ICEE-2

Utilization of Augmented Reality as an Interactive Media in The Learning of Fine Arts in Elementary School Education Students

Jenny Indrastoeti Siti Poerwanti✉1, Tri Budiharto2

1,2 Teacher Training adn Education Faculty, Universitas Sebelas Maret, Surakarta
✉ jenny_isp@staff.uns.ac.id

Abstract. Utilization of Augmented Reality (AR) as interactive learning media can stimulate students' mindset in thinking critical because AR can visualize abstract concepts for understanding and the structure of an object model. This allows AR as a more effective medium. Augmented reality applications show good potential in giving students more active, effective and meaningful learning. Augmented Reality (AR) can be defined as a technology that can combine virtual objects two-dimensional or three-dimensional into a real environment and then bring it or project it in real time. The purpose of this study was to describe the ability of students to appreciate the results of fine art. It also aims to examine user acceptance of augmented reality applications within an art learning at primary teacher education program, from students' opinion when AR is used in class. The research design was descriptive. The study was conducted with 30 primary school teacher education students in Universitas Sebelas Maret. Data collection techniques used in this study are portfolio and questionnaire. The results show that (1) 75% ability of students' appreciation in appreciating art works is very good, especially in the stages of analysis and assessment, (2) Students' opinion about AR media 87.66% said it was beneficial for art learning, because AR can motivate to produce creative works of art. These results indicate that the application of AR as an interactive learning media can improve the ability to appreciate fine art.

Keywords: Augmented Reality, primary teacher education, art appreciation

INTRODUCTION ~ Technological advances throughout the world have created challenging competition between company where each company tries to attract customers using different techniques. One of the newest techniques is (AR). Augmented Reality (AR) can be defined as a technology able to combine two-dimensional or three-dimensional virtual objects into the real environment then emerges or projects it in a manner real time.

AR technology can also be used in education, used as a learning medium. By using Augmented Reality as an alternative learning media, it is hoped that in a learning activity it can be more interesting for students. Another benefit gained is more advanced learning media by utilizing current technological developments. Through Augmented Reality can be one solution to overcome the lack of activity in the learning process

AR Technology is the latest technology for teaching, learning and creative research (Tekedere & Göker, 2016) that has three characteristics: (1) real and virtual combines; (2) interactive in real time; and (3) registered in 3-D. AR technology allows virtual objects to be produced by computers to be placed on physical objects in real time(Ozdemir, at al., 2018). Based on reality on the ground, visual arts learning does not use interactive media so the learning process is less interactive. The level of appreciation of art works is lacking because learning is not interesting. By using AR-based interactive media is expected to overcome the problems that occur in learning.

AR can be used in teaching fine arts as learning in conveying images such as collages, mosaics and montages. Augmented reality in this study is used as an art learning medium that is run using smart phones. Smart phone technology contributes positively to education (Radosavljevic, at al., 2018; Huang, at al., 2016) augmented reality (AR) is considered as "the main educational technology in the future decade (Bacca, 2014). The use of AR as a medium is studied and general conclusions from several studies are that the application of AR can improve the learning process, learning motivation and effectiveness (Bower, 2014; Cubillo, 2014). Through augmented reality it is hoped to make art learning more interactive and encourage students to produce works of art such as mosaics, collages and montages. From the artwork produced, this will encourage students to appreciate the work.

The benefits of AR in improving children's motivation and learning effectiveness have been reported by researchers among varying contexts (Izwan & Syed, 2017; Kaufmann, 2011; Mona, 2012). By utilizing appropriate teaching strategies, AR can give students many benefits and leads to effective learning experiences. AR technology also provides opportunities to create more interesting experience. The benefits of AR as a medium can be used using additional story books to increase students' understanding of the story because it can remember stories more easily (Billinghurst & Dunser, 2014).

AR which is combined in the learning process especially in art can produce students' imagination in producing artwork (D'Souza, at al., 2013). Students' motivation and interest in learning also increased this because they were interested in the images displayed with AR technology (Delello, 2014; Pérez-López & Contero, 2013). The formulation of this research problem is to determine the benefits of augmented reality which is used as an interactive media. This study discusses the use of AR in learning fine arts in order to find out the level of student appreciation, and students' opinions regarding the use of AR in learning.

