

The Effectiveness of Multimedia-Based Interactive Learning Media on Mathematics Learning Outcomes in 7th Grade Students

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Abstract

This study aims to determine the effectiveness of multimedia-based interactive learning media on mathematics learning outcomes. This research is a quantitative type of experiment with Pre-Experimental Design. The research design used is the One-Group Pretest & Posttest Design, which is an experiment which is carried out in one group only without a comparison group. The population in this study were all students of class VII MTs Madani Alauddin Pao-pao Kab. Gowa, amounting to 220 people. The sample in this study was class VIIA totaling 37 people. In this study, there are two variables, namely: (1) Variable X: Multimedia-Based Interactive Learning Media. (2) Variable Y: Mathematics Learning Outcomes. The data collection techniques used in this study are: learning outcome tests consisting of pre-test and post-test as well as observation sheets for the implementation of the learning process. The research hypothesis test in this study is to use paired sample t-test. The pre-test values are mean of 49.7295; standard deviation of 15.91604. The value ranges from 13.33 to 80.00. The Post-Test Value is the Mean of 71.3514; standard deviation of 14.72978. Value ranges from 40.00 to 100.00. Because the mean value of the pre-test learning outcomes was $49.7295 < 71.3514$, then descriptively there was a difference in the average learning outcomes between the pretest and the post-test results. Based on the paired sample t test, it is known that the sig. (2-tailed) value is $0.000 < 0.05$. So it can be concluded that there are differences in the average student learning outcomes before the application of multimedia-based interactive learning media.

Keywords: Mathematics Learning Outcomes, Learning Media, Multimedia

INTRODUCTION

Education has a very central role in improving the quality of human resources. The National Education System Law (Sisdiknas), for example, shows the strategic role of education in the formation of quality human resources. According to the law, the Indonesian human character expected to be a person who is faithful and devout, has high character, has personality, is advanced, intelligent, creative, skilled, disciplined, professional, responsible, productive, and is physically and mentally healthy. Effective efforts to shape human character like this can be done through improving the quality of education (Herman, 2007: 47)

Mathematics is a science that studies the basic concepts used to develop other sciences, so that mathematics is said to be a pure science. Mathematics can provide the ability to think logically, systematically, and creatively to solve problems. This is the main asset in mastering science and technology to face global competition. (Mulyono, 2003: 6). The cause of the low quality of mathematics education is the lack of mastery of basic mathematical concepts, including in understanding formulas, generalizations, and the real-life context of mathematics. In fact, it was found that 80% of the participants had very weak mastery of basic mathematical concepts. Sujianto's note (2008) also implies that students' low understanding of mathematics is still low which causes the low quality of mathematics education.

One of the learning media that is currently popular is interactive learning media based on multimedia. The use of interactive media in mathematics learning in the classroom is expected to attract and motivate students to improve their achievement. Kusumah (in Rosmana, 2008) argued, "In general, students have a high curiosity to try something new, including technology which is being loved by teenagers and school children in this decade. Through the use of interactive media, it is hoped that students can play an active role and learn independently so that it has an impact on improving student mathematics learning outcomes.

Based on research on needs analysis conducted by researchers at MTs Madani Alauddin Pao-Pao about the importance of using learning media. The results of interviews with a mathematics teacher in grade VII, namely Mr Amiruddin Mansur, S.Pd. about teaching flat shape material, that learning for flat shape material has not used learning media. Starting from some of the problems above, the author is interested in conducting a research entitled "The Effectiveness of Multimedia-Based Interactive Learning Media on Mathematics Learning Outcomes in 7th Grade Students"

Syaiful Bahri Djamarah (1994: 19) states that "learning outcomes or learning achievements are results that have been achieved by students after carrying out learning activities. Therefore learning achievement is not a measure, but can be measured after carrying out learning activities. A person's success in participating in a learning program can be seen from the person's learning achievement. According to Krathwol (2001: 67) the learning outcomes achieved by students can be grouped into 3 (three) areas, namely cognitive, affective, and psychomotor. According to this opinion, the cognitive aspect is related to the behavior of thinking, knowing, and solving problems. Based on the opinions of the experts above, it can be concluded that learning outcomes are the result of activities that someone has done, these activities include three aspects, namely cognitive, affective and psychomotor.

