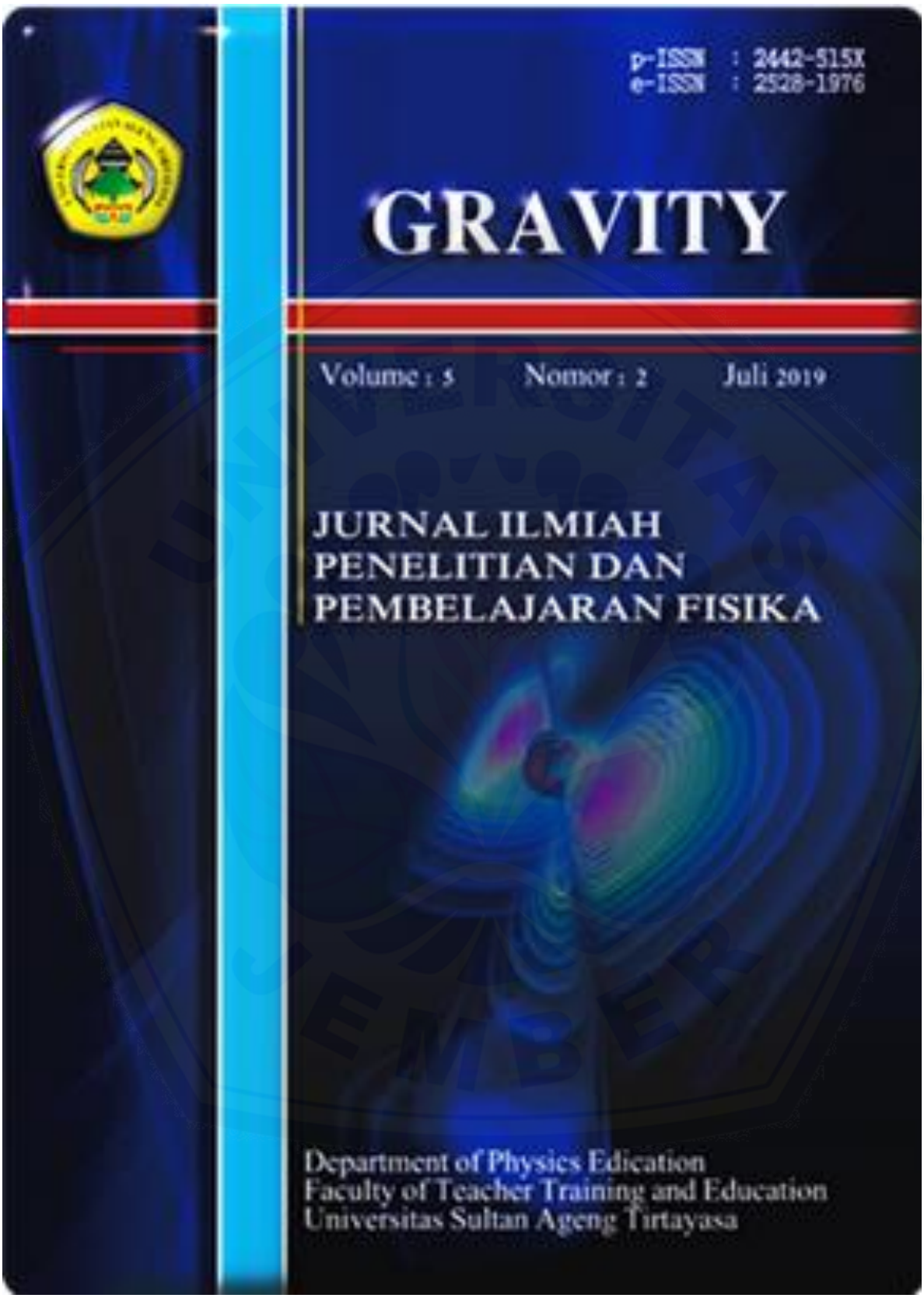

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Self-efficacy and student physics learning outcomes in problem based learning (PBL) with phet media

