The Application of Problem Based Learning Assisted by Variety of Visual Media on Student’s Physiscs Learning Outcomes

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Abstract

The aim of this study was to find a significant difference between the learning outcomes of physics students taught through problem-based learning supported by a variety of visual media and those taught through conventional learning. is to determine whether The method used in this study is a quasi-experimental method using only a post-test control group design. The study population consisted of all 7th graders from public schools in South Sulawesi, and the sample was divided into her two classes, an experimental class and a control class. The test vehicle for learning cognitive outcomes in the multiple-choice format of the extended material serves as a test vehicle. The sig values were obtained as a result of data analysis, i.e. based on the independent-samples t-test. (two-sided) is 0.000, which is less than the significance of 0.05, so H_0 is rejected and H_1 is accepted. Thus, there is a significant difference between the physics learning outcomes of students taught through problem-based learning supported by a variety of visual media and the physics learning outcomes of students taught through conventional learning.

Keywords: problem based learning, variety of visual media, and physics learning outcomes.

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INTRODUCTION

Education is the main factor to improve the quality of human resources better in the face of competition in the 21st century (Stevens, 2012). Thus, the government has undertaken efforts to support almost all elements of education, such as curriculum renewal, teacher quality improvement, and learning quality improvement, including the updated strategies, models, methods, and media to optimize quality of learning.

Problem-based learning is a constructivist-influenced interactive learning model that emphasizes student-centered learning. A problem-based learning model is defined as a learning model that uses problems as a starting point for acquiring new knowledge. Problem-based learning is learning as a result of a learning process to understand and solve a problem (Inel & Balim, 2010). Problem-based learning is a learning model in which student learning takes place in a true problem-solving context. This is in line with the view (Siew et al., 2015) who argue that problem-based learning requires students to work together in a group environment, understand the needs of unresolved problems, and consider multiple solutions. I am doing it. It can be concluded that problem-based learning models are learning in which students are given problems to solve in groups to stimulate them to build knowledge. Problem-based learning is suitable for applications because it requires solving real-world problems through stages of the scientific method so that students can acquire problem-related knowledge.

One of the difficulties faced by students in learning physics concepts is the absence of something that can be observed directly. As a result, it cannot explain abstract material. Various kinds of visual media that can help clarify abstract material include animation media (Yanti et al., 2017) and simulation media (Hidayah & Dwikoranto, 2018; Sabrina & Wasis, 2019; Sinulingga et al., 2016)

Especially on the expansion material, which contains a lot of material that is abstract (difficult to understand) so that learning media is needed to make it easier for students to clarify the abstract material and the material being studied will be more memorable for students because there is something that can be observed in the given learning media. Visual media can clarify abstract material (Chiu & Lin, 2005). Therefore, this study used a variety of visual media, namely animation media and simulation media.

Dealing with the background, the researcher is interested in applying problem-based learning supported by various visual media to students' physics learning outcomes. The purpose of this study was to find a significant difference between the learning outcomes of physics students taught through problem-based learning supported by a variety of visual media and those taught through conventional learning. is to determine whether This study explores the application of problem-based learning supported by a variety of visual media to the learning outcomes of students in physics, and whether there is a significant difference from the learning outcomes of physics students supported by conventional learning. I will describe the process and research results that have been carried out so far.

METHOD

The method used in this study was quasi-experimental method with a posttest-only control group design and the study sample was divided into two groups, an experimental group and a control group. The two groups were processed differently, with the experimental group being processed using problem-based learning supported by a variety of visual media, and the control group being processed using a typical learning process (conventional learning) in the research setting. received. After treatment, the two groups underwent post-tests to measure the students' learning outcomes. Differences in post-test student learning outcomes in the two groups were informative for analyzing the effectiveness of problem-based learning supported by different visual media in delivering student learning outcomes. . The study design used is shown schematically in Table 1.

Table 1 Research Design

Group	*Treatment*	*Posttest*
Experiment	X	O_1
Control	Y	O_2

Table 1 shows that X is a treatment in the form of problem-based learning supported by various visual media in an experimental class. O1 is a post-test of student learning outcomes in an experimental class, and Y is a treatment in the form is shown. Applying conventional learning to the control class, the O2 is a post-test of the learning outcomes of students in the control class.

