

The Influence of Using Interactive Media in Improving Students' Basic Mathematics Learning Outcomes

Alvi Sahrin Nasution^{1*}, Mhd. Rahman Rambe², Rizky Febriani Pohan², Noni Paisah²

¹Mathematics Study Program, Faculty of Mathematics and Natural Sciences, State University of Medan, Medan 20221, Indonesia

²Civil Engineering Study program, Faculty of Engineering, Graha Nusantara University, Padangsidempuan 22719, Indonesia

Corresponding Author: alvinasution90@gmail.com

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Abstract: The problem in learning Basic Mathematics is that students are slow in calculating, do not understand and remember the material, have verbal difficulties in solving problems and students are lazy in doing practice questions to deepen the material. So interactive media is needed to overcome this. The purpose of this study was to determine the effect of interactive media in improving students' Basic Mathematics learning outcomes and to determine the improvement in their learning outcomes. The design of this study was a nonequivalent control group, where students were grouped into experimental groups and control groups, each consisting of 15 students. The results showed that the use of interactive media had an effect on improving the Basic Mathematics learning outcomes of Civil Engineering students, Faculty of Engineering, Graha Nusantara University, Padangsidempuan by 55.34% in the control group and 62.34% in the experimental group. The use of interactive media has an effectiveness percentage of 18.75% in improving the Basic Mathematics learning outcomes of Civil Engineering students, Faculty of Engineering, Graha Nusantara University, Padangsidempuan. Thus, interactive media is very effective for use in learning in Higher Education.

Keywords: Effectiveness, learning outcomes, Basic Mathematics, interactive media, improvement

INTRODUCTION

Education is a solution to create a superior and quality next generation of the nation. Quality education is one indicator for creating superior human resources (Nusroh et al., 2024). Education makes humans intelligent, knowledgeable, humanistic, independent, moral, pious, and populist (Ariandini & Ramly, 2023). However, the rapid advancement of technology has had a major impact on education. In the field of education, technology can be utilized as a sophisticated facility to facilitate and help make the learning process more effective. The use of technology in the field of education, especially in the teaching and learning process, has been proven to improve student learning outcomes because it provides new and interesting learning experiences so that students will avoid boredom during learning (Putra & Salsabila, 2021).

The problems faced by students in studying Basic Mathematics are that students are slow in calculating, do not understand and remember the material, have verbal difficulties in solving problems and students are lazy in doing practice questions to deepen the material. So that students' Basic Mathematics learning outcomes are low (Syakur et al., 2021). For this reason, an appropriate solution is needed to overcome these learning problems. One solution that can be done to improve students' Basic Mathematics learning outcomes is through the use of interactive media. Interactive media is a digital service in the form of images, text, videos, games and animations. The goal is to add interesting features so that it has a better impact. In the world of education,

this interactive media can be applied in making interesting quizzes, presentations, distance learning processes, learning simulations, and learning CDs (Nisa' & Aryanti, 2023).

Based on several previous studies, the use of interactive media in learning has a very high level of effectiveness. Research of Nasution (2023) shows that the use of interactive media in Physics learning has a positive impact on increasing students' Physics learning outcomes by 0.04 with a small effect category. Research of Ariandini & Ramly (2023) shows that the use of interactive media in learning can improve the learning outcomes of students at SMP Negeri 5 Makassar by 12.35 or 58.95%. Research of Pratiwi (2018) shows that the use of interactive media in learning Indonesian can improve the learning outcomes of Indonesian students at SMP Negeri 1 Bungoro, Bungoro District, Pangkep Regency by 10%. Thus, the author is interested in researching "The Effect of Using Interactive Media in Improving Students' Basic Mathematics Learning Outcomes". The aim is to determine the effect of interactive media in improving students' Basic Mathematics learning outcomes and to determine the improvement in their learning outcomes.