According to Krathwol (2001: 67-87) the cognitive dimension consists of: (1) remembering, which is getting back knowledge from old memories. The dimension of remembering is divided into two more dimensions, namely: (a) recognizing, (b) recalling; (2) understand (understanding), namely constructing the meaning of the learning message. This dimension is further divided into seven dimensions, namely (a) interpreting, (b) exemplifying, (c) classifying, (d) summarizing, (e) inferring, (f) compare (compare), (g) explain (explaining); (3) apply, namely implementing or using a procedure in a certain situation.

According to Gerlach and Ely (1971) in Arsyad (2009: 3) that "media when it is understood in broad terms is human, material, or events that build conditions that enable students to acquire knowledge, skills, and attitudes." Learning media is essentially a channel or bridge of learning messages conveyed by message sources (teachers) to message recipients (students) with the intention that these messages can be absorbed quickly and precisely according to their objectives (Anitah, 2011: 6.11) .

Learning media is an inseparable part of the teaching and learning process in order to achieve educational goals in general and learning objectives in schools in particular. Another opinion is expressed by Munadi (2013: 7-8) that "learning media is anything that can convey and transmit messages from sources in a planned manner so as to create a conducive learning environment where the recipient can carry out the learning process efficiently and effectively."

Based on the opinion of these experts, it can be concluded that learning media is anything that is used as a liaison, provider, and / or delivery of learning to the recipient of learning. Through learning media, it is hoped that it can help teachers explain the material and help students more easily understand the material being taught.

Hackbart (1996: 229) argues that multimedia is a combined use of several media in conveying information in the form of text, graphics or animated graphics, movies, videos, and audio. Computer-based interactive multimedia includes hypermedia and hypertext. Hypermedia is a multimedia presentation format that includes text, still graphics or animation, movie, video and audio. Hypertext is the form of text, static diagrams, images and tables that are displayed and arranged in a non-linear manner (in sequence or in line).

Vaughan (2006) in Winarno (2009: 7) states that "multimedia is a combination of text, art, sound, animation, and video delivered via computers or other electronic and digital manipulation equipment". Media in the context of learning is defined as language, so multimedia in that context is multilingual, that is, there is language that is easily understood by the senses of hearing, sight, smell, touch, and so on; or in other languages multimedia is a medium that is able to involve many senses and organs during the learning process.

Based on the above understanding, it can be concluded that interactive learning multimedia is learning that uses computers as a medium in presenting material by creating and combining audio, animation, text, graphics, images and there is a reciprocal relationship between computers and users through intermediary devices (keyboards), mouse, etc.) to get active, creative, effective and fun responses for students.

RESEARCH METHODS

Research Approach, Type, and Design

This research is a quantitative type of experiment with Pre-Experimental Design. The research design used is the One-Group Pretest & Posttest Design, which is an experiment which is carried out in one group only without a comparison group. In this design using a pre test before being given treatment.

Research sites

This research will be conducted at MTs Madani Alauddin Pao-Pao, Gowa Regency, South Sulawesi Province.

Population and Sample Research

The population in this study were all students of class VII MTs Madani Alauddin Pao-pao Kab. Gowa, amounting to 220 people. The sample in this study was class VIIA MTs Madani Alauddin Pao-Pao Kab. Gowa, amounting to 37 people.

