The Influence of the Use of Geo-Augmented Reality for Student Learning Outcomes and Activities in Cartography Courses in the Geography Education Study Program, Faculty of Social Sciences, Padang State University

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Abstract. This study goals to analyze the influence of the use of Geo-Augmented Reality on student learning outcomes and activities in the cartography course in the Geography Education Study Program. FIS UNP. The research method is quasi-experiment used quantitative approach. The population was all students of the Geography Education Study Program who took the Cartography course in the July-December 2021 Semester which amounted to 105 people. The sample in this research was 70 students. Data collection techniques through observation, documentation and tests. The data analysis technique used independent t-test (t-test) technique. The results of this researh found that. the results of learning cartography students of the Geography Education Study Program using geo-augmented reality are better with the acquisition of N-Gain 0.78, cartographic learning activities of students of the Geography Education Study Program using geo-augmented reality obtained N-Gain 0.82. This means that the use of Geo-Augmented Reality can support student learning outcomes and activities in the cartography course at the Geography Education Study Program, Department of Geography, FIS UNP.

Keywords: Use of Geo-Augmented Reality, Learning Outcomes, Learning Activities.

1 Introduction

Learning is a complex dynamic process that individuals experience throughout life. Learning is the process of human interaction with the environment so as to create behavioral changes in the process of life. Starting from the publication of the report "Learning for the 21st Century" in 2009 which discussed the "Framework for 21st Century Learning" related to four fields or competencies that must be mastered by students. [1] Namely; 21st century themes and core subjects, learning and innovative skills, career and life skills, information skills, and technology and media.Perkembangan ilmu pengetahuan ini berdampak pada semua kompetensi yang diciptakan oleh manusia, terutama dalam bidang pendidikan. In essence, the world of education must be able to adapt to the times. The era of development intended is the digital era, an era that runs very fast and makes many changes. The challenges of the digital era have become a problem in all fields, this will have an impact on positive and negative changes. [2] This change occurs also in the educational process. This digital era affects models, modules, media, and learning devices.

Within the framework of 21st century learning, there are four competencies, which are an effort to equate educational practice with the demands of the times. There are several signs that show that the

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world has entered the 21st century, namely; the availability of information that can be accessed anywhere and anytime; faster computerization; the emergence of automation capable of replacing the work that is usually done regularly; and communication that can be done anywhere and anytime. [3]

The running of the era of digital development makes the world of education in this era live in the real world combined with the virtual world, where the learning process moves towards a teaching material system by utilizing learning media that can be accessed easily and based on technology. This is also seen in the learning process that focuses on process skills in students, so the role of learning media is needed in accordance with the development of the educational era.

The availability of innovative media and learning resources can help students understand the teaching material, increase student learning motivation, student interest, and have an impact on improved student outcomes and activities. [4]

Based on the above problems, innovative and interesting ways of learning are needed to increase students' willingness to learn. So that the learning is able to improve student learning outcomes and activities in universities which have positive effect on student learning outcomes and activities.

According to Riski Augmented Reality Sandbox is a reality application for scanning sand surfaces using a 3D kinect camera, and projecting in real time and at the same time can display topographic maps, hillshading, and simulations of water movements on the sand surface that have been calibrated with a projector and can be adjusted to the user's wishes. [5]

Learning outcomes are the result of mastering the knowledge of students carried out after the learning process, concerning the achievement of learning achievements in accordance with cognitive, psychomotor and affective aspects. While learning activities are student activities that are seen during the learning process both physically and mentally.

From the description above, researchers will conduct experiments on Geo-Augmented reality media, and see if using Geo-Augmented reality media can make student learning outcomes and activities increase or vice versa.

2 Research Method

This study used a quantitative approach. Quantitative research is research that utilizes calculations or quantity figures to obtain the results of the research carried out. Sugiyono explained that this quantitative research is a study whose data collection techniques utilize research instruments that must be tested first, the data analysis is statistical or calculating with the aim of testing predetermined hypotheses. [6] Sampling technique for this research utilizes the Purposive Sampling technique. This research was conducted in cartography courses in the Geography Education Study Program. Faculty of Social Sciences, located at Padang State University, Jl. Prof. Dr. Hamka, West Fresh Water, North Padang District, Padang City, West Sumatra Province, Zip Code 25173. This research will be carried out for one semester of lectures.

The population in this reasearch is all students of the Geography Education Study Program who took the July-December Semester Cartography course in 2021, totaling 105 people. The sample in this study was Purposive sampling of 70 students. For the determination of the sample to be studied, there are certain ways based on scientific and rational considerations. In this study, researchers used purposive sampling techniques so that it was found that the classes to be studied were Cartography A and Cartography B, where each class numbered 35 people with a total sampling of 70 student.