METHOD

Research Sample

The sample consisted of 30 first-semester students from the Civil Engineering Study Program, Faculty of Engineering, Universitas Graha Nusantara Padangsidempuan, during the 2024/2025 Academic Year.

Research Location and Time

This research was conducted within the Civil Engineering Study Program, Faculty of Engineering, Universitas Graha Nusantara Padangsidempuan, between October and November 2024.

Research Type and Design

This study used a quasi-experimental method with a nonequivalent control group design. The students were divided into an experimental group and a control group, with 15 students in each.

Implementation Procedure

Before the treatment, both the experimental and control groups were given a pre-test to assess their initial abilities. The experimental group then received instruction using interactive media, while the control group was taught conventionally. Both groups were assessed against a Minimum Completion Criteria (MCC) of 60. Following the treatment, both groups were given a post-test to measure the improvement in Basic Mathematics learning outcomes (Pohan et al., 2022).

Data Collection Techniques

Data were collected through tests and observations. The tests aimed to determine student learning outcomes before and after the use of interactive media. The observations aimed to monitor the learning process during the implementation of the interactive media.

Data Analysis Techniques

Data were analyzed using a t-test and a normalized gain (N-gain) test. The t-test was used to determine the effect of interactive media on Basic Mathematics learning outcomes. The steps for conducting the t-test were as follows:

1. Formulate the hypothesis

The statistical hypotheses were formulated as follows:

- $H_0: \mu \leq \mu_0$ (The use of interactive media does not have a significant effect on improving the Basic Mathematics learning outcomes of Civil Engineering students at the Faculty of Engineering, Universitas Graha Nusantara Padangsidempuan).
- $H_a: \mu > \mu_0$ (The use of interactive media has a significant effect on improving the Basic Mathematics learning outcomes of Civil Engineering students at the Faculty of Engineering, Universitas Graha Nusantara Padangsidempuan).

2. Determine the Significance Level

The significance level (α) was set at 0.05.

3. Determine the Criteria for Rejecting H_0

H_0 is accepted if t-count < t(1- α).

H_0 is rejected for all other values of t.

4. Calculate the Test Statistic

The t-statistic was calculated using the following formula:

$$t = \frac{Md}{\sqrt{\frac{\sum s^2}{n(n-1)}}} \quad (1)$$

Note:

Md = Mean difference between pre-test and post-test

s = standard deviation

$\sum s^2$ = sum of squares of deviations

n = number of samples (Ananda & Fadhli, 2018)

The hypothesis tested was the effect of interactive media on improving the learning outcomes. A one-tailed test was used. The criteria were: if t-count < t-table, then H_0 is accepted and H_a is rejected; conversely, if t-count \geq t-table, then H_0 is rejected and H_a is accepted (Nuryadi et al., 2017).

The normalized gain (N-gain) test was used to determine the improvement in students' learning outcomes. Prior to these tests, the data were tested for normality and homogeneity. Subsequently, the effectiveness of the interactive media in Basic Mathematics learning was determined (Ulfa et al., 2023). The formulas for the N-gain and effectiveness percentage are as follows:

$$\text{N-gain} = \frac{\text{Post-test score} - \text{Pre-test score}}{\text{Maximum score} - \text{Pre-test score}} \times 100\% \quad (2)$$

$$\% E = \left| \frac{\bar{Xd}_1 - \bar{Xd}_2}{\bar{Xd}_2} \right| \times 100\% \quad (3)$$

Description:

%E = percentage of effectiveness

\bar{Xd}_1 = average difference between pre-test and post-test scores of the experimental group

\bar{Xd}_2 = average difference between pre-test and post-test scores of the control group (Pohan & Rambe, 2022).

