



Augmented Reality Media Development to Improve Cultural Literacy in Prospective Elementary School Teacher Students

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Abstract. This study aims to develop AR (Augmented Reality) learning media in the subject "Javanese Culture" in the Elementary School Teacher Education study program in Surakarta City. This research and development (R&D) comprised a preliminary study and development stage. This research was conducted on the seventh-semester students, totaling 60 students. Data collection techniques employed were observation, interviews, and questionnaires. This research produced an AR prototype through STEAM learning and was validated by experts. The research results at the preliminary study stage revealed that lecturers still used limited learning media, namely PowerPoint, visualizing text, images, and videos. Thus, lecturers and students needed AR applied through the STEAM approach. The prototype developed was validated by five media experts and five material experts. The material expert's validation results showed a score of 4.30, which was included in the very good category, while the media expert's validation results uncovered a score of 4.60, which was included in the very good category.

Keywords: augmented reality, cultural literacy, elementary school

1 Introduction

The development of the industrial revolution 4.0 demands a change in the education system in Indonesia. The rapid development of new technologies has also changed the way of teaching in the positive use of teaching methods and tools (Al Bataineh, 2014; Uzunboylu & Karagozlu, 2015; Ozcan & Genc, 2016). Moreover, nowadays, it is not appropriate to learn to use traditional methods and media because many things have changed for students. This change is because students who are digital natives spend more time looking at texts on a mobile phone or laptop screen than in books (Atsusi, 2014: 11). Learning must also be relevant to the challenges and demands of real life, including raising the ability to work together, problem-solving skills, self-control, critical thinking skills, mastering technology, processing information, and communicating effectively (Hadinugrahaningsih et al., 2017).

Furthermore, the use of media and learning methods that are less than optimal impacts learning output. The assessment results on the Javanese Culture Course, according to the lecturer teaching at the Elementary School Teacher Education study program, revealed that only 42% of students scored above the minimum mastery criteria. From the preliminary study results, the media commonly utilized was PowerPoint, consisting of pictures, CDs, and e-gamelan applications. In this case, the use of media limited to two dimensions is not in accordance with the characteristics of courses containing abstract concepts, so they cannot be visualized and cannot interact directly with students. Also, media use influences students' lack of understanding of local culture, no interest in cultural issues, and no responsibility to preserve culture.

Cultural literacy, in fact, is an important thing to be mastered in the 21st century by everyone, especially the millennial generation, with the aim that they can continue to love and participate in preserving Indonesian culture. This country has various ethnic groups, languages, customs, traditions, beliefs, and social layers. As part of the world, Indonesia is also involved in global development and change. Therefore, accepting, adapting, and acting wisely and intelligently on this diversity becomes essential in this 21st century.

With the ASEAN Economic Community (AEC) implementation, the challenges are getting tougher in Southeast Asia. This regional policy has great potential to create interaction between nations with various cultures and customs. It happens because, in free trade, products and people from other countries have a great opportunity to come to other countries. This condition must be anticipated by preparing a generation with the knowledge and life skills, one of which is cultural literacy. Cultural literacy will eventually lead individuals to succeed in their existence in the AEC era.

For this reason, it is vital to provide cultural literacy at the family, school, and community levels, especially the millennial generation, so that they continue to love and preserve culture in Indonesia, both nationally and internationally. In addition, cultural literacy not only saves and develops local and national culture but also builds the identity of the Indonesian nation amid a global society so that they continue to love and preserve that culture.