The study population, all in her 7th grade at public schools in South Sulawesi, consisted of 5 classes with a total of 175 students. The sample for this study consisted of 62 of her students, divided into two classes: an experimental class of 32 students and a control class of 30 of her students. Samples were selected using class random sampling. With this technique, the student stays in an empty class and a lottery selects her two classes. This will be the study sample from all open classes. In this way, one class was selected as an experimental class to undergo a problem-based learning treatment using visual media, and another class was selected as a control class to undergo a conventional learning treatment.

The learning outcome instrument used in this study was the learning outcome test instrument, which was used to identify the learning outcomes of students included in the extended material after learning treatment was administered. The learning outcome test instruments used in this study were those of the cognitive domains measured:

knowledge (C1), comprehension (C2), and application (C3).

The learning outcome instruments used were structurally validated, followed by testing of the validity and reliability of the criteria. Validation of the construct was performed by three experts: his two physics educators and her one physicist. Based on his three expert analysis of construct validation, all items were found to be valid out of the 32 items validated with the conclusion that they could be used for validation. In addition, criterion validity was performed on 35 respondents who studied the extended material. Validity test analysis determined that 15 of her 32 validated items were valid question numbers. Valid items are then checked for authenticity. Dealing with the result, the reliability of valid research instruments was indicated to be moderate.

The data analysis techniques used in this study are descriptive and inferential data analysis techniques. Descriptive statistics are used to describe learning outcomes achieved by students after being taught through problem-based learning, assisted by students taught through a variety of visual media and traditional learning. The goal is to determine the sample population, highest score (maximum), lowest score (minimum), mean score, standard deviation, and variance. Inferential statistics are used to test research hypotheses. Test the hypothesis using an independent-samples t-test. Before testing our hypotheses, we performed basic tests: data normality and variance uniformity tests. Descriptive and inferential data analyzes were computed using the SPSS program.

RESULT AND DISCUSSION

The study was conducted in two classes, an experimental class treated with a form of problem-based learning supporting different visual media, and a control class treated with a form of conventional learning. Post-tests were performed in the experimental and control classes after treatment activity was completed in both classes. This is done to see how the average scores of learning outcomes for students in the experimental and control classes compare. In addition, we aimed to examine whether there was a significant difference between students' learning outcomes through problem-based learning and students' learning outcomes through conventional learning. Figure 1 shows the results of a descriptive analysis of the learning outcomes achieved by students in the experimental and control classes.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Posttest of Experimental Class	32	11	27	21,00	3,877	15,032
Posttest of Control Class	30	7	26	15,93	5,146	26,478
Valid N (listwise)	30					

Figure 1 General description of student learning outcomes in the experimental class and control class

Figure 1. Mean learning outcome scores of students in experimental classes taught through problem-based learning supported by a variety of visual media show higher mean learning outcome scores than students in control classes. through traditional learning. Therefore, based on our descriptive analysis, we can conclude that problem-based learning supported by a variety of visual media provides students with better learning outcomes than traditional learning.

Data from this study were analyzed descriptively as well as by inference analysis using independent-samples t-tests aimed at testing hypotheses. Normality and homogeneity tests were first performed before using the independent-samples t-test. Figure 2 shows the results of the normality test analysis and Figure 3 shows the results of the homogeneity test analysis.

Based on the results of the Kolmogorov-Smirnov normality test, the analysis in Fig. 2 shows that the experimental class taught using problem-based learning supported by different visual media has a significance value of 0.200, which is less than the significance value of is also large. The obtained 0.05 can therefore be concluded that the experimental classes taught using problem-based learning supported by a variety of visual media came from a normally distributed population. Similarly, the class taught by traditional learning received a significance value of 0.200, which is greater than the significance value of 0.05. It was therefore concluded that the control class taught by traditional learning came from a normally distributed population.