This study has variables are the learning outcomes and learning activities of students in the cartography course, so that the research instrument is taken from the achievement indicators in the RPS of the cartographic course in the July-December semester.

In this study, quantitative approach became the choice for data analysis techniques. In quantitative data processing, this is pretest and posttest result data and observations of student learning activities in two meeting cycles. Here are the data analysis steps:

2.1 Learning Outcome

2.1.1 Hypothesis Test

To find out whether or not there significant increase in understanding of student learning concepts before and after learning, a t-test sample test is used. The formula used in the t-test sample test is as follows.

$$t_{count} = \frac{x_2 - x_1}{\sqrt{\frac{s_1^2}{n} + \frac{s_2^2}{n} - 2r.\frac{s_1}{\sqrt{n}} - \frac{s_2}{\sqrt{n}}}}$$

Description:
x_2 = average understanding of the concept of pretest
x_1 = average understanding of posttest concepts
n = the multiplicity of samples
s_1 = standard store of pretest data
s_2 = standard store of posttest data

According to Duwi Priyatno hypothesis testing utilizes the SPSS 26 Paired Sample T-Test program on the pre-test value – post test of the experiment class and the pretest – posttest of the control class with a significance level of 5%. This hypothesis test is used to see the difference between the average value before being given treatment (pre-test) and the average value after being given treatment (post-test) using Geo-Augmented Reality learning media.[7] The hypothesis applied is:

$\boldsymbol{H_0}$: There is no significant difference between the average pre-test value and the average post-test value.

$\boldsymbol{H_1}$: There is a significant difference between the average pre-test score and the average post-test value.

Based on probability :

$\boldsymbol{H_0}$ accepted if significant > 0,05

$\boldsymbol{H_0}$ rejected if significant < 0,05

The t test is used only to see whether or not there is a significant increase in the understanding of learning geography students in cartographic courses.

2.1.2 Gain Test (N-Gain)

To find out the increasing understanding of students and student activities, the N-gain formula is used. Gain is the difference between the pretest and posttest scores, from the gain we can find out the improvement of students abilities after the learning process. The analysis of the gain index in this study is normalized gain which is formulated as follows:

$$g = \frac{Posttest\ Score\ -\ Pretest\ Score}{Maximum\ Score\ -\ Pretest\ Score}$$

2.2 Learning Activities

This stage is also the most important stage of analysis in this study, so the researcher will carry out calculations in the form of:

Data on learning activities are obtained from analysis using the following formula:

$$P = \frac{f}{N} \text{ x } 100$$

Description :
P = The number of respondents' percentage figures
f = Frequency of respondents' answers
N = Number of respondents
100 = Fixed numbers

The following are the criteria carried out to measure student learning activities:

Table 1. Learning Activity Assessment Criteria

Number	Value %	Assessment Categories
1	0-20	Inactive
2	21-40	Less Active
3	41-60	Enough
4	61-80	Active
5	81-100	Very Active

Source : Primary Data Analysis Processing 2022

The existence of a percentage number will later be known which category students' learning activities are included in the activity criteria that have been determined above.

3 Results And Discussion

3.1. Research Results

3.1.2 Influence of Geo-Augmented Reality Learning Media

a. Students' Initial Ability

Before giving treatment to students, researchers first measure the initial ability of students through pretests. The pretest scores are processed and analysis activities are carried out to see and measure the initial ability of students in experiment classes and control classes before students receive learning and are treated using different learning media. This pretest value analysis is useful for seeing the initial ability of students. The following is the data obtained from the pretest results.

Table 2. Descriptive Data of Pretest Results

Class	N	Average	Highest Score	Lowest Score
Experiment	35	58.72	74	44.83
Control	35	54.13	69.83	40.67

Source : Primary Data Processing 2022

From the table above, it can be seen that the highest score in the experimental class is 74 and in the control class it is 69.83. While the lowest score in the experiment class is at 44.83 and the control class is at 40.67. And it can also be known that the average score between the experimental class and the control class is not too much difference, this means that the initial ability of students between the experimental class and the control class can be seen as almost the same. To prove the similarity of the analysis, it's necessary to conduct a similarity test (Test t).

Difference Test (T Test) As Hypothesis Test

This difference test is carried out to see whether the student's posttest scores in the experiment class and control class have significant differences or no, the difference test will also be a hypothesis test as a basis for drawing conclusions in the research conducted by the researcher. In the previous stage, researchers have carried out homogeneity tests and normality tests, the results obtained show that the two classes to be treated with data are normal and homogeneous. In the difference test, researchers conducted parametric test statistics (Independent Sample T-Test) with consideration of the significant value on equal variance assumed by SPSS 26 program.