RESULTS & DISCUSSION

The learning outcomes of students in this study were assessed from the results of learning Basic Mathematics studied before and after the use of interactive media in learning Basic Mathematics (Pohan & Rambe, 2022). The learning outcomes of Basic Mathematics of Civil Engineering students obtained are described as follows:

Basic Mathematics Learning Outcomes Before Using Interactive Media

The implementation of the pre-test before using interactive media aims to determine the initial abilities of Civil Engineering students in understanding Basic Mathematics lecture material (Pohan, 2017). Based on the results of the pre-test obtained, the average learning outcomes of Basic Mathematics obtained by the control group and the experimental group were 60.67 and 74.33, respectively. Mathematically, the difference in the average learning outcomes obtained by the two groups was 13.67. The results of the pre-test showed that 9 students (60%) from the control group and 15 students (100%) from the experimental group were declared successful in learning Basic Mathematics. Meanwhile, 6 other students (40%) from the control group were declared to have failed in learning Basic Mathematics. Based on the results of the normality test and homogeneity test conducted as a prerequisite test for analysis, it was obtained that the pre-test data obtained were normally distributed and came from homogeneous samples. The results of the normality test and homogeneity test in detail are presented in Tables 1 and 2 below.

Table 1. Results of the Pre-test Data Normality Test

Group	X^2_{table}	X^2_{count}	α	Conclusion
Control	6.571	2.867	0.05	Normal
Experimental	6.571	2.800	0.05	Normal

Table 2. Results of the Pre-test Data Homogeneity Test

Activity	F_{count}	$F_{left table}$	$F_{right table}$	α	Conclusion
Pre-test	1.621	0.395	2.53	0.05	Homogeneous

Basic Mathematics Learning Outcomes After Using Interactive Media

The implementation of the post-test after using interactive media aims to determine the ability of Civil Engineering students in understanding Basic Mathematics lecture materials after learning is carried out (Pohan, 2017). Based on the results of the post-test obtained, the average Basic Mathematics learning outcomes obtained by the control group and the experimental group were 79.67 and 90.33, respectively. Mathematically, the difference in the average learning outcomes obtained by the two groups was 10.67. The results of the post-test showed that all students from the control group and the experimental group (100%) were declared successful in learning Basic Mathematics. So that there was an increase in Basic Mathematics learning outcomes after using interactive media. Based on the results of the normality test and the homogeneity test carried out as a prerequisite analysis test, it was obtained that the post-test data obtained were normally distributed and came from homogeneous samples. The results of the normality test and the homogeneity test in detail are presented in Tables 3 and 4 below.

Table 3. Results of the Post-test Data Normality Test

Group	X^2_{table}	X^2_{count}	α	Conclusion
Control	6.571	3.933	0.05	Normal
Experimental	6.571	1.600	0.05	Normal

Table 4. Results of the Post-test Data Homogeneity Test

Activity	F_{count}	$F_{left table}$	$F_{right table}$	α	Conclusion
Post-test	1.484	0.395	2.53	0.05	Homogeneous

N-Gain Analysis of Basic Mathematics Learning Outcome Data

The improvement in Basic Mathematics learning outcomes was tested using N-gain analysis. Based on the N-gain analysis conducted on the learning outcome data, it was found that the improvement in Basic Mathematics learning outcomes of the control group was 0.5534 or 55.34% and the improvement in Basic Mathematics learning outcomes of the experimental group was 0.6234 or 62.34%. The improvement in Basic Mathematics learning outcomes of the control

group and the experimental group is classified as moderate (Jusmawati et al., 2020). Mathematically, the difference in the improvement in Basic Mathematics learning outcomes of the two groups is 0.07 or 7%. The results of the detailed N-gain analysis of Basic Mathematics learning outcomes are presented in Table 5 below.

