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The Effect of Using Animation Media on Students' Physics Learning Outcomes in Linear Motion Material

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Abstract

This quasi-experimental research was conducted with the aim of 1) comparing the learning outcomes of students taught conventionally and those taught using animation media and 2) calculating the value of the influence of using animation media on student learning outcomes. The experimental research design used in this research is in the form of a nonequivalent control group design with a test as the research instrument, carried out at the research's beginning (pretest) and end (posttest). The sample classes in this study are two classes that were taken using the cluster random sampling method. The results obtained are: 1) The average physics learning outcomes of students in the experimental class are higher than the average learning outcomes in the control class, and 2) There is a significant difference in learning outcome scores between classes that have been taught using animation media compared to conventional classes so that animation media has an influence on students' physics learning outcomes in Pinrang. The research becomes a reference for physics teachers in Pinrang who use animation media in the learning process.

Keywords: animation; learning outcomes; media; physics

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INTRODUCTION

Physics is a subject that studies nature and its interactions, such as interactions between humans and the environment and between humans and humans; therefore, physics becomes the backbone for the development of science and technology (Abdullah et al., 2011; Lehesvuori et al., 2023; Nurhayati, 2014). However, students often experience difficulties in learning physics, even though physics learning should use an active, user-centered learning process to encourage the division of responsibility for learning (Fandos-Herrera et al., 2023; Nasir, 2011). Low student learning outcomes in physics subjects are influenced by several factors, including 1) physics is still considered a difficult and boring subject, 2) learning media is less varied, so it seems monotonous, 3) the use of outdated learning methods and models (lectures), 4) minimal interaction between teacher and teacher and student and student, making students passive in receiving learning (Fakhri et al., 2018; Said et al., 2023). As a result, teachers must have the ability to recognize and explore initial knowledge and be able to search for and use alternative or other learning sources to change the teaching and learning process, which was originally abstract and difficult to understand into material that is interesting and easy to understand ; (Anggraeni & Kustijono, 2013; Johari & Muslim, 2018). These learning tools and resources are called learning media.

Learning media is a physical means for conveying learning content/material such as books, films, symbols, images, audio, video animation, and so on, which should be developed by academics and practitioners with the aim of increasing understanding or memorization. The educational process is more successful when technology-assisted media is used (Abdulrahaman et al., 2020; Ambe et al., 2024; John & Bates, 2024; Sudarma, 2016). With advances in computer technology used in education to support the learning process and improve the quality of learning, it certainly makes it easier for teachers to prepare learning media, especially animation media. Animation is often used in teaching and learning to represent dynamic processes (Schneider et al., 2023; Suri et al., 2022; Sukiyasa et al., 2013). The advantage of animation in learning is that it can help explain physics concepts that are still abstract and difficult to imagine, encourage constructive learning, and make education more meaningful and easier than conventional identification keys (paper-printed) (Cotič et al., 2020; Jaafar et al., 2013; Sani et al., 2020). The interaction between teaching strategies, such as the use of digital media and emotional intelligence, has an impact on understanding physics concepts as a representation of learning outcomes (Degner et al., 2022; Sakti, 2013; Sutiani & Silitonga, 2017).

Based on the results of observations, it is known that in Pinrang, studying physics seemed boring and scary, so students were lazy about studying, which resulted in low students' physics learning outcomes. In previous research, Sakti (2013) found an influence of animation media in the Direct Instruction Model on students' interest in studying physics at Bengkulu City State High School. Sukiyasa & Sukoco (2013) also found a significant influence of the use of animation media on learning outcomes and motivation to learn automotive electrical system material in a class high level of learning outcomes and student motivation taught using PowerPoint media. Similar to the findings of other researchers, there are differences in the understanding of physics concepts among students who are taught using animation media and students who are not taught using animation media in class X SMAN 3 Pinrang (Permana & Kadir, 2018).

This research differs from previous research because it combines experimental methods with qualitative analysis, such as interviews or observations, to gain a more holistic understanding. Most teachers in Pinrang do not use moving media such as animation and video in the teaching and learning process. Therefore, this research is important to introduce Pinrang teachers and students to animation media as a learning tool that can break down abstract physics concepts and make them more real. It is hoped that the results of this research become a reference for teachers to use animation as a medium to attract students' attention and improve learning outcomes. This quasi-experimental research was conducted with the aim of 1) comparing the learning outcomes of students taught conventionally and those taught using animation media and 2) calculating the value of the influence of using animation media on student learning outcomes.

METHOD

This quasi-experimental research (White & Sabarwal, 2014) involves two groups: experimental and control groups. In the experimental group, the students were given learning using animation media. The control group continued studying as usual or without using animation media. At the end of the study, the experimental and control groups were measured with the same measuring instrument.

The experimental research design used was a nonequivalent control group design, as shown in Table 1.