Table 3. T-Test Results (Pretest)

Independent Sample T	***Test* Sig. (2-tailed)**
Equal Variance Assumed	0,227
Equal Variances Not Assumed 0,77	0,222

Source : Primary Data Processing 2022

The similarity test (T test) was carried out using by SPSS 26 program with a significance level of 5%, with hypotheses as:

Ho = There is no significant difference between the value of the experimental class and the control class.
Ha = There is a significant difference between the value of the experimental class and the control class.

Table 4. Posttest Result Data

Class	N	Average	Highest Score	Lowest Score
Experiment	35	89,58	100	70.83
Control	35	80,94	85.83	62.5

Source : Primary Data Processing 2022

- If the value of Sig. (2-tailed)i > 0.05 then Ho Accepted and Ha Rejected
- If the value of Sig. (2-tailed) < 0.05 then Ho Is Rejected and Ha Accepted

From the results of the T test that has been carried out, a Sig. (2-tailed) value of 0.227 which is greater than 0.05, so it can be decided that Ho is accepted and Ha is rejected , meaning that there is no significant difference between the value of the experimental class and the control class before being treated using Geo-Augmented Reality learning media and the form of powerpoints.

b. Students' Final Ability

The aim of this research is to see the influence of the used of Geo-Augmented Reality learning media on student learning outcomes and activities, then after measuring students' initial abilities and treating students using Geo-Augmented Reality learning media and powerpoint learning media as a comparison, then researchers will see the influence given by Geo-Augmented Reality learning media on student learning outcomes and activities by comparing student learning outcomes and activities between students who learn using Geo-Augmented Reality learning media and students who learn using powerpoint learning media. Then researchers will posttest students to obtain data on learning outcomes after being treated using two different learning media. From the data on student learning outcomes, a t test will be carried out in the form of an independent sample t test as a hypothesis test and to see learning activities from the results of observations of activities determined from the activity criteria in accordance with the percentage obtained.

Posttest scores were analyzed to see and also measure student learning outcomes in experiment classes and also control classes after students received learning and were treated using learning media. This means that the analysis of posttest scores is used to see whether or not a student's ability improves after being given treatment. The following is the data obtained from the posttest results.

From the table above, it can be seen that the highest score in the experimental class is 100 and in the control class it is 85.83. While the lowest score in the experiment class is at 70.83 and the control class is at 62.5. In addition, it is also known that invisibly the average score of the experimental class is higher than that of the control class, this indicates that one of the treatments given is classified as having a better effect than the other. However, to prove this, it is necessary to do a t test (difference test).

Difference Test (T Test) As Hypothesis Test

The difference test is carried out to find out whether the student's posttest value data in the experiment class and the control class have significant differences or not, the difference test will also be a hypothesis test as a basis for drawing conclusions in this study. Previously, researchers had conducted normality tests and homogeneity tests, the results of which were both classes of normal and homogeneous data. So that the difference test will be carried out parametric test statistics (Independent Sample T Test) by considering the significance value of equal variance assumed in the SPSS 26 program.

Table 5. Posttest Data T Test Analysis

Independent Sample T	***Test* Sig. (2-tailed)**
Equal Variance Assumed	0,000
Equal Variances Not Assumed 0,77	0,001

Source : Primary Data Processing 2022

The similarity test (T test) was carried out using the SPSS 26 program with a significance level of 5%, with the following hypothesis:

- If the value of Sig. (2-tailed) > 0.05 then Ho Accepted and Ha Rejected.
- If the value of Sig. (2-tailed) < 0.05 then Ho Rejected and Ha Accepted.

Ho = Geo-Augmented Reality media does'nt have a better influence on student learning outcomes, due to the absence of significant differences between the scores of experiment classes and control classes.

Ha = Geo-Augmented Reality media has a better influence on student learning outcomes, due to the significant difference between the value of the experiment class and the control class.

