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Transformation of Topeng Malang Through Digitalization and Characterization as Augmented Reality Prototype Assets in Order to Preserve Indonesian Culture

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Traditional art in Malang cannot be considered as separate from the cultural impulse in that environment. The most famous Traditional Art is Topeng Malang, however, this type of art is now declining and losing space to modern art. One way to maintain the Topeng Malang culture, especially in the form of masks, is through digitalization and the characterization of Topeng Malang. The character forms in the Topeng Malang are divided into several groups: Raden, Dewi, Begawan, Patih, and Buto. There are several studies related to Topeng Malang but, to date, no research has implemented Topeng Malang in augmented reality media through mobile platforms. This study uses descriptive and procedural research models through the method of observation, interviews, and documentation to triangulate and validate data. Observation data consists of visual data, library data, and target audience data. The contribution of this research is to improve the introduction of Topeng Malang through mobile applications with augmented reality techniques. By changing the design of Topeng Malang into an augmented reality asset with local wisdom in Malang, there will be recognition, pride, and improvement in the image of Indonesian culture.

Keywords: *Topeng Malang, Asset Design, Augmented Reality.*

Introduction

At present, the use of mobile phones is very high where mobile devices are no longer secondary goods but rather have become the primary communication medium for all levels of society, especially in Indonesia. This is in the form of learning technology, through interactive media that produces movements by projecting a series of sequences of images drawn one by one to display motion actions on the screen (Müller & Tina, 2018). Research on mobile phone-based learning, based on observations in Junior High School 4 and MTSN 1 Malang, in grade VII students found that the level of mobile phone ownership is 95% higher than the property of 65% computer/laptop. Mobile types also range from feature phones to smartphones. The problem for class VII students is that it is difficult to understand the material, especially in the art lessons of Topeng Malang learning material because the subject matter of cultural arts specific to Topeng Malang involves many elements that need to be explained not only in two-dimensional visualisations as mask shapes but also in terms of symbolic meanings and mask character formations. Another problem is that the school does not have teaching materials using the Topeng Malang art form which amounts to about 67 types of masks.

ARTop is an offline learning media application based on an Android mobile phone. ARTop was developed so that students could easy learn Topeng Malan with minimized learning costs. Topeng Malang content has been studied by several researchers. Wulan's research in the 2003 RUAS Journal, which examined the semiotic meanings of masks and costumes in the Topeng Malang (Astrini, Amiuza, & Handajani, 2013) is a key piece of evidence. The research from Soerjo Wido with the theme of the Symbolic Structure of Patih Mask Dance on the Topeng Malang Dramatari Performance in Kedungmonggo Hamlet, Karangpandan Village, Pakisaji District, Malang Regency emphasizes the study of symbolic meaning and specific structure of Patih figures on Topeng Malang (Minarto, 2008). Research by Wida entitled Packaging of Topeng Malang Dance Teaching Materials in the Malang Dance Vocational Course in Harmonia journal, examines the description of motion, the motion of Topeng Malang dance (Rahayuningtyas, 2013). From the research, it can see that there is still a lack of research that examines: 1. Visualization of characters from the form of Topeng Malang, 2. The deficit in implementation of learning media in mobile phone technology implementation, 3. The augmented reality model on material Topeng Malang with the application of ARTopeng based on mobile phones. This learning method could be effecting using a drill or practice method. Drill methods can apply with Android mobile phone-based learning because students can learn more in the same time period and practice can be repeated several times engaging with deeper understanding into the Topeng Malang material.

This is an essential basis for conducting research on ARTop application development and the development of learning media Topeng Malang to answer the problems and increase understanding of Topeng Malang material using mobile phone technology

Literature Review

Studies of articles by several researchers related to Topeng Malang and augmented reality have resulted in the article "The Symbolic Meaning of the Role of Wayang Topeng in Malang, Est Java, Indonesia" by Robby Hidajat. The findings of this study internalized by the community in the village of Kedungmonggo are a symbol of the role of Wayang Topeng related to the environment. Panji Asmoro Wake is a relationship with the entity "Pundhen" (Hidajat, 2005). The dancer symbol is the center of life. Klana Sewandana is a relationship with villages related to culture. The symbols of behavior in life are implied in the Topeng Malang. The journal article "Local Wisdom through Learning Topeng Malang Dance" by Dewayani in 2017, found that learning dance can simultaneously provide moral values that students need as a basic foundation to continue their education to a higher level (Dewayani, 2017) and provide conceptual contributions to moral values in learning dance.