Table 5. Results of N-gain Analysis

Group	Post-test Score	Pre-test Score	Maximum Score	N-gain
Control	79.67	60.67	95	0.5534
Experimental	90.33	74.33	100	0.6234

Analysis of the Effect of Using Interactive Media on Basic Mathematics Learning Outcomes

Based on the results of the analysis prerequisite test, the Basic Mathematics learning outcome data were stated to be normally distributed and came from a homogeneous sample, so the data analysis was carried out using a parametric test, namely the t-test. Based on the results of the t-test, it was obtained that the t_{count} was 8.764 and the t_{table} was 1.753. So that $t_{\text{count}} > t_{\text{table}}$, then H_0 is rejected and H_a is accepted (Nuryadi et al., 2017). Thus, the use of interactive media has a significant effect on improving the Basic Mathematics learning outcomes of Civil Engineering students, Faculty of Engineering, Graha Nusantara University, Padangsidempuan. The detailed results of the t-test are presented in Table 6 below.

Table 6. Results of the t-test

Statistic Test	t_{table}	t_{count}	α	Conclusion
t-test	1.753	8.764	0.05	H_0 is rejected H_a is accepted

Percent Effectiveness

Effectiveness is the ability to produce desired results or achieve predetermined goals (Muallif, 2024). In the context of this study, effectiveness is the ability of interactive media to improve Basic Mathematics learning outcomes. Based on the results of the calculation of the percentage of effectiveness, it was obtained that interactive media has a percentage of effectiveness of 18.75% in improving the Basic Mathematics learning outcomes of Civil Engineering students, Faculty of Engineering, Graha Nusantara University, Padangsidempuan. The results of the calculation of the percentage of effectiveness in detail are presented in Table 7 below.

Table 7. Percent of Effectiveness

Group	\bar{X}_d	%E
Control	19	18.75
Experimental	16	

Discussion

Based on the results of the pre-test and post-test obtained, it shows that there is an increase in the learning outcomes of Basic Mathematics of Civil Engineering students, Faculty of Engineering, Graha Nusantara University, Padangsidempuan. This is indicated by the increase in the average score obtained by the control group from (60.67 ± 2.55) to (79.67 ± 2.30) and the experimental group from (74.33 ± 2.01) to (90.33 ± 1.89) . In addition, the increase in success in learning Basic Mathematics showed that all students from the control group and the experimental group (100%) were declared successful in learning Basic Mathematics after the post-test was held. This is due to the optimization of the use of good interactive media for learning in lectures.

The success of interactive media in improving the learning outcomes of Basic Mathematics of Civil Engineering students, Faculty of Engineering, Universitas Graha Nusantara Padangsidempuan is supported by several factors including: a classroom atmosphere that supports lectures, the ability of lecturers to teach (Yudianto et al., 2014), and better social interaction

(Erawati et al., 2024). The increase in Basic Mathematics learning outcomes obtained from the control group was 55.34% and the experimental group was 62.34%. This is supported by research of Budianti et al. (2023) which shows that the increase in learning outcomes of Elementary School students increased in the control group by 48% and the experimental group by 65%.

Based on the results of the t-test conducted, it was obtained that t_{count} was 8.764 and t_{table} was 1.753. So that $t_{\text{count}} > t_{\text{table}}$, then H_0 is rejected and H_a is accepted (Nuryadi et al., 2017). Thus, the application of interactive media has a significant effect on improving the learning outcomes of Basic Mathematics of Civil Engineering students, Faculty of Engineering, Graha Nusantara University, Padangsidempuan. This means that the use of interactive media has the ability to improve the learning outcomes of Basic Mathematics by 18.75%. Thus, interactive media is very effective for use in learning in Higher Education.

CONCLUSION

Based on the research results obtained, it can be concluded that the use of interactive media has an effect on improving the learning outcomes of Basic Mathematics of Civil Engineering students, Faculty of Engineering, Graha Nusantara University, Padangsidempuan by 55.34% in the control group and 62.34% in the experimental group. The use of interactive media has an effectiveness percentage of 18.75% in improving the learning outcomes of Basic Mathematics of Civil Engineering students, Faculty of Engineering, Graha Nusantara University, Padangsidempuan. So that this research can be developed further in other courses and with other types of interactive media.

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