THE EFFECT OF COOPERATIVE LEARNING MODEL TYPE OF GROUP INVESTIGATION ASSISTED BY PHET SIMULATION ON STUDENT LEARNING OUTCOMES AT SMA NEGERI 1 BAHOROK

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ABSTRACT

The purpose of this study was to find out whether the investigative group-type cooperative learning model assisted by PhET (Physic Education Tecnology) simulations can improve student learning outcomes at SMA Negeri 1 Bahorok. The research method used is quantitative research design *quasi experiment two group pretest-posttest*. The population in this study was class XI IPA at SMA Negeri 1 Bahorok and the sample used was class XI IPA 1 with a total of 36 students as the experimental class and XI IPA 2 with a total of 34 students as the control class. Data collection was carried out by using questions on *pretest* and *posttest*. The results showed that the average value *pretest* in the experimental and control classes of 50.0 and 43.06 while the average value *posttest* obtained in the experimental and control classes of 73.5 and 59,24. Based on one-party hypothesis testing to find out differences in student learning outcomes that have been carried out, it is found that the value of $t_{table} = 1.9954$. Furthermore, by comparing the value of t_{table} with t_{count} obtained that $t_{count} > t_{table}$ namely $5.4265 > 1.9954$. This means null hypothesis rejected and alternative hypothesis accepted which states that "There is an influence from the cooperative learning model of the Simulation-assisted Investigation Group type *PhET* on the material Elasticity and Hooke's Law on student learning outcomes.

Keywords: Investigation Group Type Cooperative Model, Learning outcomes

INTRODUCTION

Education is an important thing in life because education is a process that can change a person's attitude and behavior to mature someone through teaching and training. In an educational process there are activities called learning and teaching. Learning and teaching are interrelated activities. Learning is an activity to acquire knowledge. While teaching is the activity of conveying information from the teacher to students. The process of conveying information requires the right learning model strategy so that information is conveyed optimally. It is important for the teacher to choose the right learning model in transferring knowledge because the learning model chosen by the teacher determines the success of student learning (Erpan *et al.*, 2021). The learning model is one component that plays an important role in learning because when educators use effective learning models it is very helpful in the learning process so that learning objectives can be achieved.

According to Rahmawati, A et al (2022) a learning model that is in accordance with the characteristics of physics with students' motivation to be active in learning by involving the process of collecting data with group discussion activities. From the results of interviews that researchers conducted with physics subject teachers Mr. Surya Sitepu and

Mrs. Delima Debby Utari at SMA Negeri 1 Bohorok, currently learning focuses only on teachers who use conventional learning models. One of the obstacles that exist in schools is the lack of availability of tools and materials to do practicum in the laboratory. The results of the interview also concluded that during a pandemic *Covid-19* many students do not understand in learning physics. Student interest in learning is also low which is exacerbated when there is a pandemic *Covid-19*. Therefore, to overcome and increase students' interest in learning again, an appropriate learning model is needed. This is in line with the results of research (Nurdin, 2019) which states that students' interest and motivation in learning physics is still low due to the lack of variations in models and learning media that teachers use when teaching. Research by (Akly Nur, 2015) which says that students' physics learning outcomes are still low because most students complain that physics learning is difficult to understand, so they are less actively involved in the teaching and learning process and they are not serious in participating in learning and answering questions. This is because the learning model used so far is not optimal.

In connection with the research above, several researchers have used the investigative group type cooperative learning model to overcome these problems. According to Siska Widiawati *And* al, (2018) and Erpan *And* al., (2021) said that learning physics with the investigative group type cooperative learning model has an effect on student learning outcomes and interest. Based on the problems that exist in SMA Negeri 1 Bahorok, about the infrequent practicum being carried out due to the lack of practical tools and materials, the researcher offers practicum using a simulation *PhET*. PhET Simulation Is a virtual laboratory developed by Katherin Perkins, et al from the University of Colorado, United States of America which is made in Java so that it can be run directly from the website, besides that users can download it for offline use. This PhET simulation media can be obtained free of charge by students through the website http://phet.colorado.edu/en/get-phet/full-instal (Rizaldi *et al.*, 2020). This simulation will be integrated into the Investigation Group type cooperative learning model. One learning model that can be applied to the problems above is the cooperative learning model.