The article entitled "Mobile augmented reality: the potential for education" by Danakorn Nincarean was written at the 13th International Educational Technology Conference volume 103 pages 657-664. This research contributes to the rapid evolution of technology that has uniquely changed the face of education, where technology combines with pedagogical foundations. This combination creates new opportunities to improve the quality of teaching and learning experiences. Augmented Reality (AR) is one technology that offers a new way to educate. Due to the increasing use of mobile devices globally, the widespread use of AR on mobile devices such as smartphones and tablets has become a growing phenomenon (Nincarean, alia, Halim, & Rahman, 2013).

The article entitled "Supporting Media for Learning Indonesian Traditional Houses Using Augmented Reality" by Andy Pramono in the ELTEK Vol 11 No 1 Journal in 2013 detailed research conducted by the author in relation to the development of material learning models for traditional Indonesian houses based on Augmented Reality so that it can be used for the development of learning, especially Indonesian conventional dwellings that are applied at the elementary school level (Pramono, 2013). There is research related to the use of augmented reality in articles: current status, opportunities and challenges of augmented reality in education in the journal Computers & Education (Hsin-Kai, Silvia Wen, Hsin-Yi, & Jyh-Chong, 2013). There are studies related to the use of augmented reality in applications, e.g. AugmentedRreality technologies, systems and applications in the journal Multimedia Tools and Applications (Carmigniani dkk., 2011). There are studies related to the use of augmented reality in education and articles regarding e.g. Augmented Reality in Education and Training in the journal TechTrends (Lee, 2012). Damiani, Demartini, Guizzi, Revetria, & Tonell 2018 in their study of augmented reality in education found several concepts such as interactive

education, simplicity, contextual information and the effectiveness and efficiency of education (Damiani, Demartini, Guizzi, Revetria, & Tonell, 2018)

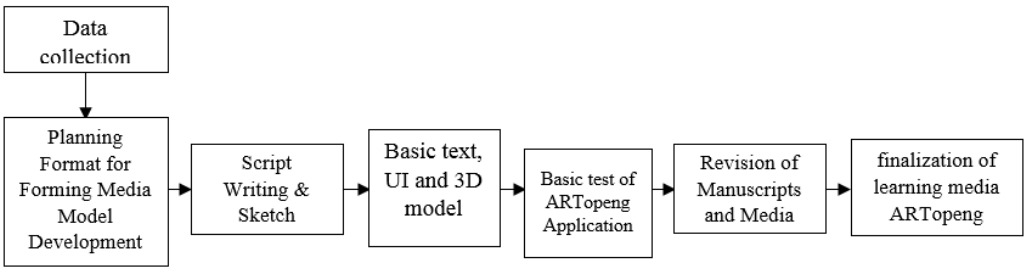
Research Problems

From the research, it can see that there is still an evident gap in the examination of the use of technology, especially cellphones, in the visualization of the general Topeng Malang and an absence of research of how to implement an augmented reality model to visualize Topeng Malang. With cell phone-based learning, learning can be accomplished using a drill or practice methodology. Drill methods can be applied with Android mobile phone-based knowledge because students can learn more in less time and can repeat activities several times. Further, the understanding of the mask material is more in-depth.

Research model

Research in this study on the theme of art education and humanities, and the sub-theme of developing a tick-based digital learning model that encourages autonomy for learning, was conducted by developing the theory of Borg WR & Gall MD, to produce the stages detailed in Figure 1 below.

Figure 1. Research Model (Borg & Gall, 2003)



Data collection is the first step in carrying out this developmental research. At this stage literature review activities were carried out, data collection and needs analysis related to information about the learning conditions of the topeng malang in Malang city junior high school was conducted. The use of three data collection techniques intended to capture as much data as possible in order to obtain various findings during the research and these Literature Review activities included the following: (1) Analyzing the contents of the curriculum in arts and culture subjects and skills, in order to find concepts, functions, goals, and scope; competency standards, basic competencies, and substance of Topeng Malang learning materials; (2) Data collection using observation, interview, and document techniques. (3) Analyzing the concepts and material substance for the development of augmented reality learning media technology on Android.