Fine art learning focuses on developing affective aspects (attitude, taste sensitivity). Activities in learning fine arts are observation to feel the values of beauty, analyze and appreciate work. The activity of evaluating or evaluating the work is an important aspect of the process learn to appreciate art. There are many studies that have been done, that the use of AR in the classroom can increase academic achievement (Sin & Zaman, 2010; Yen, at al., 2013; Zhang, at al. 2014). In this context, there are a great number of studies conducted that relate to AR in learning Arts. One specific technology that has many potential applications in the art classroom is augmented reality (AR) AR can help young children inspect 3D objects from different angles and enhance their understanding of different concepts (AR Garden) to teach children the theory of colour (Ucelli, at al., 2015). The 3D virtual

ICEE-2

chameleon showed children how to get secondary colours from a combination of primary colours, and vice versa. The study showed positive effects of engaging children with AR learning and demonstrated the educational value for nurturing children's creativity and imagination.

METHOD

The research used quantitative research, respondent consist of 30 primary school teacher education students in Universitas Sebelas Maret. Data collection techniques used in this study are portfolio and questionnaire. Portfolios are used to assess the ability of appreciation and questionnaire to find out students' opinions of the AR media used during learning. To check the questionnaire used the content validity test. Content validity is assessed by media experts. Data processing in this research is conducted using descriptive analysis. Student portfolios are obtained from drawing activities which are the results of learning in the classroom using AR media. Students' portfolio works are exhibited at the end of a learning program. Through this exhibition activity the level of student appreciation can be seen.

Augmented Reality which is operated on smart- phones with the Android operating system, accompanied by fine art teaching materials. Teaching materials contain instructions for use, summary of material, and marker images. The results of the realization of the developed learning media will be presented as follows.

1. The splash screen page is the first page that appears when the user opens the application page is a branding page of a 3D unity product that is displayed a few seconds before entering the main menu page.

2. The AR start menu is the core menu in the application of augmented reality technology. Through this menu, users will be directly connected to the camera feature. Users simply shoot the camera on the markers available in the teaching material. Real images will be projected in real time, and take place interactively.

The processes of using AR technology can be explain simply in terms of normal computer technology such as hardware and software. The needed equipment as follows

1. Hardware. The hardware consist of two main categories smart mobile phone and a web camera which can perform normal functions as a computer and includes a camera able to connect to the internet.

2. Software. The software is an important tool in displaying AR.

3. Marker. The marker is a symbol printed on any type of material. The markers might be a real object or printed in a book, flyer, brochure etc.

During the class, the teacher showed various kinds of mosaic images, collages

and montages that have been connected to textbooks to the students and let them choose their favourites. When students finished watching, the teacher asked who would want to ask and share about images presented using AR media. We connected students' smart phone to the class projector after they are sharing. After the explaining activities are completed students try to draw a mosaic form of collage, and a montage in accordance with the themes given by the teacher. Work in the form of mosaic works, montage and collage during one learning program will be exhibited as a portfolio.

RESULTS

The ability to appreciate student art

The ability to judge art works is carried out through the following stages: (1) Perception In perception activities we recognize or identify forms of artwork that are appreciated, (2) Knowledge At this stage, knowledge as a basis for appreciating both the history of art introduced, and the terms commonly used in the arts; (3) Definition At this stage, we translate themes into various forms of art, based on experience; (4) Analysis At this stage, begin to describe one form of art that is being studied, interpreting the object being appreciated; (5) Assessment At this stage, more emphasis on the assessment of works of art that are appreciated, both subjectively and objectively; (6) Appreciation The appreciation phase consists of three things; value (empathy), empathy and feeling.

Value is the activity of assessing the beauty of art, aesthetic experience and the meaning / function of art in society. While empathy, understanding and appreciating activities. While feeling, more on living the artwork, so that you can feel the pleasure in the artwork. The ability of students' appreciation is seen in the following table 1 below.

Table 1. The ability of students' appreciation

No	Aspect	N	Students' appreciation			
			less	enough	good	Very good
1	Perception	30	1	1	3	25
2	Knowledge	30	2	5	6	15
3	Definition	30	1	1	3	25
4	Analysis	30	3	2	5	20
5	Assessment	30	-	2	3	25
6	Appreciation	30	-	2	3	25
	Total		10	14	4	135

Based on table 1 above the students' appreciation ability for each aspect is very good with a total score of 135. This means that 75% of students have excellent appreciation skills. Students' appreciation ability is obtained from student portfolios exhibited at visual art exhibition activities at the end of a learning program.