Singgih Bektiarso*, Ninik Megawati, Sri Handono Budi Prastowo

Department of Physics Education, Universitas Jember, Indonesia

**E-mail: singgih.fkip@unej.ac.id*

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ABSTRACT

This research aimed to examine the application of the problem-based learning model with PhET to students' self-efficacy and physics learning outcomes at SMA Negeri Pakusari, especially in light waves. This research is an experimental study with a pretest and posttest control group design. Determination of the sample using purposive sampling technique and obtained samples, namely the control and experimental classes. Self-efficacy data was collected through a questionnaire consisting of 9 statements, while the learning outcomes data were viewed from the cognitive domain through tests in the form of pretest and posttest. The test consists of eight multiple choice questions and four essay questions. Analysis of self-efficacy data and learning outcomes using the T-test sig value. Obtained is less than 0.05. Thus, it is concluded that there is a significant influence in applying problem-based learning models with PhET media on self-efficacy and student learning outcomes in high school.

Keywords: learning outcomes, pbl model with phet, self-efficacy

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INTRODUCTION

Physics learning is a process of increasing knowledge in studying various kinds of physical phenomena that occur in the universe. Learning physics will be more interesting if, in addition to students being given equations in the material, they are also given phenomena that students can know so that they can understand the concept as a whole. The phenomena presented can be in the form of actual events in real life, which aim to make it easier for students to understand and remember them (Dahar, 1989). Therefore, it is expected that in the learning process, students not only listen, write and remember the learning materials provided by the teacher, but students are emphasized to be able to understand the concepts that have been

learned. Self-efficacy is the level of confidence or self-confidence of a person or individual in taking action in certain situations with success (Yoannita et al., 2016). Generally, the level of self-efficacy can increase or decrease. This can happen due to the changing learning environment, factors such as a less conducive class atmosphere, and group discussions that tend to be passive. The higher the level of self-efficacy, the higher the student's effort in solving the given problem, while students who have a low level of self-efficacy will tend to assume that the given situation is more complex than it is so that it can reduce students' effort and persistence in solving the problem (Emrisena & Suyanto, 2018).

Students with high self-efficacy will be calmer in accepting complex assignments and other activities. In contrast, students who have low self-efficacy doubt their abilities by seeing that something looks complicated, so this can affect their achievement of these students. So it can be said that students who have a high level of self-efficacy will make them tend to choose complex tasks in understanding the material as a challenge. On the other hand, students who have low self-efficacy tend to view the task as difficult to complete, so they often try to avoid it (Hasmyati & Arafah, 2018). Based on researchers' observations, especially in the physics learning process, students have difficulty receiving material. Students revealed that physics subjects were difficult to remember and understand. In addition, based on the researcher's observations, some students looked less confident and doubtful when asking the teacher, so they chose to ask other friends or didn't even ask. Lack of understanding of the subject can impact student learning outcomes that are less than optimal.

Learning outcomes are abilities possessed by students, which can be seen through changes in behavior and concepts owned by students after receiving the test (Sudjana, 2011). In addition, learning outcomes are abilities students possess after carrying out learning activities and achieving a learning goal or instructional goal (Abdurrahman, 1999). Learning outcomes is a process of seeing the ability of students to master the material after learning and how much success the student has achieved in participating in learning. Learning outcomes are changes in behavior experienced by students, which can be said as a result of the learning process, which includes attitudes, knowledge, and skills. This behavior change will later grow the unique abilities of these students (Rosyid et al., 2019).

Based on the description above, learning outcomes can also be said as a series of evaluations of the learning process. In evaluation, it requires an effective tool in the assessment of learning outcomes, namely, using tests. In this study, a test was used to know students' cognitive abilities related to students physics learning outcomes. This learning outcome can be known through evaluation to determine student learning outcomes after learning. Based on observations made previously, students often find it challenging to accept physics material during the learning process. Most students will feel afraid or even embarrassed to ask about the material presented that they have not understood. This can cause students to get used to being passive. Therefore, it is necessary to have a learning model in which students are the center of learning activities. By applying a model based on these criteria, teachers are expected to be able to find solutions to improve self-efficacy and student learning outcomes.

PBL learning is learning that, in its application, makes real phenomena a context for students so they can get used to learning and solving problems (Kunandar, 2011). Learning

using this model involves students directly in solving problems so that students not only gain knowledge but also have the ability or problem-solving skills. This problem-based learning model aims to improve students' thinking skills so that students are seriously encouraged to learn and invited students to think and solve problems given independently. The problem-based learning (PBL) model can be applied to increase student involvement in the learning process by giving problems to students who have been divided into several small groups. Students can be more actively involved and take responsibility for the group. Thus students not only listen and take notes but are also actively involved in the learning process (Muniroh, 2015).