In this case, lecturers can play a substantial role in increasing cultural literacy by using learning media that are useful in developing visual perception and logical thinking skills and visualizing abstract concepts (Alqahtani & Powell, 2012). Following new directions in the world of technology education and using them in teaching activities is necessary for an effective teaching process. One of the new technologies is Augmented Reality (AR) technology. AR allows students to learn abstract concepts (Sural, 2018). Particularly, material in Javanese Culture Courses, such as discussions of Javanese cultural heritage, i.e., artifacts, temples, and stupas, can be presented more realistically using AR. Moreover, lecture programs that meet the needs of "Javanese Culture" learning achievement can be packaged through the Science, Technology, Engineering, Art, and Mathematical (STEAM) approach, which links the five fields of science so that students are given a holistic understanding of the interrelationships of the fields of science through 21st-century learning experiences. Applying the STEAM approach to Javanese Culture Courses is a new thing, as with cultural heritage materials. For example, temple material is taught using the STEAM approach; from the point of view of science regarding scientific studies, the temple building is made of stone so that it forms a temple and does not collapse; its technology is the construction of tall buildings on the temple; engineering is in the form of sacred Hindu-Buddhist architecture; art examines the cultural studies of the creation of the temple; mathematics examines ethnomathematics, such as building measurements. Also, other materials in the Javanese Culture Course can be packaged using the STEAM approach.

This research is crucial because the learning media is needed for seventh-semester students to overcome various problems regarding the fading of national culture, which is starting to be replaced by a foreign culture. The novelty of this research is the media used and the content applied to learning in higher education, which can increase students' cultural literacy values. Hopefully, this research can increase student interest in learning culture so that local culture remains sustainable.

2 Research Method

The research method used was research and development, i.e., research that produces certain products and tests the effectiveness of the resulting products. Sukmadinata (2012: 189) described the ten stages of Borg & Gall, simplified into three stages: (1) exploration or preliminary study stage, (2) model development stage, and (3) model testing stage. This research reached the model development stage.

Preliminary studies were conducted at the Elementary School Teacher Education study program, Universitas Sebelas Maret (UNS) and Universitas Muhammadiyah Surakarta (UMS). The preliminary study aimed to analyze the availability of learning media for the "Javanese Culture" subject in both study programs. The data used in the preliminary study stage were the results of observations during learning and documents. Data collection techniques comprised (1) structured interviews, (2) questionnaires, (3) observations, and (4) document analysis. The samples used at this stage were 30 students from the Elementary School Teacher Education study program at UNS and 30 students from the Elementary School Teacher Education study program at UMS. The

data obtained in this stage were then analyzed using interactive analysis techniques (Miles, Huberman, and Saldana, 2014: 14), including (1) data collection, (2) data reduction, (3) data display and (4) drawing a conclusion.

The development activity began with identifying the material and compiling the initial design of the Augmented Reality product by making flowcharts and storyboards. The researchers then collected supporting materials, such as relevant materials, pictures, and videos. The researchers arranged all the materials collected according to the barcode/image to be scanned. Product validation was done by asking for opinions or suggestions from several experienced experts, namely learning media experts and material experts about Javanese Culture. After the design validation, the next stage was the prototype improvement according to experts' advice. Initial products declared eligible could be used for product trials.

3 Research Results and Discussion

The preliminary study results showed that the use of learning media was still limited. Lecturers who taught Javanese Culture Courses at the Elementary School Teacher Education study program in Surakarta City often used PowerPoint media to deliver the material. Although there were e-gamelan applications, the frequency of their use was still rare. At the time of learning, lecturers also had not used varied approaches or learning models. The following are the needs analysis results of the STEAM-based AR learning media:

Table 1. Results of the needs analysis questionnaire for STEAM-based AR learning media

No.	Question	Answer Options	
		Yes	No
1.	Do you have difficulties in using learning media? (For example, limited availability of learning media)	40%	60%
2.	Can the availability of learning media you use affect students' abilities when teaching Javanese Culture Courses?	100%	0%
3.	Do you have difficulty teaching the concept of Javanese culture material?	20%	80%
4.	In your opinion, are students' knowledge of Javanese culture good?	40%	60%
5.	In your opinion, do students currently hold tightly to local cultural values?	45%	55%
6.	Have you ever used augmented reality?	40%	60%
7.	Have you ever made an augmented reality?	40%	60%
8.	Have you ever used the STEAM approach?		
9.	Have you ever used augmented reality in combination with the STEAM approach?	20%	80%
10.	a. Do you need special learning media to teach Javanese Cultural material more interestingly, for example, using STEAM-based augmented reality?	100%	0%
	b. Do you agree that it is necessary to develop STEAM-based augmented reality?	100%	0%