Class	Kolmogorov-Smirnov^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Posttest of Experimental Class	,126	32	,200*	,952	32	,164
Posttest of Control Class	,091	30	,200*	,967	30	,458

Figure 2 The results of the analysis of the normality test of student learning outcomes in the experimental class and control class

Test of Homogeneity of Variance

		Levene Statistic	df1	df2	Sig.
Students' Learning Outcome	Based on Mean	3,803	1	60	,056
	Based on Median	3,641	1	60	,061
	Based on Median and with adjusted df	3,641	1	58,432	,061
	Based on trimmed mean	3,755	1	60	,057

Figure 3 The results of the homogeneity test analysis of student learning outcomes in the experimental class and control class

Regarding to the results of the homogeneity test analysis in Figure 3, we can see that the significance value based on the mean is 0.056, which is greater than the significance value of 0.05. This indicates that the experimental class samples taught with mixed-media problem-based learning and the control class samples taught with conventional learning came from populations with uniform variances.

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
Students' Learning Outcome	Equal variances assumed	3,803	,056	4,396	60	,000	5,067	1,152	2,761	7,372
	Equal variances not assumed			4,357	53,822	,000	5,067	1,163	2,735	7,398

Figure 4 The results of the independent sample t-test analysis in the experimental class and control class

Dealing with the results of the independent-samples t-test analysis in Figure 4, the value of sig (two-sided) is 0.000, less than the significance of 0.05. Based on the criteria, Ho is rejected and H1 is accepted. This indicates that there is a significant difference between the learning outcomes of students taught with problem-based learning using different visual media and those taught with conventional learning.

Dealing with results of the data analysis, we found significant differences between the learning outcomes of students taught with problem-based learning and those taught with traditional learning models. In this case, the learning outcomes of students in classes taught through problem-based learning outperform those of students taught through traditional learning models. This finding is in line with the findings obtained by (Rerung et al., 2017) that the application of problem based learning can improve student learning outcomes. This finding is supported by (Nafiah & Suyanto, 2014) that student learning outcomes after the application of problem based learning are students who reach the KKM. The application of the problem based learning model can improve students' science learning outcomes (Safitri et al., 2018;

Syafriana, 2017). Furthermore, (Wasonowati et al., 2014) also found that student learning outcomes with problem based learning were categorized as good.

Problem-based learning is a student-centered learning model. This is because students do research to find solutions to problems presented by teachers. Students are considered scientists. Students do this activity in groups or together, exchanging ideas and opinions among students in the group until finally reaching a mutual solution to the problem. Collaborative activities are discussion activities when carrying out tasks in order to reach consensus on a given task.

The implementation of problem based learning includes several stages and steps. The first stage is the teacher provides a stimulus/motivation to deliver students so that they are connected to the problem to be given. Then the teacher gives the problem and the students understand the problem at hand. Problem solving instruction is effective in improving student learning outcomes (Gok & Silay, 2008). At this stage, students look motivated in responding to the problems given because these problems are often experienced in life and it is the first time for students to learn through problems. Then students are divided into several groups to do collaborative activities. The next stage is for students to determine what information they can get from the problems presented. Next, students express ideas and determine the formulation of the problem and make hypotheses. The next step is for students to identify their learning needs and find solutions to the problems they face. At this stage, students are seen actively giving arguments to exchange opinions or exchange ideas with their group friends until a mutual agreement is found in the form of a hypothesis formulation. Students are actively involved in solving problems through collaborative activities (Balta & Awedh, 2017; Yusal et al., 2021). Then the next step is for representatives from each group to make presentations to inform their solutions to problems to other friends or other groups. This is done to exchange ideas or exchange opinions if the solution is different from that of their friends or group until a mutual agreement is found. In this step, students look enthusiastic in giving arguments in exchanging ideas and exchanging opinions with friends or other groups. Problem solving builds arguments to anticipate rebuttals and rebuttals from other alternatives (Jonassen, 2011).

The application of problem-based learning is supported by a variety of visual media to ensure proper comprehension of the extended material learned. Animated and simulated media help visualize abstract concepts of augmentation to the naked eye. Simulation media are often used to help students understand abstract scientific concepts (Chiu & Lin, 2005). Variety of visual media plays a significant role in strengthening students' understanding of concepts significantly in science learning (Aykutlu & Sen, 2011).

CONCLUSION

Regarding to the findings, it can be concluded that there is a significant difference between the students' learning outcomes of physics taught through problem based learning facilitated through various visual media and those taught through conventional learning. Hence, problem-based learning can be an alternative learning model to optimze learning quality and improve student learning outcome.

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