Research variable

In this study, there are two variables, namely: (1) Variable X: Multimedia-Based Interactive Learning Media. (2) Variable Y: Mathematics Learning Outcomes

Operational Definition of Variables

The following is the operational definition of the variables used in this study: (1) Multimedia-Based Interactive Learning Media is a learning that uses computers as a medium in presenting material by creating and combining audio, animation, text, graphics, images and a reciprocal relationship between computers and users through intermediary tools to get active, creative, effective and enjoyable responses for students. (2) Mathematics Learning Outcomes are a person's ability to study mathematics with maximum results, indicated by the test scores or numbers given by the teacher. In this study, the intended learning outcomes are the scores obtained by students after carrying out research tests.

Data Collection Technique

Data collection techniques are needed to obtain the data needed to answer the research hypothesis. The data collection techniques used in this study are: (1) The test is an instrument or tool to collect data about the ability of the subject to be studied by means of measurement. For example, to measure the subject's ability to master a certain material, it is carried out using a written test (Widiasworo, 2018: 95). So that in this study two tests will be carried out, namely the pretest and posttest. The pretest was carried out with the aim of knowing students' mathematical abilities before being given treatment, while the posttest was carried out to determine students' mathematical abilities after being given treatment, namely providing learning experiences using multimedia-based interactive learning media. Based on the results of these two tests, it can be seen that the results of students' mathematics learning on the flat shape material. (2) Observation is direct observation of the object of research. The technique of collecting data by observation is used to observe the implementation of the lesson plan.

Research Instruments

The instrument used to collect data was a test of mathematics learning outcomes in grade VIIA MTs Madani Alauddin Pao-pao Kab. Gowa, which is obtained before and after the application of multimedia-based interactive learning media. In addition, researchers also use observation sheet instruments, which are used to obtain data on the implementation of the lesson plan (RPP) or learning scenarios that have been planned. The aim is to determine the consistency of the procedures or steps carried out in accordance with the plan which contains learning scenarios from start to finish and is equipped with a

"implemented or not implemented" column. The observer will put a check mark (✓) in the accomplished or not implemented column. Data analysis techniques with descriptive statistics and inferential statistics.

Descriptive Statistics

Management of research data used two statistical techniques, namely descriptive statistics and inferential statistics. Descriptive statistical analysis is to describe the mathematical comprehension abilities obtained by students in both the experimental group I and the experimental group II. According to Tiro (2014: 127) the descriptive statistics used are analysis using :

$$\bar{X} = \frac{\sum_{i=1}^k f_i x_i}{\sum_{i=1}^k f_i}$$

Keterangan :

\bar{X} = mean

x_i = statistics value

f_i = frequence

k = the number of groups

a. Standar Deviasi (S)

$$S = \sqrt{\frac{n \sum f_i x_i^2 - (\sum f_i x_i)^2}{n(n-1)}}$$

b. Categoryzation

Categorization aims to place individuals into separate groups tiered based on what is measured. For the category of mathematical comprehension abilities, researchers used Suherman's criteria in Naimah (2015: 30) which are listed in the following table

Table 2. Capability level categories

Percentage of mathematics learning outcomes	Category
90-100	Very good
75-89	Good
55-74	sufficient
40-54	Bad
0-39	Very Bad

Inferential Statistics

Prerequisite Test

Before testing the hypothesis, the basic test is conducted first, namely the normality test and the homogeneity test.

1) Data normality test

The normality test is used to test whether the existing data is normally distributed or not. This is based on the assumption that parametric statistics work on the assumption that each variable to be analyzed must be normally distributed. The normality test that is often used in research in the field of mathematics education is Shapiro Wilk and Kolmogorov-Smirnov Z. For this test, the Shapiro Wilk test formula is used because the test can be used for samples less than 50.

The data normality test is meant by the hypothesis:

H0 : Data comes from populations that are normally distributed

H1 : Data comes from populations that are not normally distributed

For this test used data processing using SPSS.

2) Data homogeneity test

According to Lestari and Yudhanegara (2015: 248) data homogeneity means that data has the same variance or diversity of values statistically. To perform calculations on the homogeneity test, the F test is used with the following formula :

$$F_{hitung} = \frac{\text{varians terbesar}}{\text{Varians terkecil}}$$

The data homogeneity test is meant by the hypothesis:

-H₀: Data comes from a homogeneous population

-H₁: Data comes from a population that is not homogeneous

Hypothesis Test

Hypothesis testing is used to determine the provisional presumptive answers formulated in the research hypothesis. The research hypothesis in this study is to use paired sample t-test.