Based on this explanation, it can be concluded that there was a need for innovations in Javanese Culture lectures. The innovation was to develop augmented reality that could introduce Javanese cultural values. The researchers then applied augmented reality using the STEAM approach. This approach can introduce Javanese cultures from various fields of science, namely science, technology, engineering, art, and mathematics.

The next stage was the development stage. The first stage of development was to draw up a media program outline (GBPM). Making GBPM serves to minimize the possibility of material errors in the development of learning media. The steps taken in preparing the GBPM included (1) identifying the needs and characteristics, (2) detailing the learning objectives to be achieved, (3) formulating the items of material or subject matter, and (4) formulating the form of presentation of learning materials. The second stage was the development of a flowchart. The flowchart used was a program flowchart, explaining in detail how the steps or procedure sequences were executed.

The next stage was making a storyboard. The storyboard was intended so that the flowchart made could be described in more detail in each frame/slide. A storyboard is a detailed description of the application content to be created. This study's development of several storyboards referred to the following basic concepts.

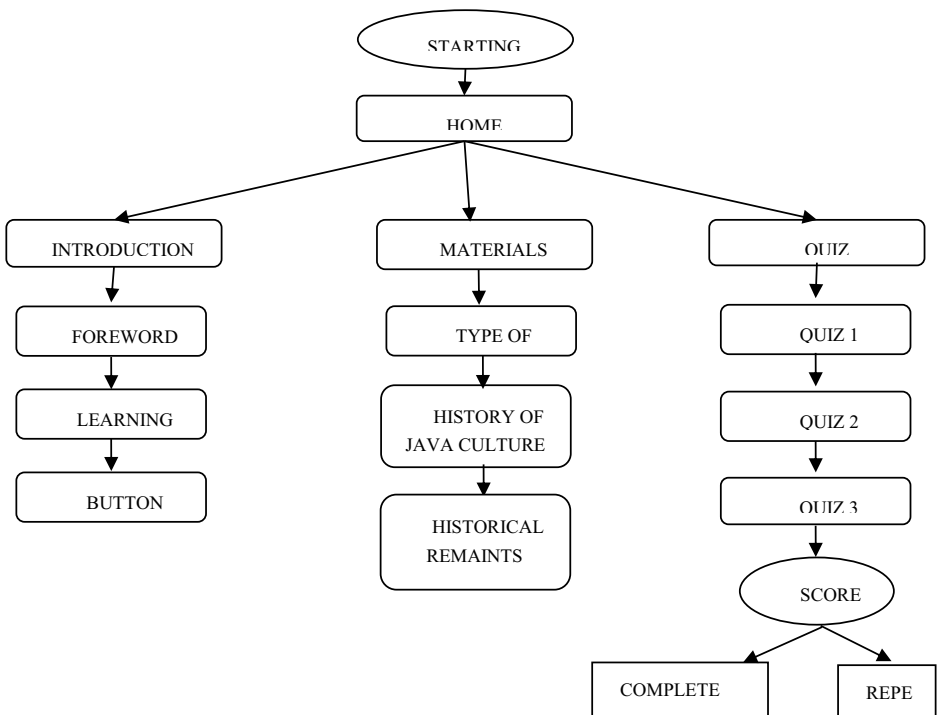


Fig. 1. Basic concept of research storyboard

The media developed was then validated by experts to determine its suitability and feasibility for use in learning. Based on this, the following are the media usability test results developed based on material and media experts.

The material experts were validated by five lecturers who were experts in the field of learning. Validation to material experts aimed to get responses in the form of assessments and suggestions regarding several aspects of the developed product. The following results from an assessment or validation from a material expert.

