Improving knowledge about Indonesian culture with augmented reality gamification

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Abstract. Digital technology cannot be dammed or avoided, moreover, the current generation of children is a native digital generation is those who are born very close to the world of digital technology such as smartphones, laptops, digital applications, internet access, and others. This may affect the attitudes and behaviors of children in both positive and negative impacts. However, we can act wisely, not by alienating or avoiding children from technology but by providing education about technology (digital literacy) and directing video game access to positive video games that are beneficial. The method used in this research is Research and Development with a modified SDLC (Software Development Life Cycle) development model in the development of Augmented Reality (AR) educational games. This study also uses a pre-test-post-test group matching design to analyze the increase of elementary school students' knowledge in learning about Indonesian culture. The measurement results of student learning outcomes are carried out by giving tests in the form of multiple choice. The statistical analysis used in this study is the validity test and Wilcoxon Signed Rank test. Validity testing shows 93.33% of the questionnaire items are valid. The results of the Wilcoxon Signed Rank test analysis obtained a significant value of 0.00 <0.05, then it was stated that there were differences in the average student learning outcomes for pre-test with posttest (increased). This research concludes that after the use of AR Edugame learning media, it has an influence compared to before learning with the media. This shows there is an increase in student learning outcomes.

1. Introduction

The digital technology flooding cannot be dammed or avoided, moreover the current generation of children is a native digital one that is children who are born very close to the world of digital technology [1–3] such as mobile phones/smartphones, laptops, digital applications, internet access and others. Furthermore, in demographic data based on a survey of elementary school children conducted by researchers in 2017 [4], all respondents stated that their family must have a cellphone/smartphone and 76.47% suggested that there were family members who already had laptops. In fact, 55.88% children remarked that all family members already had a cell phone/smartphone. The access facility to digital technology through smartphones and laptops is certainly affect primary school age children, especially video games [5]. It is not impossible that this will affect the attitudes and behaviors of children either in positive or negative impact [6], although there is a controlling side of parents showing that children can...
access digital technology in a certain time (76.47%) but not at any time. In other side however, video games are indeed very popular among children as 94.12% of children mentioned that they liked playing video games and nearly 50% of them said that they played it within 1 hour - 3 hours [4]. It is the children’s intensity in playing video game that must worth to be watched by either parents or educators in school.

However, we can act wisely, not by alienating or avoiding children from technology but by providing education about technology (digital literacy) [7] and directing video game access to the one having positive impact [8,9].

Augmented Reality Gamification application as a learning media (AR EduGame) can be a means to introduce school age children to video game having positive content and purpose that is to be a learning media for them at school. This will be beneficial to improve children’s knowledge. ER EduGame employed this time will have Indonesian culture theme available in school curriculum as well as using Augmented Reality since 3D game application has been assessed as interesting if it is operated by children in playing game [10,11].

2. Method
The method used in this study can be categorized into two (2). They are gamification creation stage and improvement knowledge stage with the following explanation.

2.1. Gamification creation stage
The Augmented Reality Gamification was designed by employing SDLC (System Development Life Cycle) research method using modified Waterfall approach model that was designed to operate in a linear and sequential manner. Augmented Reality application development was performed in several application development processes as the flow chart described in figure 1.

The necessity analysis was conducted by interviewing elementary school teachers and students as well as observing the curriculum of elementary school students regarding user experience and Indonesian culture material. The analysis result of this necessity was used as the material to design AR EduGame [12,13] of the culture. Hereinafter, AR EduGame design included use case diagram, activity diagram, mock-up to storyboard creation. Software concept was constructed by coding to produce an AR EduGame prototype being a learning media for Indonesian culture, especially about Traditional Dance and Gamelan [14].

The system testing of AR EduGame prototype was performed by black box test, expert judgment (elementary school teachers) and usability assessment by elementary school students. Black box test was performed to find out AR EduGame system functionality whether or not it can well function and in accordance to expectation [15,16], and usability test to find out the feasibility of using the system [17]. The implementation for this AR EduGame was actually performed in elementary school as learning media.
2.2. Improvement knowledge stage

This intervention result can be seen by applying a pre-test-post-test group matching design method [18] by providing pre-test and post-test before and after student intervention using AR gamification application as seen in Figure 2. This test was in multiple choices about Indonesian culture material particularly in terms of traditional dance and gamelan. The test/assessment instruments were also assessed for validity first.

This implementation stage was conducted to find out whether there is or not children’s knowledge improvement related to Indonesian culture especially regarding traditional dance and gamelan. The data analysis to find out students’ knowledge improvement regarding this Indonesian culture was performed by employing statistical calculation using Wilcoxon Signed Rank method [19,20]. This is to find out whether there is positive change regarding children’s knowledge of Indonesian culture particularly in the material of traditional dance and gamelan.

3. Results and discussion
3.1. Media creation stage
This stage resulted in gamification AR application about Indonesian culture in which its screenshot interface can be seen in Figure 3. This application provides knowledge feature of traditional dance and gamelan through separate game. Each of AR edugame has learning part and AR Edugame. The AR Edugame application has been previously tested by expert judgment and usability before implemented to children [14]. Application is considered as good and feasible with an interpretation percentage above 80% both by users (elementary school students) and expert judgment by elementary school teachers.

![Screenshot user interface of AR edugame.](image)

3.2. Improvement knowledge stage
The researcher implemented learning method by employing AR gamification application to elementary school students in which it can be seen in Figure 4. The learning used this media, before the class started, the students were provided with pretest exercise to figure out their initial ability and ended with post-test exercise in order that it can be seen the result of the learning that has employed AR Edugame. Both pre- and post-test is very important to do as it can show the effect gained after and before the intervention has been administered [18].

This study used statistical analysis with validity test method for both pre- and post-test questionnaire items. There were 30 intervention questionnaire items in which they were separated into 15 items each for knowledge about gamelan culture and traditional dance culture. Based on Pearson correlation validation test for the 30 questionnaire items, there were two items stated as non-valid and the rest 28 items were indicated as valid. Validity testing showed that 93.33% questionnaire items were valid based on Pearson Correlation method.
The testing was subsequently for children’s knowledge improvement toward research object, that was Indonesian culture particularly gamelan and traditional dance. The analysis result of Wilcoxon Signed Rank test obtained significant value $0.00 < 0.05$, and thus it was suggested that there was statistically significant different for students’ study result average between pre- and post-test (improved). The detail calculation using Wilcoxon Signed Rank can be seen in Figure 5. This result showed that after employing AR Edugame learning media, it has more effect compare to before implementing it. This showed that there is some improvement in student learning outcomes.

![Figure 4. Augmented reality edugame implementation.](image)

![Figure 5. Analysis result of Wilcoxon signed rank test.](image)

4. Conclusion
This study used validity test and Wilcoxon Signed Rank test as the statistical analysis. Validity testing showed that 93.33% questionnaires were valid. Wilcoxon Signed Rank test resulted in significant value of $0.00 < 0.05$, therefore there was a difference in the average students learning outcomes for pre- and post-test (improved). It can be concluded after employing AR Edugame learning media, there was an effect to the student learning outcomes in comparison to before using it. This showed that there was an improvement in student learning outcomes.

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