Students' opinions about AR media in fine arts learning

20 students were used as respondents to find out their opinions about the AR media

used. The overall results can be seen in table 2.

Table 2. Students' Opinions

No	Student	Aspect				Total	Category
		Design	Performance	Material	Benefits		
1	A	10	12	14	26	64	Good
2	B	14	14	13	25	66	Very good
3	C	12	13	12	24	63	Good
4	D	12	12	14	30	68	Very good
5	E	12	12	14	29	69	Very good
6	F	12	14	14	24	64	Good
7	G	10	12	14	30	66	Very good
8	H	13	12	13	26	64	Good
9	I	13	13	14	27	67	Very good
10	J	14	14	10	30	68	Very good
11	K	13	14	12	30	69	Very good
12	L	14	13	14	29	70	Very good
13	M	13	14	13	30	70	Very good
14	N	13	14	14	27	68	Very good
15	O	12	13	14	30	69	Very good
16	P	12	12	14	26	64	Good
17	Q	14	14	13	28	69	Very good
18	R	14	14	13	30	71	Very good
19	S	13	14	13	30	70	Very good
20	T	13	14	14	30	71	Very good
	Total	253	264	266	561	1.350	
	Mean score	12.65	13.2	13.3	28.05	67.5	
	Category	Good	Very good	Very good	Very good		
	%	79.6	82.5	83.13	87.66		

Based on Table 2 above, the average learning design aspect scores 12.65 in the good category, the average aspect of media display is 13.2 with the "very good" category, the average aspect of the material is 13.30 with the "very good" category ", the average aspect of benefits is 28.05 with the" Very good "category. The score of the aspect of media display gets a score of 13.2 with the category of "Very good", the material aspect score gets a value 13.3 with the category of "very good", and the aspect of the benefits of getting an average score of 28.05 with the

category of "very good". As well as the total average score obtained is 67.5 of the total score of 80 in the "good" category.

DISCUSSION

Overall, students reacted positively to using AR technology both in and outside of the classroom. AR is a fairly new development within the field of education, and there are areas that students reported that need improvement. Four educational uses to AR mobile technology, which are in no particular order: field science, field

visits, games, information services, and guides. AR games can be played independently or dependently. Researchers, teachers, and students alike were very pleased to find more collaboration while using the AR technology (Annetta, at al., 2012; Billinghurst & Dunser, 2012).

Students also reported that learning in an AR environment is more stimulating and appealing than viewing a traditional slide presentation (i.e., Microsoft PowerPoint, Smart Notebook) because they preferred the audio, video, and feeling as if they were part of the 3D model that was transposed into a real physical space (DiSerio, at al., 2013). Finding "hotspots" also known as "triggers," and using the smartphone were both reported as what the students really enjoyed while using AR technology (Kamarainen, at al., 2013). Utilizing handheld devices was considered the most motivating and engaging factor when students played the AR simulation game Alien Contact! (Dunleavy, at al., 2009).

CONCLUSION

AR can be used as an innovative technology integrating actual reality and virtual reality. This article described in general the benefits of AR in education, especially in fine arts learning. The research and development of AR for education is very high demand, because the capacity of the technology to create a learning. AR research and development for education is in great demand,

because of the technological capacity to create active and creative learning

AR can be used as a medium for art learning to improve the ability to appreciate art and the students' opinions about the use of AR as a medium of learning art are very good. The use of AR as an art learning media can be well received. It can be seen in students' opinions about the results of media use.

REFERENCES

Annetta, L., Burton, E. P., Frazier, W., Cheng, R., & Chmiel, M. (2012). "Augmented reality games: Using technology on a budget." *Science Scope*, 36(3), 54-60.

Bacca, J.; Baldiris, S.; Fabregat, R.; Graf, S.; Kinshuk. (2014). "Augmented Reality Trends in Education: A Systematic Review of Research and Applications." *Educ. Technol. Soc.*17, 133–149.

Billinghurst, M., & Dunser, A. (2012). "Augmented reality in the classroom." *Computer*, 45(7), 56-63.