1) Hypothesis of the sentence

H₀: There is no difference in the average learning outcomes of students taught by the application of multimedia-based interactive learning media in class VII students of MTs Madani Alauddin Pao-Pao.

H₁ : There is a difference in the average learning outcomes of students taught by the application of multimedia-based interactive learning media in class VII students of MTs Madani Alauddin Pao-Pao.

1) Statistics Hypothesis

$$H_0 : \mu = \mu_1$$

$$H_1 : \mu \neq \mu_1$$

2) Conclusion

Conclusion drawing is the determination of whether it is accepted or rejected or whether or not there are differences in student mathematics learning outcomes before and after using multimedia-based interactive learning media in class VII students of MTs Madani Alauddin Pao-Pao.

RESULTS AND DISCUSSION

Result

Based on the results of the pre-test descriptive statistical analysis given to students before the application of Multimedia-Based Interactive Learning Media in class VIIA MTs Madani Alauddin Pao-Pao as follows.

Table 3. Results of Pre-Test Descriptive Statistical Analysis

	N	Minimum	Maximum	Mean	Std. Deviation
Pre Test	37	13,33	80,00	49,7295	15,91604
Valid N (listwise)	37				

From the table above it can be seen that the value of mathematics learning outcomes for class VIIA MTs Madani Alauddin Pao-Pao, at the time of the pre-test it was found that the mean value was 49.7295; standard deviation of 15.91604. The scores achieved by students varied from a Minimum Score of 13.33 and a Maximum of 80.00. Furthermore, the presentation of the Pre-Test data before implementing Multimedia-Based Interactive Learning Media can be seen in the following histogram:

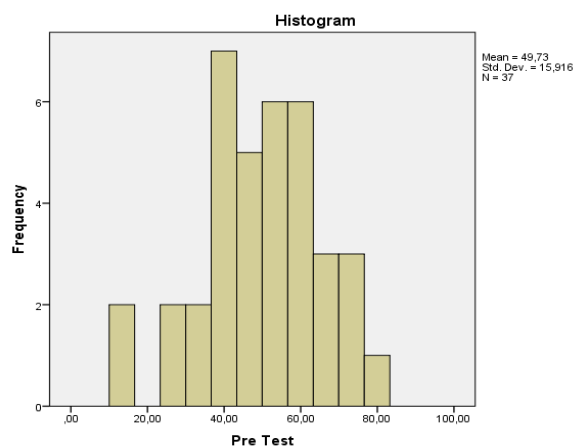


Figure 1. Histogram Data Pre-Test

Based on the results of the Post-Test descriptive statistical analysis given to students after the Application of Multimedia-Based Interactive Learning Media in class VIIA MTs Madani Alauddin Pao-Pao following:

Table 4. Results of Post-Test Descriptive Statistical Analysis

	N	Minimum	Maximum	Mean	Std. Deviation
Post Test	37	40,00	100,00	71,3514	14,72978
Valid N (listwise)	37				

From table 4 above it can be seen that the value of mathematics learning outcomes for class VIIA MTs Madani Alauddin Pao-Pao, at the time of the Post-Test it was found that the Mean value was 71.3514; standard deviation of 14.72978. The scores achieved by students varied from a minimum value of 40.00 and a maximum value of 100.00. Furthermore, the presentation of the Post-Test data after the application of Multimedia-Based Interactive Learning Media can be seen in the following histogram:

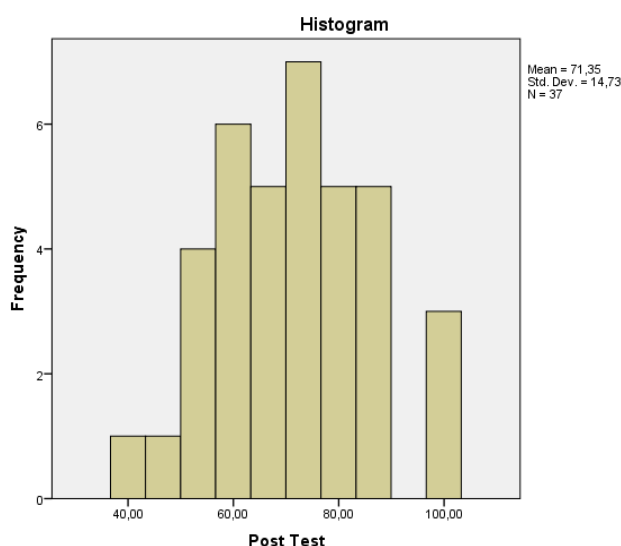


Figure 2. Histogram data Post-Test

Effectiveness Testing

Testing the basics of the analysis carried out includes testing for normality and testing for homogeneity as a prerequisite test for the pre-test and post-test results, and hypothesis testing using the Independent Samples t-test. To find out whether there is a difference in the value of student mathematics learning outcomes before the application of Multimedia-Based Interactive Learning Media and after the application of Multimedia-Based Interactive Learning Media.

Normality test

The data normality test is used to determine whether data is normally distributed or not. If the number of samples is less than 50 then the normality test uses the Shapiro-Wilk. Based on the output above, the sig value is known. for the Pre-Test group of 0.363 and the sig value. for the Post-Test group of 0.373. Because of the sig value for the two groups, based on the decision making in the Shapiro Wilk normality test, it can be concluded that the pre-test and post-test mathematics learning outcomes are normally distributed.

Homogeneity Test

The homogeneity test was carried out on the mathematics learning outcome test before the application of the Pre-Test Multimedia-Based Interactive Learning Media and after the Post-Test the application of the Multimedia-Based Interactive Learning Media. The level of significance previously set was $\alpha = 0.05$. Based on the results of SPSS version 20 data processing, the following data were obtained:

In the table above, you can see the descriptive statistical results of the Paired Sample t-test from the two samples studied, namely the pre-test and post-test. For the pre-test value obtained an average learning result or mean of 49.7295. Meanwhile, for the post-test score, the average value of learning outcomes was 71.3514. The number of respondents or students used as the research sample was 37 students. The

standard deviation value in the pretest is 15.91604 and the post test is 14.72978. Furthermore, the mean std error value for the pre test is 2.61658 and for the post test is 2.42156.

Because the mean value of pre-test learning outcomes is $49.7295 < 71.3514$, it means that descriptively there is a difference in the average learning outcomes between the pretest and the posttest results. Furthermore, to prove whether the difference is real (significant) or not, it is necessary to interpret the results of the Paired Sample t Test contained in the "Paired Sample Test" output. Based on table 4.6 above, shows the results of the correlation test or the relationship between the two data or the relationship between the pre-test variable and the post-test variable. Based on the table above, it is known that the correlation coefficient value is 0.848 with a sig value. amounting to 0,000. Because the sig. $0.000 < 0.05$, it can be said that there is a relationship between the pretest variable and the post test variable. From the result reseach, also contains information about the value of "Mean Paired Differences" is -21.6219. This value shows the difference between the average pre-test learning outcomes and the post-test average learning outcomes or $49.7295 - 71.3514 = -21.6219$ and the difference between these differences is between -24.46284 to -18.78094 (95% Confidence Interval of the Difference).

Discussion

This research is a quantitative type of experiment with Quasi Experimental Design. The research design used was One Group Pre-Test & Post-Test Design, namely experiments carried out in one group only without a comparison group. In this design using the Pre-Test before being given treatment and Post-Test after being given treatment.

