] Wu L Y and Yamanaka A 2013 Exploring the effects of multimedia learning on pre-service teachers’ perceived and actual learning performance: the use of embedded summarized texts in educational media EMI. Educ. Media Int. 50 (4) 291–305
[3] Iqbal J and Sidhu M S 2017 A review on making things see: Augmented reality for futuristic virtual educator Cogent Educ. 4 (1) 1–14
[4] Cuendet S, Bonnard Q, Do-lenh S and Dillenbourgh P 2013 Computers & Education Designing augmented reality for the classroom Comput. Educ. 1–13
[5] Wu H K, Lee S W Y, Chang H Y and Liang J C 2013 Current status, opportunities and challenges of augmented reality in education Comput. Educ. 62 41–49
[6] Lin C Y et al. 2016 Augmented reality in educational activities for children with disabilities Displays 42 51–54
[7] Bower M, Howe C, McCredie N, Robinson A and Grover D 2014 Augmented Reality in education - cases, places and potentials EMI. Educ. Media Int. 51 (1) 1–15
[8] Turan Z, Meral E and Sahin I F 2018 The impact of mobile augmented reality in geography education: achievements, cognitive loads and views of university students J. Geogr. High. Educ. 42 (3) 427–441
[9] Chi H, Kang S and Wang X 2013 Automation in Construction Research trends and opportunities of augmented reality applications in architecture , engineering , and construction Autom. Constr.
[10] Wang X, Jeong M, Love P E D and Kang S 2013 Automation in Construction Augmented Reality in built environment : Classifi cation and implications for future research Autom. Constr. 32 1–13
[11] Chang H Y, Hsu Y S, Wu H K and Tsai C C 2018 Students’ development of socio-scientific reasoning in a mobile augmented reality learning environment Int. J. Sci. Educ. 40 (12) 1410–1431
[12] Billinghurst M, Belcher D, Gupta A and Kiyokawa K 2003 Communication Behaviors in Colocated Collaborative AR Interfaces Communication Behaviors in Colocated Int. J. Hum. Comput. Interact. 16 (3) 395–423
[13] Azuma R T 1997 A Survey of Augmented Reality.pdf 4 355–385
[14] Schmitz B, Klemke R and Specht M 2012 An analysis of the educational potential of augmented reality games for learning CEUR Workshop Proc. 955 140–147
[15] Pratikno H 2015 Kontrol Gerakan Objek 3D Augmented Reality Berbasis Titik Fitur Wajah dengan POSIT J. Nas. Tek. Elektro dan Teknol. Inf. 4 (1) 16–24
[16] Widiati I, Yustiawan I, Wibisono Y, Abdullah A G, Abdullah C U and Riza L S 2018 Implementation of markerless augmented reality method to visualise philosophy of batik based on Android Pertanika J. Sci. Technol. 26 (3) 1383–1400
[17] Koutromanos G, Sofos A and Avraamidou L 2015 The use of augmented reality games in education: a review of the literature EMI. Educ. Media Int. 52 (4) 253–271
[18] Cheng K H and Tsai C C 2013 Affordances of Augmented Reality in Science Learning: Suggestions for Future Research J. Sci. Educ. Technol. 22 (4) 449–462
[19] Ramirez H, Mendivil E G, Flores P R and Gonzalez M C 2013 Authoring software for augmented reality applications for the use of maintenance and training process Procedia Comput. Sci. 25 189–193
[20] Sumadio D D and Rambli D R A 2010 Preliminary evaluation on user acceptance of the augmented reality use for education 2010 2nd Int. Conf. Comput. Eng. Appl. ICCEA 2010 2 461–465
[21] Radosavljevic S, Radosavljevic V and Grgurovic B 2018 The potential of implementing augmented reality into vocational higher education through mobile learning Interact. Learn. Environ. 1–15
[22] Chang S C and Hwang G J 2018 Impacts of an augmented reality-based flipped learning guiding approach on students’ scientific project performance and perceptions Comput. Educ. 125 226–239
[23] Widiati I, Riza L S, Danuwijaya A A, Hurriyati R and Mubaroq S R 2017 Mobile-based augmented reality for learning 3-dimensional spatial Batik-based objects J. Eng. Sci. Technol. 12 (10) 12–22
[24] Yilmaz R M 2016 Educational magic toys developed with augmented reality technology for early childhood education *Comput. Human Behav.* **54** 240–248

[25] Chang K E, Chang C T, Hou H T, Sung Y T, Chao H L and Lee C M 2014 Development and behavioral pattern analysis of a mobile guide system with augmented reality for painting appreciation instruction in an art museum *Comput. Educ.* **71** 185–197

[26] Huang Y, Li H and Fong R 2016 Using Augmented Reality in early art education: a case study in Hong Kong kindergarten *Early Child Dev. Care* **186** (6) 879–894

[27] Wei X, Weng D, Liu Y and Wang Y 2015 Teaching based on augmented reality for a technical creative design course *Comput. Educ.* **81** 221–234

[28] Rai A S, Rai A S and Mavrikakis E 2017 Teaching binocular indirect ophthalmoscopy to novice residents using an augmented reality simulator *Can. J. Ophthalmol. Can. d’ophtalmologie* 1–5

[29] Sommerauer P and Müller O 2014 Augmented reality in informal learning environments: A field experiment in a mathematics exhibition *Comput. Educ.* **79** 59–68

[30] Hsu T C 2017 Learning English with Augmented Reality: Do learning styles matter? *Comput. Educ.* **106** 137–149