Billinghurst, M., & Dunser, A. (2014). "Augmented reality in the classroom." *Computer*, 45(7), 56-63.

Bower, M.; Howe, C.; McCredie, N.; Robinson, A.; Grover, D. (2014). "Augmented Reality in education—cases, places and potentials." *Educ. Media Int.* 51, 1–15.

Cubillo, J.; Martín, S.; Castro, M.; Diaz, G.; Colmenar, A.; Botički, I. (2014). "A learning environment for augmented reality mobile learning." *In Proceedings of the 2014 IEEE Frontiers in Education Conference (FIE) Proceedings*, Madrid, Spain, 22–25 October 2014; pp. 1–8.

D. D'Souza, U. Singh, D. Sharma, and P. Ranjan. (2013). *"Educational technology in teaching and learning: Prospects and challenges."* Patna: Patna Women's College.

D. Pérez-López and M. Contero. (2013). "Delivering educational multimedia contents through an augmented reality application: A case study on its impact on knowledge acquisition and retention," *Turkish Online J. Educ. Technol.*, vol. 12, no. 4, pp. 19–28.

DiSerio, A., Ibáñez, MB., Kloos, CD. (2013). "Impact of an augmented reality system on students' motivation for a visual art course." *Computers & Education,* 68, 586-596.

Dunleavy, M., Dede, C., & Mitchell, R. (2009). "Affordances and Limitations of Immersive Participatory Augmented Reality Simulations for Teaching and Learning." Journal of Science Education and Technology, 18, 7-22.

H. Tekedere and H. Göker. (2016). "Examining the Effectiveness of Augmented Reality Applications in Education: A Meta-Analysis," *Int. J. Environ. Sci. Educ.*, vol. 11, no. 16, pp. 9469–9481.

Huang, T.C.; Chen, C.C.; Chou, Y.W. (2016). "Animating eco-education: To see, feel, and discover in an augmented reality-based experiential learning environment." *Comput. Educ.*, 96, 7282.

Izwan Nurli Mat Bistaman, Syed Zulkarnain Syed Idrus Salleh Abd Rashid. (2017). "The Use of Augmented Reality Technology for Primary School Education in Perlis, Malaysia." *1st International Conference on Green and Sustainable Computing (ICoGeS).*

J. A. Delello. (2014). "Insights from pre-service teachers using science-based augmented reality," *J. Comput. Educ.*, vol. 1, no. 4, pp. 295–311.

Kamarainen, A. M., et al. (2013). "EcoMOBILE: Integrating augmented reality and probeware with environmental education field trips." *Computers & Education*.

Kaufmann H. (2011). *"Journals Collaborative Augmented Reality in Education Institute of Software Technology and Interactive Systems."* Vienna University of Technology: Favoritenstrasse.

Mona Alkhattabi. (2012). "Augmented Reality as E-learning Tool in Primary Schools' Education: Barriers to Teachers' Adoption" https://doi.org/10.3991/ijet.v12i02.6158.

Ozdemir, M., Sahin, C., Arcagok, S., & Demir, M. K. (2018). "The Effect of Augmented Reality Applications in the Learning Process: A MetaAnalysis Study." *Eurasian Journal of Educational Research, 74*, 165-186.

Radosavljevic, S., Radosavljevic, V., Grgurovic, B. (2018). "The potential of implementing augmented reality into vocational higher education through mobile learning." *Interact. Learn. Environ*. 1–15.

Sin, A. K., & Zaman, H. B. (2010). "Live Solar System (LSS): Evaluation of an Augmented Reality book-based educational tool." *In 2010 International Symposium on Information Technology*. Vol. 1, 1.

Ucelli, G., Conti, G., Amicis, R. D., Servidio, R. (2005). "Learning using augmented reality technology: Multiple means of interaction for teaching children the theory of colours." *In M. Maybury, O. Stock, W. Wahlster (Eds.)*, 3814, pp. 193–202. Heidelberg: Springer.

Yen, J.-C., Tsai, C.-H., & Wu, M. (2013). "Augmented reality in the higher

ICEE-2

education: Students' science concept learning and academic achievement in astronomy."

Zhang, J., Sung, Y.-T., Hou, H.-T., & Chang, K.-E. "The development and evaluation of an augmented reality-based armillary sphere for astronomical observation instruction." *Computers & Education*, 73, 178, 2014.