Format Planning Phase to Establish Media Model Development: the phase of planning applications, filling out forms and model selection. Writing & Script Sketching Phase: The steps of preparing the content script and the model sketch are the results of the evaluation of the Topeng Malang shape. The preparation of this script based on Topeng Malang's shape, formation of the Topeng Malang character design, and description. In the implementation of the development of scripts determined seven types of Topeng Malang were involved.

Phases of basic models of text, UI, and 3D: aspects of typographic analysis, layout design, and making three-dimensional models based on results at the sketching stage. The 3D shape of Topeng Malang allocates the resemblance of the shape 3D model from the original Topeng Malang. Representation shape of Topeng Malang to 3D printing of the Topeng Malang model. Regarding character formation, a character formation sketch design is performed based on the shape feature of the mask, human anatomy references, and traditional clothing design references.

The Phase of basic test ARTopeng Applications. Conversion of three-dimensional model formats, and implementation of model placement in applications. In the content writing section, design implementation has made. The internal testing phase is carried out on a small team in the laboratory of the art and design department of Malang State University. This test includes testing the installation of applications on mobile phones, running applications and evaluating the application content process.

Script and Media Revision Phase: Steps to evaluate test results and make improvements. Steps to finalize the ARTopeng learning media: the stage of combining the mask module, the mask character design module, and the character explanation module. This phase was carried out by a test at a public high school in Malang, involving 100 students. Students who took the test were 8th-grade students in 4 classes.

Results and Discussion

When collecting data, it was known that the Topeng Malang used in the performance of the Topeng Malang dance is can only be presented as a story through the performance of the Topeng Malang dance. There are two types of characters in the kind of Topeng Malang, the protagonist and the antagonist. In the Topeng Malang data as detailed in Figure 2 below, an analysis of the description of the shape is presented, which can be seen in the eyes, eyebrows, nose, mouth, mask color, and shape of the hat. The results of the data collection stage and analysis of the Topeng Malang characters obtained are presented as Table 1 below.

Figure 2. Topeng Malang data

Table 1: example identification of Topeng Malang Character

Character Name	**Characteristics of Masks**	**Character and Role in Psychological Dimensions**
Dewi Ragil Kuning	- Eye: Liyepan - Nose: Pangotan - eyebrow: Nanggal Sepisan - mouth: Jambe Sigar Setangkep	Protagonist Nature: graceful, helpful, cheerful, kind
Panji Anom	- Eye: Gabahan - Nose: Pangotan - eyebrow: Blarak Sineret - mouth: Dlimo Mlethek Mustache: Ulo Nglangi	Protagonist Character: knight, brave, obedient

In the next stage, a three-dimensional Topeng Malang design is carried out, based on the following Topeng Malang data by using the Zbrush application and blender. The making of three-dimensional objects with shapes, colors, and textures is completed as carefully as possible with Topeng Malang data. The results can be see in Figure 3 below. In this study, there is still limited production of 3 three-dimensional models consisting of Bapang characters, Emban Ono Ini, and Panji Anom. Making a three-dimensional model as carefully as possible improves understanding of forms for students to learn .