Based on the results of research (Himah et al., 2015) stated that problem-based learning can generate student interest in learning because the PBL model presents real problems as topics in learning and requires students to explore information, generate solutions, and be carried out systematically, so that requires students to learn independently. In learning that applies this learning model, students not only have to learn and understand relevant concepts but this model is designed to help students understand concepts through practical experience (Yusuf et al., 2020). Learning media are everything used to deliver material planned so that the learning environment becomes conducive and students can carry out learning activities effectively and efficiently (Gunawan & Sunarman, 2018). According to Djamarah, media is a tool that, in its use, can make learning activities more concrete so that students become more interested and motivated to learn (Djamarah, 2006). PhET is one media that can be applied in physics learning simulation activities. It is expected to make it easier for teachers to simulate physical phenomena according to the concept. Based on the background described previously, the researchers found research gaps in applying the Problem Based Learning model with PhET media that can be collaborated in learning activities. This study aimed to examine the effect of problem-based learning with PhET media on self-efficacy and student learning outcomes.

RESEARCH METHODS

The type of research used a true experiment with a research design that is a pretest and posttest control group design. The research was conducted at SMA Negeri Pakusari in the semester, with the chosen material being light waves. The following is a research design according to (Ismail, 2018) :

Table 1. Pretest and Posttest Control-Group Design

R	O_1	X	O_2
R	O_3	-	O_4

Determination of the location of this study using a purposive sampling area technique. The research sample used was determined after the homogeneity test was carried out with the help of the SPSS application through the One Way Anova test on all populations, namely class XI IPA. From this test, two samples were obtained. From these two samples, the experimental and control classes were determined using a lottery technique, namely class XI IPA 2 as the experimental class and class XI IPA 5 as the control class.

We collected data by giving tests given before and after learning the experimental and

control classes. Students' self-efficacy was measured through the provision of a questionnaire. In addition, learning outcomes data were obtained through tests in the form of pretest and posttest.

Self-efficacy value data collection through a questionnaire consisting of 9 statements. The questionnaire includes three dimensions: Magnitude or level, Generality (general condition), and Strength (strength). The scoring category of the questionnaire refers to Riduwan (2004) positive and negative statements. Scoring categories can be seen in the following table:

Table 2. Questionnaire scoring technique

Alternative Answer	Positive	Negative
Strongly Agree (SS)	4	1
Agree (S)	3	2
Disagree (TS)	2	3
Strongly Disagree (STS)	1	4

Data collection on learning outcomes was obtained through tests in the form of pretest and posttest given before and after learning. Each test is given consisting of 8 objective questions and 4 essay questions. In this study, learning outcomes are viewed from the cognitive domain. Furthermore, data on self-efficacy and learning outcomes were analyzed with the help of SPSS. The data were then tested for normality using the Independent Sample T-test.

RESULTS AND DISCUSSION

This study examines the effect of applying the PBL learning model with PhET media on self-efficacy and student learning outcomes. Self-efficacy test data collection in the form of a questionnaire and learning outcomes in the form of pretest and posttest. In addition to using PhET media, the experimental class was given worksheets to direct and connect with the material being studied. The first objective of this study is the students' self-efficacy after being treated with the PBL (problem-based learning) learning model with PhET media. Data was obtained through the provision of a questionnaire. The following is student self-efficacy data:

Table 3. Student Self-efficacy Value

	Class	Mean	Standard Deviation
Pretest	Experiment	25,5	4,5
	Control	23,9	3,3
Posttest	Experiment	29	3,9
	Control	24,5	3,7

Group Statistics

	Kelas	N	Mean	Std. Deviation	Std. Error Mean
Self-efficacy	Kelas Eksperimen	32	29,00	3,951	,699
	Kelas Kontrol	32	24,50	3,724	,658

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
Self-efficacy	Equal variances assumed	,185	,669	4,688	62	,000	4,500	,960	2,581	6,419
	Equal variances not assumed			4,688	61,784	,000	4,500	,960	2,581	6,419

Figure 1. Self-efficacy T-test Results

Based on Figure 1 above shows that the value of Sig. (2-tailed) of 0.000. It can be said that the results of the data analysis of the average value of student self-efficacy, which is 0.000, are less than 0.05. Thus, it can be concluded that H_0 is rejected and H_a is accepted, which means a difference in the average value of students' self-efficacy between the experimental and control classes. The average value of the experimental class students' self-efficacy is higher than the control class, so the Problem Based Learning (PBL) learning model with PhET media significantly affects students' self-efficacy.