Table 1 Research design

O_1	X	O_2
O_3	-	O_4

(Sugiyono, 2017)

Information:

O_1 : Experimental class pretest
O_2 : Experimental class posttest
O_3 : Control class pretest
O_4 : Control class posttest
X :The treatment in the experimental class is learning using animation media
- : Conventional learning model

This research was carried out at Madrasah Aliyah Negeri Pinrang, South Sulawesi. The research implementation time was planned for the odd semester of the 2022/2023 academic year. The population in this study was all class X students at MAN Pinrang, consisting of 10 classes, with each class (study group) consisting of 38 students. Meanwhile, the sample in this study was taken using the cluster random sampling method by viewing the population as groups (Agustianti, 2022). Then, samples of 2 classes were obtained: X MIPA 3 and X MIPA 4.

The instruments used in this research were tests (pretest and posttest), observation guidelines, and interview guidelines. The data analysis technique began with testing the instrument using validity and reliability tests. Valid and reliable instruments were used in the research. The results obtained are tested for prerequisites, namely the normality and homogeneity tests. for normality using the Chi-square test. The basis for decision-making is if the Chi-Square (χ^2) count < Chi-Square (χ^2) table, then the data is normally distributed (Sugiyono, 2017). Next, a hypothesis test is carried out. The data on student learning outcomes categories can be seen in Table 2.

Table 2 Classification of learning outcomes

Score	Value	Category
12 - 14	$80 \leq P \leq 100$	Very Good
9 - 11	$60 \leq P \leq 80$	Good
6 - 8	$40 \leq P \leq 60$	Medium
3 - 5	$20 \leq P \leq 40$	Low
0 - 2	$P < 20$	Very Low

RESULT AND DISCUSSION

Animation Media Used

The animation media used is short videos accessed via the YouTube application. Some of these videos are shown in the following images. Figures 1 and 2 are examples of an animation of uniform linear motion, and Figure 3 is an example of an animation of non-uniform linear motion.

Figure 1 Uniform linear motion

Source: https://www.youtube.com/watch?v=-aJZZaOwkRk

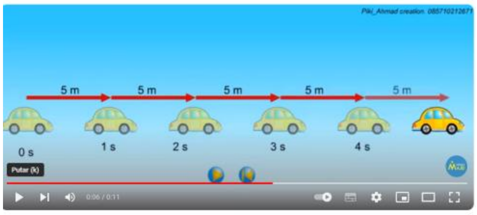

Figure 2 Uniform linear motion

Source: https://www.youtube.com/watch?v=R43uzIUFd30


Figure 3 Non-uniform linear motion

Source: https://www.youtube.com/watch?v=WlQBSm7eLyY

Instrument Testing

The 25 prepared questions were validated using Pearson Correlation item validation with the help of the SPSS 21 application. From the results of the data analysis, 14 valid questions were obtained, and their reliability was tested with the help of SPSS 21. The results obtained are shown in Table 3.

Table 3 Instrument reliability test results

Reliability Statistics	
Cronbach's Alpha	N of Items
0.893	25

The critical value for the instrument reliability index is 0.7. This means that an instrument is said to be reliable if it has an Alpha coefficient value of at least 0.7. Based on Table 2, it can be seen that the Cronbach's alpha value is 0.893. Thus, it can be said that the instrument is reliable and can be used in research.

Test prerequisites

The average student physics learning outcomes before and after the experiment can be seen in the Figure 4.

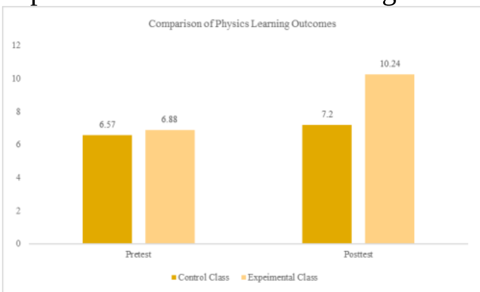

Figure 4 Histogram of comparison of physics learning outcomes

Data on student learning outcomes from the pretest and posttest, both the control class and experimental class, were tested for normality using the Chi-square test. After testing the data, data was obtained where the calculated χ^2 was 20.274 while the table χ^2 was 5.991. This means that χ^2count > χ^2 table, thus the pretest data for the control class is not normally distributed.

Because one of the prerequisites is not met, the parametric hypothesis testing requirements are not met. Thus, homogeneity tests no longer need to be carried out (Sugiyono, 2017; White & Sabarwal, 2014). Therefore, data analysis continued with hypothesis testing using non-parametric statistics.

Hypothesis test

The hypothesis test used in this research is a non-parametric hypothesis test using the Mann-Whitney Statistical Test assisted by SPSS 21. The results obtained are shown in Table 4.

The basis for decision-making: If probability > significance level (α = 0.05), then H_0 is accepted or fails to reject H_0 (Sugiyono, 2017; White & Sabarwal, 2014). Conversely, if the probability < significance level (α =

0.05), then H_0 is rejected. The hypotheses for this research are:

H_0 : There is no significant influence of the use of animation media on physics learning outcomes at Pinrang.

H_1: The use of animation media significantly influences physics learning outcomes in Pinrang.