Figure 3. A. Topeng Malang Data, B Model 3 Dimensi Topeng Malang

A B A B

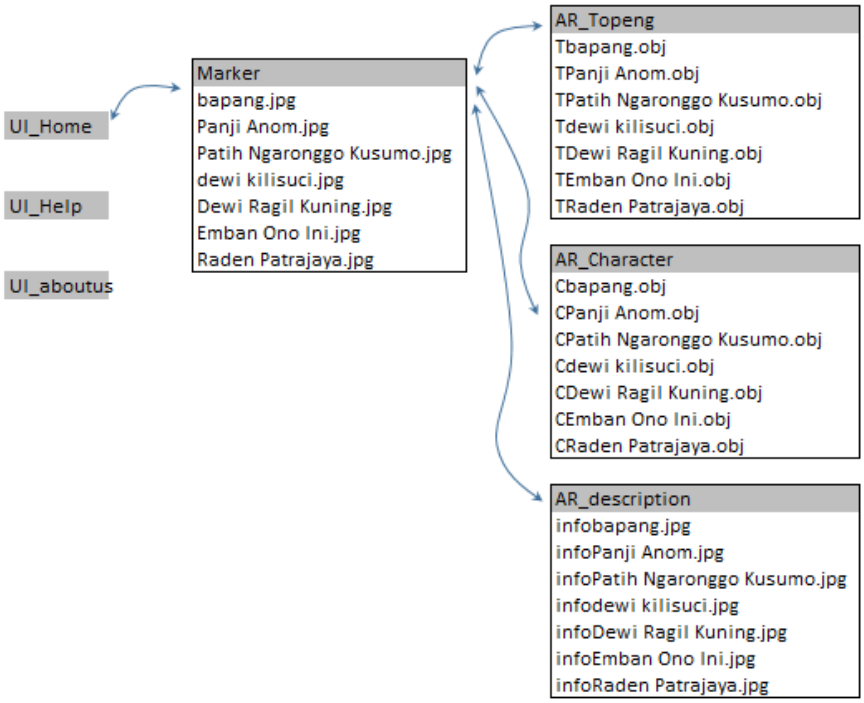
At the design stage of the three-dimensional character Topeng Malang, the first step is to consult the Table 1 results and reference data and an initial draft of the character sketch is made. The next step is coloring the results of the initial draft. Based on the results of character drafting, three-dimensional modeling is completd with the Zbrush application and blender. The coloring and texture of the characters through the Adobe Photoshop application can be seen in the example in Figure 4 below.

Figure 4. a.Skets design, b. Colouring Character design, c. 3D Character model

a b c

The design plan stage generates The ARTop flow diagram. At this stage, it's agreed that the appearance of the application scenario will divide into three parts, namely the Topeng Malang model, the Topeng Malang character, and the description of the Topeng Malang characteristic. Further to that, this study planned seven characters of Topeng Malang which were used as the prototype stage. The bScenario Flow Chart can be seen in Figure 5 below.

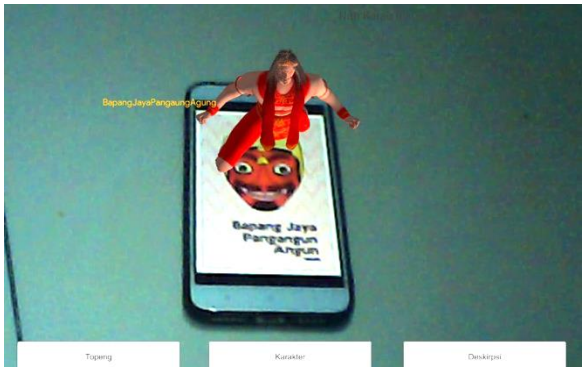
Figure 5: Scenario Flow



The design phase of the augmented reality application uses the scenario reference in Figure 5. Initially, the first test is conducted using one character, namely the Bapang mask. The project is carried out for two types of 3-dimensional models and 1 type of image format jpg. This Bapang character for 3 types uses 1 marker. Model 3 dimensions of Bapang masks and Bapang characters with OBJ format is included in the project unity.

With good results in 1 character mask, there is progress to other mask characters. The 3D model of the mask form is collected first and then for the 3D model of the character. The final component part is the character description section – and, as depicted in Figure 7 below, a 3D model is created.

Figure 7. preview character Bapang 3D model



Trial And Error

This study produced a visualization and simulation application ARTopeng based on android that can visually display to the user the 3D model designs for all markers. Application results of this research at an early stage have the APK file extensions with large 80,2Mb. At this early stage some improvements were then made on the display interface by changing some of the description views using image format and, after correction, was obtained at the final stage of the application form format APK with large file 78,6Mb. Based on the results of trials that have been conducted on 8 gadgets in the laboratory of Art and Design Department Universitas Negeri Malang Indonesia, the data is presented in Table 2 below.