The mean value of self-efficacy of experimental class students showed an increase before and after learning was carried out by applying a problem-based learning model with PhET media. The average value of self-efficacy before learning is 25.5, and after learning is 29. Students show this during discussions. Students confidently convey and accept opinions from group friends and teachers to solve problems in LKS. Based on the previous description, it can be concluded that there is a significant difference between the self-efficacy of experimental class students who use the PBL (problem-based learning) learning model assisted by PhET media and control class students who use the learning model commonly used at SMAN Pakusari, namely the CTL learning model. The increase in self-efficacy in this study was also supported by the results of previous research, namely (Bawa, 2019) which stated that the application of the Problem Based Learning model assisted by LKS was found to help increase students' self-efficacy. It is indicated that there are differences in the value of students' self-efficacy before and after learning. Likewise, the results of research (Sawitri et al., 2020) state that applying the Problem Based Learning model with the Creative Problem Solving technique increases student self-efficacy.

Based on the results of the self-efficacy research that has been described previously,

followed by student learning outcomes in the cognitive domain obtained through the provision of tests in the form of pretest and posttest. The pretest value data was used to determine the initial ability of the experimental class and control class students. The following is the data of the students' posttest scores:

Table 4. Student Learning Outcomes

	Class	Mean	Standard Deviation
Pretest	Experiment	40,2	7,5
	Control	42,6	8
Posttest	Experiment	80,2	7,3
	Control	70,8	8

Group Statistics

	Kelas	N	Mean	Std. Deviation	Std. Error Mean
Nilai Posttest	Kelas Eksperimen	32	80,2188	7,25896	1,28322
	Kelas Kontrol	32	70,8750	8,02315	1,41831

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
Nilai Posttest	Equal variances assumed	,248	,620	4,885	62	,000	9,34375	1,91265	5,52041	13,16709
	Equal variances not assumed			4,885	61,389	,000	9,34375	1,91265	5,51966	13,16784

Figure 2. T-test Results Learning Outcomes

Based on Figure 2, the results of the Independent Sample T-test show that the value of Sig. (2-tailed) of 0.000. It can be said that the results of data analysis on student learning outcomes are 0.000 less than 0.05. Thus, based on the first statistical hypothesis, it can be concluded that H_0 is rejected and H_a is accepted, which means that there is a difference in the average value of student learning outcomes between the experimental and control classes. The average value of the experimental class learning outcomes is higher than the control class, so the Problem Based Learning (PBL) learning model with PhET media significantly affects student learning

outcomes.

Based on Table 4, learning in the experimental class using a problem-based learning model with PhET media has a better average value of learning outcomes than the control class students. The increase in the value is shown during learning that students can work together and exchange ideas with their group friends in solving the problems given. In addition, based on the results of interviews with experimental class students after the lesson ended, students revealed that learning became more fun and interesting to follow the lesson better.

The increase in cognitive learning outcomes in this study is supported by previous research (Jauhari et al., 2017) which states that the problem-based learning model with PhET media affects the results of learning physics. In addition, the research results (Marianus & Umboh, 2020) show that the Problem Based Learning learning model with PhET media is effective in the process, and student learning outcomes are marked by differences in the value of student outcomes before and after learning. Likewise, the research results (Gusniar & Juliani, 2019) how that applying the Problem Based Learning model with PhET media can improve student learning outcomes.

CONCLUSION

Based on the data analysis and discussion obtained, it can be concluded that the Problem Based Learning (PBL) model with PhET media significantly affects self-efficacy and student learning outcomes. Suggestions that can be given are that this research can be used as an alternative in learning physics so that students can relate the problems of everyday life to the concept of physics.

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