Table 2. Material Expert Validation Results

Aspect	Score	Mean Score	Category
Conformity of Core Competencies (KI) and Basic Competencies (KD)	19	4.75	Very good
Material accuracy	33	4.13	Good
Language	13	4.33	Very good
Learning	21	4.20	Good
Total	86	4.30	Very good

The validation results from material experts on the suitability of Core Competencies (KI) and Basic Competencies (KD) got a score of 19 and a mean of 4.75, including in the very good category. The accuracy aspect of the material obtained a score of 33 and a mean of 4.13, including in the good category. In addition, the language aspect scored 13, and the mean was 4.33, which was included in the very good category. Then, the learning aspect had a score of 21, and when averaged, it became 4.20, including in the good category. Based on these results, when converted on a scale of 5, overall, augmented reality was very good and feasible to be applied in the learning process with revisions according to the advice of material experts.

Then, validation from media experts was carried out by five lecturers who were experts in the field of learning media. Validation to media experts aimed to get responses in the form of assessments and suggestions regarding several aspects of the product being developed. The following are the assessment or validation results of media experts.

Table 3 Media Expert Validity Results

Aspect	Score	Mean Score	Category
Display	45	4.50	Good
Technical	23	4.60	Very good
Usefulness	24	4.40	Good
Amount	92	4.60	Very good

The results of the media expert validation based on the display aspect got a score of 45 and a mean of 4.50, included in the good category. Then, the technical aspect scored 23 and a mean of 4.60, which was included in the very good category. Meanwhile, the usefulness aspect obtained a score of 24 and a mean of 4.40, including in the good category.

Some inputs and suggestions from media experts covered the need to add rules/instructions for using augmented reality and add certain buttons, such as home, music, exit, previous, and next, which can be enabled. Material experts suggested that some images had an unclear resolution, and the appropriateness of the font, size, and background should be made more attractive and clearer to read.

The results of this study align with Akcay & Cetinkaya's (2013) opinion that AR has been used in classrooms around the world. Some advantages of using AR are that it can minimize misunderstandings (misconceptions), improve content understanding (Radu, 2014), increase student creativity (Weng, Liu, and Wang, 2015), increase student interest and motivation (Cai et al., 2017), increase enthusiasm (Lamounier et al., 2010), and improve achievement (Thomas et al., 2019). AR also has the advantage of providing virtual object information and helping users perform activities in the real world (Fatimah, Setiawan, & Surur, 2019). In this study, learning was packaged through a Science, Technology, Engineering, Art, and Mathematical (STEAM) approach, linking the five sciences so that a holistic understanding of the interrelationships of the fields of science was provided through the 21st-century learning experiences. Experiential learning can increase student engagement and their overall academic achievement (AEE, 2018). Research conducted by Techakosit, S. & Wannapiroon, P. (2015) also showed that the Connectivism learning environment developed in an AR-based science laboratory to improve scientific literacy consists of four main components: the learning environment, the learning process to improve scientific literacy, environmental characteristics, and scientific literacy. Also, a study carried out by Sirakaya (2018) uncovered that AR positively contributed to student achievement and reduced student misunderstandings.

4 Conclusion

Based on the research results, several conclusions can be drawn. The learning media used in Javanese Culture courses was still limited to PowerPoint media. Thus, lecturers and students needed learning media to improve cultural literacy, namely augmented reality through the STEAM approach. In this study, the prototype was validated by five media experts and five material experts. The material expert's validation results showed a score of 4.30, which was included in the very good category, and the media expert's validation results revealed a score of 4.60, which was included in the very good category. The augmented reality product produced also received a very good rating, based on the validation results of material and media experts. In the next stage, the successfully developed media needs to be tested for feasibility, both from the side of students and lecturers as potential users. With further feasibility assessments from both sides, it is hoped that the developed augmented reality media can be applied in learning through the STEAM approach for Javanese Culture Courses to increase literacy and increase cultural literacy in the Elementary School Teacher Education study program students.

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