Table 2: Results of Trial Application

	Instalasi	Registrasi	Model	Warna	Desain	Simulasi	Visualisasi
Lenovo A369i	Ok	Ok	Ok	Ok	Int Ok Eks Ok	Ok	Ok
Lenovo S820	Ok	Ok	Ok	Ok	Int Ok Eks Ok	Ok	Ok
Samsung Galaxy Chat	Ok	err	err	err	err	err	err
Samsung S2	Ok	Ok	Ok	Ok	Int Ok Eks Ok	Ok	Ok
Samsung Galaxy W	Ok	Ok	Ok	Ok	Int Ok Eks Ok	Ok	Ok
Lenovo S880	Ok	Ok	Ok	Ok	Int Ok Eks Ok	Ok	Ok

Findings

For trial applications for students carried out in public junior high school 3 Malang, a total of 100 students carried out trials on ARTopeng application. The test applied to 4 classes in SMP 3 Malang, two-classes as experiment classes, and two as control classes. Student respondents were 2nd-year students in an odd semester. The procedure for conducting the test was that the student received the mask material and preliminary experiments were conducted to measure student abilities as presented in Table 3 below.

Table 3: Control class Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	PRE_TEST - POST_TEST	-8.580	11.695	1.654	-11.904	-5.256	-5.188	49	0.000

The table above is the main table that shows the results of the tests (Paired Sample t-Test). Itb can be seen from the significance value (2-tailed) in the table. Sig. Value (2-tailed) in the table above is 0,000 where the number is less than 0.05 (0,000 <0.05), meaning that there are significant differences in the pretest and posttest scores in the control class. Based on descriptive statistics, Posttest scores are higher than Pretest scores. The data table shows that student learning outcomes have increased significantly.

In Table 4 below data also depicts that there is Mean Paired Differences value of -8,580. This value is the difference between the average Pretest value and the average Posttest value.

Table 4: Experiment Class Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	PRE_TEST - POST_TEST	-23.880	15.313	2.166	-28.232	-19.528	-11.027	49	0.000

The table above is the main table that shows the results of the tests (Paired Sample t-Test). The data table detrmines the significance value (2-tailed) in the table. Sig. Value (2-tailed) in the table above is 0,000, where the number is less than 0.05 (0,000 <0.05), meaning that there are significant differences in the pretest and posttest scores in the experimental class. Based on descriptive statistics, Posttest scores are higher than Pretest scores. The data table shows that student learning outcomes have increased significantly. Further, in the table above, there is also the Mean Paired Differences value of -8,580. This value is the difference between the average Pretest value and the average Posttest value.

Discussion

Descriptive statistics show that the control class and the experimental class have increased insight into the mask material. The pretest data in the control group was M = 58.82 (SD = 9.572), and in the experimental group was M = 58.82 (SD = 7.458), indicating that there were no differences in student learning outcomes. Student learning outcomes data after being given learning media based on augmented reality application ARTop (Posttest) in the experimental class showed data in the control class of M = 67.40 (SD = 7.908) and the experiment class of M = 82.70 (SD = 11.575) indicating that there are significant differences in student learning outcomes. The experimental group (M = 23.880) experienced a higher increase in learning outcomes compared to the control class (M = 8,580). Thus, there are differences in learning outcomes between classes using ARTop-based augmented reality application learning media, and without using ARTop augmented reality application-based learning media in terms of improving student learning outcomes.

The results of the Paired Sample t-Test analysis for the control class show that the average student learning outcomes were -8,580 (SD = 11,695) with a value of t = -5,188, and p (0,000) <0.05. This means that student learning outcomes in the control group increased significantly. Meanwhile, the results of the Paired Sample t-Test analysis for the experimental class showed that the average student learning outcomes regarding the mask material were -23,880 (SD = 15,313) with t values = -11,027 and p (0,000) <0.05. The results indicate that student learning outcomes in the experimental group also increased significantly as presented in Table 5 below.

Table 5: Group Statistics

	Kelas	N	Mean	Std. Deviation	Std. Error Mean
Learn Result	Eksperiment Class	50	82.70	11.575	1.637
	Control Class	50	67.40	7.908	1.118

Based on the "Group Statistics" output table above, it is found that the amount of learning outcomes data for the experimental class is 50 students, and the control class is also 50 students. The average value of student learning outcomes for the experiment class was 82.70, whereas the control class is 67.40. Thus, descriptive statistics can conclude that there are differences in average student learning outcomes between the experimental class and the control class. Based on the average value in the table above, the average amount of student learning outcomes of the experimental class is higher than the average amount of student learning outcomes of the control class. Then it can be said that the classroom learning process using learning media based on the augmented reality application ARTop (experimental class) obtains higher average learning outcomes than classes where the learning process uses conventional models / does not use media (control class).