Based on the Mann-Whitney test results, it can be seen that the Asymp. Sig. (2-tailed) is 0.000. Compared with the significance level, 0.000 < 0.05 means that H_0 is rejected. So, the conclusion is that the use of animation media has a significant influence on physics learning outcomes in Pinrang.

Before being used in conducting research, this instrument was first tested on respondents outside the population whose cognitive abilities were not much different from the population. Based on the test results, of the 25 questions provided, it turned out that only 14 questions were declared valid, while the others were invalids, so they were discarded. The invalidity of this question is because almost all respondents answered the same, both right and wrong.

Table 4 Mann-Whitney statistical test results

Ranks

	Class	N	Mean Rank	Sum of Ranks
Physics Learning Outcomes	Control Class	30	20.15	604.50
	Experiment Class	25	37.42	935.50
	Total	55		

Table 5 Mann-Whitney statistical test results

Test Statistics

	Physics Learning Outcomes
Mann-Whitney U	139.500
Wilcoxon W	604.500
Z	-4.004
Asymp. Sig. (2-tailed)	.000

a. Grouping Variable: Class

Then, the pretest was in two classes, namely the control and experimental classes. The control class is the class that continues to learn using conventional methods or learns as usual. In contrast, the experimental class is the class that is given treatment, namely the class that is taught using animation media. The pretest was carried out before the researcher taught the two classes. A pretest was carried out to ensure that the cognitive abilities of the two classes were equivalent. In this way, the learning outcomes of students in the control class and experimental class can be compared. Based on the pretest results, the average learning outcome score for students in the control class was 6.57, while in the experimental class, it was 6.88. This means that control class students' cognitive abilities are equivalent to experimental class students' cognitive abilities.

The same instrument, called posttest data, is then used again to collect data on student learning outcomes after receiving treatment. Based on the test results, the average score of students in the control class was 7.2, while in the experimental class, it was 10.24. From these data, it can be seen that there are quite large differences between the two classes. This data means that according to the researchers' expectations, students who were taught using animation media obtained higher scores than students who were taught conventionally. Maya found a similar thing in student learning outcomes in science learning by using animation media in class IV SD Telkom.

Makassar has increased. Likewise, Rina found that animated media is related to understanding the material, as seen from the learning outcomes (Ramadhan et al., 2023; Qurbaniah et al., 2023).

The t-test hypothesis test was used to determine animation media's effect on student learning outcomes. The condition for a t-test is that the data distribution must be normally distributed and homogeneous. So, the next step is the normality test. There are four groups of data distribution. Based on the test results on the four data distributions using the Chi-Square test with the help of Microsoft Excel, it was concluded that none of the data distributions were normally distributed. Thus, the prerequisites for conducting hypothesis testing using the t-test are not met. This abnormal data distribution usually occurs with data less than 50 (Agustianti, 2022). So, the next prerequisite no longer needs to be fulfilled. Steps that can be taken to obtain normally distributed data distribution are by adding the number of respondents. However, this option is not possible considering the maximum number of students in the class is 35 people. The next possible step to make the data normally distributed is to transform the data into logarithms. This step also does not produce good results, so the best option is to test the hypothesis using non-parametric statistical tests

The non-parametric statistical test used was the Mann-Whitney test with the help of SPSS 21. From the data processing results, a very good conclusion was obtained, namely, animation media had a significant influence on students' physics learning outcomes in Pinrang.

Based on the results of interviews with several students, it is known that animation media is a more interesting experience, thereby increasing students' enthusiasm for learning. Students even look forward to studying physics again. Based on the results of observations, it is known that in the control class, many students skipped the physics subject; other students even looked sleepy and uninterested. While in the experimental class, student attendance was almost 100%. Students were enthusiastic about competing to answer when given a quiz, as shown in Figure 5.

Figure 5 Students take quizzes

Animation media helps students easily remember the physics concepts taught so that it is easy to answer questions on the post-test. A progressive drawing and a narrative context within whiteboard animation fostered learning relevant variables and learning outcomes (Permana & Kadir, 2018; Schneider et al., 2023; Sukiyasa et al., 2013).

The results obtained are in accordance with the results of previous research. As Permana (2018) said, there has been an increase in understanding of physics concepts after implementing the learning model based on animation media. Meanwhile, in this research, it was seen that physics learning outcomes increased after learning using animation media. Where animation media has a positive influence on student learning outcomes. This animation media is suitable for rectilinear motion materials, electrical and automotive materials, and fluid materials.

CONCLUSION

Based on the research results obtained, the conclusions are that 1) the average physics learning outcomes of students in the experimental class are higher than the average learning outcomes in the control class, and 2) there is a significant difference in learning outcome scores between classes that have been taught using animation media compared to conventional classes so that animation media has an influence on students' physics learning outcomes in Pinrang. The weakness in this research is the limited availability of general media such as LCD Projectors or Television. So, sometimes, students need to collaborate using their respective smartphones. Therefore, the suggestion for further research is that researchers should prepare these facilities if the research object cannot provide them. Therefore, it is highly recommended for teachers and schools to use animation media in suitable learning materials so that students' physics learning outcomes continue to improve.

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