Based on the results of research that has been carried out before the application of Multimedia-Based Interactive Learning Media and after the application of Multimedia-Based Interactive Learning Media on mathematics learning outcomes in class VIIA Tsanawiyah Madani Alauddin Pao-Pao students totaling 37 people. The research instrument used was a multiple choice test totaling 15 item numbers. After being given the test to students, the data was obtained which would then be analyzed.

The results of data analysis obtained before the application of Multimedia-Based Interactive Learning Media obtained an average score of learning outcomes in mathematics in the Pre-Test is 49.7295. Furthermore, the results of data analysis after being given treatment with the application of Interactive Learning Media Based on Multimedia, the average value of learning outcomes for learning mathematics on the Post-Test is 71.3514.

Based on the results of the descriptive analysis, a prerequisite test was carried out, namely the normality test and the homogeneity test before testing the hypothesis on the Pre-Test and Post-Test scores of mathematics learning outcomes before and after the application of Multimedia-Based Interactive Learning Media using SPSS version 20. Normality test results and the homogeneous test before the application of Pre-Test Multimedia-based Interactive Learning Media and after the application of Post-Test Multimedia-Based Interactive Learning Media shows that the value of mathematics learning outcomes in class VIIA MTs Madani Alauddin Pao-Pao comes from a population that is normally distributed and homogeneous, it can be seen of the significance value for the Pre-Test group of 0.363 and the significance value for the Post-Test group of 0.373. The significance value of the data before the application of Pre-Test Multimedia-Based Interactive Learning Media and after the application of Post-Test Multimedia-Based Interactive Learning Media is greater than 0.05, it can be stated that the data in this study are normally distributed and on the homogeneity test the sig value is obtained. that the results of learning mathematics are homogeneous because the sig value is greater than the value

The prerequisite test is met, then the researcher then tests the hypothesis to answer the third problem formulation. The results of hypothesis testing using paired sample t-test obtained the sig value is 0,000. According to Singgih Santoso (2014: 265), Guidelines for decision making in the paired sample t-test based on the significant value (Sig.) Of the SPSS output results are as follows:

1. If the sig. (2-tailed) value < 0.05 , it is rejected and accepted.
2. Conversely, if the sig. (2-tailed) value > 0.05 , it is accepted and rejected.

Based on the paired sample t-test, it is known that the sig. (2-tailed) value is $0.000 < 0.05$, so it is rejected and accepted. So it can be concluded that there are differences in the average student learning outcomes before and after the application of Multimedia-Based Interactive Learning Media in class VII students of MTs Madani Alauddin Pao-Pao.

Conclusions and suggestions

Conclusion

Based on the description of the results of the discussion, the following conclusions can be drawn: (1) The learning outcomes of class VIIA students of MTs Madani Alauddin Pao-Pao obtained an average score of mathematics learning outcomes on the Pre-Test of 49.7295. (2) The learning outcomes of class VIIA MTs Madani Alauddin Pao-Pao students obtained an average score of mathematics learning outcomes on the Post-Test of 71.3514. (3) There is a difference in the average mathematics learning outcomes in class VIIA MTs Madani Alauddin Pao-Pao before the application of Multimedia-Based Interactive Learning Media and the average mathematics learning outcomes after the application of Multimedia-Based Interactive Learning Media. This is evidenced by the results of hypothesis testing using the paired sample t-test, the value of sig = 0.000 is obtained, because the sig (2-tailed) value is $0.000 < 0.05$, so it is rejected and accepted.

Suggestion

The suggestions in this study are as follows: (1) Mathematics teachers at MTs Madani Alauddin Pao-Pao so that in learning mathematics to apply Multimedia-Based Interactive Learning Media because it can improve mathematics learning outcomes. (2) The school should facilitate the implementation of various multimedia-based interactive learning media, so that teachers are able to apply interactive learning media according to school conditions and student conditions. (3) To further researchers to seek innovations in the application of interactive mathematics learning media as a reference in further research, so that it is more different from previous research and can add new insights and knowledge for students, teachers and researchers themselves.

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