Table 6: Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Learn Result	Equal variances assumed	5.649	0.019	7.718	98	0.000	15.300	1.982	11.366	19.234
	Equal variances not assumed			7.718	86.559	0.000	15.300	1.982	11.359	19.241

Based on the Independent Samples Test output table, Table 6 above, in the "Equal variances assumed" section, the Sig. (2-tailed) of 0,000 <0.005, the conclusion is that there is a significant difference between the average student learning outcomes in the experimental class and the control class. From the output table above, it is also evident that the Mean Difference value is 15,300. This value shows the difference between the average student learning outcomes in the experimental class and the control class. Furthermore, learning is achieved using the ARTopeng application. A final test was carried out after being given the ARTopeng application learning. After the final test the students were given a feedback form to measure the application of ARTopeng. The results of the comparative test and feedback form are displayed in Table 7 and Figure 8 below respectively.

Table 7: Tests of Between-Subjects Effect

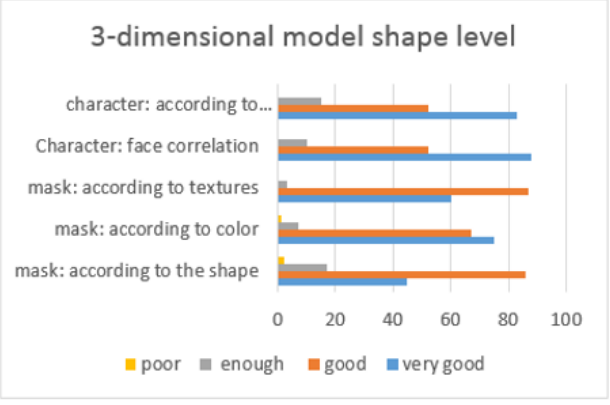
Dependent Variable: POST_TEST

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	5915.233[a]	2	2957.617	29.992	0.000
Intercept	13252.381	1	13252.381	134.387	0.000
PRE_TEST	62.983	1	62.983	0.639	0.426
KELAS	5852.250	1	5852.250	59.345	0.000
Error	9565.517	97	98.614		
Total	578731.000	100			
Corrected Total	15480.750	99			

a. R Squared = .382 (Adjusted R Squared = .369)

ANCOVA test results indicate that there are significant differences between the control class and the experimental class in influencing student learning outcomes regarding mask material with a significance value of 0,000 <0.05.

Figure 8. feedback result test



In this research, several things can be learned in regarding the use of augmented reality based mobile applications. With regard to an increase in learning in the classroom, these improvements include student motivation to learn, an increase in curiosity about Malang Mask material, and collaboration in learning between students. Improvement of students' learning motivation is indicated by an increase in experimental class activity compared to the control class. Increased curiosity about Malang Mask material was shown by 30 students in an experimental class conducting further searches about Malang Mask through the teacher. Increased collaboration in learning can be seen when there is synergy in learning related to Malang Mask learning material.

Drigas & Pappas (2015) in their study, concluded that involving mobile applications for mathematics material has a positive effect on the educational process. They presented several application innovations aimed at kindergarten children implemented to students. This application can be used to improve arithmetic skills, graph representation, geometry construction, algebraic problem solving, and mathematical programming. Also, Drigas & Pappas (2015) explained that online learning applications move to motivate students. Online applications make mathematics courses more interactive than standard teaching practices (Drigas & Pappas, 2015). Klimova, Bilyatdinova & Karsakov (2018), in their study, Augmented reality applications in several classes, mention an increase in skills and competencies. Improvements such as the ability to work as a team, communication, and criticism, responsibility on complex projects, increase individual creativity and innovation potential. All of these skills can develop through project work activities. That is why it is not surprising to see a large amount of project work in the university curriculum (Klimova, Bilyatdinova, & Karsakova, 2018).

Conclusion

Based on the results of research on the application of ARTopeng visualization, application design: Android-based Malang Mask can be said to be running well at the analysis, concept, implementation and initial test stages. It was found that an increase in learning in the classroom, including improved student motivation to learn, an increase in curiosity about Malang Mask material, and collaboration in learning between students was evident. Applications on students produce an average score of 89% of students experiencing growth in understanding of Malang Mask material. The result of ANCOVA analysis was that there were significant differences between the average student learning outcomes in the experimental class and the control class.

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