From the result of the T test that has been carried out, a Sig. (2-tailed) value of 0.000 which is smaller than 0.05, so it can be decided that Ho was rejected and Ha was accepted, meaning that there was a significant difference between the value of the experimental class and the control class before being treated using Geo-Augmented Reality Sandbox learning media and powerpoint learning media. In this case, the average posttest score of students in the experimental class is better than that of the control class students, which means that the used of Geo-Augmented Reality learning media has a better influence compared to powerpoint learning media.

c. Student Learning Activities

From the results of observations made by researchers on student learning activities in cartographic courses in the Geography Education Study Program FIS UNP. What is done in two cycles of meetings, then excellent learning activities are obtained. Student activities in learning using Geo-Augmented Reality media can be seen in the following table:

d. Student Learning Activities

From the results of observations made by researcher on the learning activities of students in the cartography course at the Geography Education Study Program FIS UNP. What is done in the two cycles of meetings, then very good learning activities are obtained. Student activities in learning using Geo-Augmented Reality media can be seen in the following table:

Table 6. Student Learning Activity Data

Number	Activity Indicators	Average (%) M.I	Average (%) M.II
1	Oral Activities	69	80
2	Visual Activities	65	83
3	Motor Activities	82	84,5

4	Listening Activities	70	82
5	Somatic Activities	-	80,5
6	Mental Activities	72	82,5
	Average	**71,6 %**	**82,08%**

Source : Primary Data Processing 2022

3.1.3. Gain Score

Gain value analysis is an analysis carried out to see the difference between the pretest value and the posttesti value and see the increase in student learning activities that have been carried out. After being given treatment using Geo-Augmented Reality learning media in learning, there will be a change in student scores from pretest to posttest and an increase in student activity. In this study, treatment was carried out using Geo-Augmented Reality in experimental classes and the use of powerpoint learning media in control classes. The two classes will be analyzed for gain value, so that researchers can see the effectiveness of the two media used based on pretest and posttest values and increase in student activity from the results of observations made. Gain value analysis is carried out using the help of the Microsoft office excel program, the following is the result of the gain value analysis of learning outcomes and learning activities of geography students:

Table 7. Pretest and Posttest Gain Values

Variable	Gain	Gain (%)	Effectiveness
Learning Outcomes	0.78	78	Effective
Learning Activities	0.82	82	Effective

Source : Pengolahan Data Primer 2022

Based on the data above, it is known that the gain value for experimental classes using Geo-Augmented Reality learning media is 78% so that its effectiveness is quite effective on learning outcomes, as well as the acquisition of N-Gain of 82% on learning activities which are quite effective as well. From these results, researchers can compare the influence given by each learning media on student learning outcomes and activities, where the use of Geo-Augmented Reality learning media has a better influence than learning media in the form of printed books and writing on student learning outcomes and activities. From the data table above, learning activities fall into the category of very active activities because they are in the percentage range of 81-100%.

3.2. Discussion of Research Results

After the implementation of research by researchers in the Geography Education Study Program in the cartography course after the application of Geo-Augmented Reality learning media, it was found that the average value of the experimental class was higher than the control class, this means that one of the treatments given is classified as better in effect than the other.

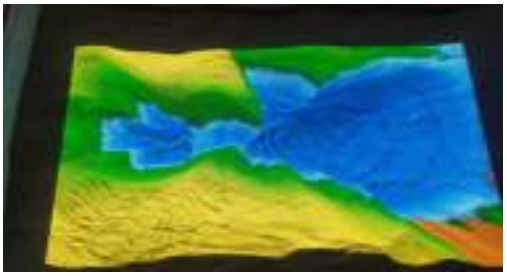

Fig. 1. Media Geo-Agmented Reality

Figure 1 above is a display of Geo-Augmented Reality media used in the study. From the results of research carried out in the cartography course with the division of control and experimental classes, it was found that classes that do not use Geo-Augmented Reality learning media seen from descriptive data show that student learning outcomes are lower than classes that use Geo-Augmented Reality learning media so that, Geo-Augmented Reality learning media is an approach that provides opportunities for students to develop abilities This thinking and learning can train problem sorving and form investigative activities in the learning process. In improving learning outcomes, an Augmented Reality-based learning approach is needed to motivate students in their learning process. So that with problems or those raised through Augmented Reality, students can think critically and get maximum learning results and impressive learning activities. This means that the used of Geo-Augmented Reality can increase student learning outcomes and activities in the cartography course in the Geography Education Study Program, Department of Gedography, FIS UNP.

4 Conclusion

From the results of the study, it is known that there was an increase in student scores and activities that differed between the two classes after being given treatment, where the increase in the scores of experiment class students who received learning with treatment using learning media using Geo-Augmented Reality was higher than that of control class students who received learning with treatment using learning media in the form of powerpoint media. The results of this research showed that the experimental class after being given treatment using Geo-Augmented Reality learning media, the learning outcomes increased because students were interested in learning when learning to use Geo-Augmented Reality learning media.

From the data processing that has been carried out, it can also be concluded that the increase in student learning activities occurred after treatment using Geo-Augmented Reality learning media with a better intensity of activity increase than before the treatment.

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