Research methods

This research was conducted at SMA Negeri 1 Bahorok which is located at Jalan Berdikari, Pekan Bahorok, Bahorok District, Langkat Regency, and North Sumatra Province. The population in this study were all students of class XI IPA at SMAN 1 Bahorok in semester 1 T.P 2022/2023, totaling 34 students for each class. Sampling and determining the class of samples in this study were taken randomly, namely *cluser random sampling*. This study was designed using groups *pretest - posttest*. This study used 2 classes, namely 1 experimental class using the Investigation Group type cooperative learning model and the 2nd class, namely the control class using conventional learning models. The test used is the initial test *(pretest)* and final test *(posttest)* each of which totals 10 questions in the form of 8 multiple choice questions and 2 essays related to indicators with levels C1 – C6. The initial test is given before learning is carried out and the final test is carried out after learning has been carried out. The prerequisite tests in this study consisted of normality tests, homogeneity and one-party and 2-party t tests.

Results

Research that has been carried out in the experimental class with the cooperative learning model of the Investigative Group type assisted by simulation *PhET* obtained physics learning outcomes with the highest score of 100 and the lowest score of 48.8. The physics learning outcomes obtained from the control class using conventional learning models obtained the highest score of 77.5 and the lowest score of 31.3.

Based on the research results, obtained data on students' physics learning outcomes in the experimental class using the cooperative learning model of the Simulation Assisted Investigation Group type *PhET* as follows:

Table 1. Experimental Class Pretest and Posttest Values

Experiment Class	Mean	SD	Variance
Pre Test	50,09	8,09	65,46
Post Test	73,59	9,89	98,007

Based on the table above, it can be seen that the average value of the experimental class after being treated with the cooperative learning model of the Simulation Assisted Investigation Group type *PhET* of 73.59 with a standard deviation of 9.89. Before being given treatment, students were first given pretest questions in order to find out students' initial abilities.

Based on the data obtained, it is known that the posttest score in the experimental class has the highest score of 100 for 1 student and the lowest score is 48.8 for 1 student. The overall learning outcomes of experimental class students are presented in the following table:

Table 2. Distribution of Experimental Class Pretest and Posttest Scores

Class	PRETEST		POST-TEST	
	INTERVAL	FREQUENCY	INTERVAL	FREQUENCY
1	30 – 36	1	48 - 56	2
2	37 – 43	2	57 - 65	5
3	44 – 50	20	66 - 74	8
4	51 – 57	9	75 - 83	17
5	58 – 64	1	84 - 92	3
6	65 – 71	3	93- 101	1

Based on the research results, obtained data on students' physics learning outcomes in the control class using the conventional model as follows:

Table 3. Pretest and Posttest Values of Control Class

Control Class	Mean	SD	Variance
Pre Test	43,06	10,26	105,24
Post Test	59,24	12,16	147,81

Based on the table above, it can be seen that the average value of the control class after being given conventional learning of 59.24 with a standard deviation of 12.16. Before being given treatment, students were first given pretest questions in order to find out students' initial abilities. The questions are given in the form of multiple choices and essays with levels C1 – C6. After obtaining the pretest value, learning with conventional models is given. After completing learning, students are given posttest questions in the form of multiple choice and essays with levels C1 – C6 to find out student learning outcomes.

Based on the data obtained, it is known that the posttest score in the control class has the highest score of 77.5 for 1 student and the lowest score is 31.3 for 1 student. The overall learning outcomes of control class students are presented in the following table:

Table 4 Distribution of Pretest and Posttest Scores for Control Class

Class	PRETEST		POST-TEST	
	INTERVAL	FREQUENCY	INTERVAL	FREQUENCY
1	24 – 31	7	31 – 38	3
2	32 – 39	4	39 - 46	2
3	40 – 47	13	47 - 54	6
4	48 – 55	7	55 – 62	11
5	56 – 63	1	63 – 70	3
6	64 – 71	2	71 - 78	9

Student Response Analysis

Student response data was carried out so that researchers know how students respond to the use of a simulation-assisted investigative group type cooperative learning model *PhET* in the learning process that has been done.

The overall student response can be calculated as follows:

$$\bar{P} = \frac{\sum P}{N} = \frac{1826\%}{15} = 86\% \text{ (Arikunto, 2002)}$$

Based on these calculations, it is known that the average percentage of student responses answering yes is 86. So based on the criteria the percentage of student responses belongs to the category of being interested in learning physics which is carried out with the cooperative learning model type Investigation Group assisted by simulation *PhET* on the material Elasticity and Hooke's Law.

Discussion

The normality and homogeneity tests that have been carried out show that the data from the experimental and control classes are normally distributed and homogeneous. Students in the experimental class were taught using a cooperative learning model of the type of Investigative Group assisted by a simulation *PhET* while students in the control class were taught using the conventional model. After the researchers gave different treatments to the experimental class and the control class, students were given a posttest to find out differences in student learning outcomes. The average value of the posttest in the experimental class was 73.59 while in the control class it was 59.24.

Based on one-party hypothesis testing to find out differences in student learning outcomes that have been carried out, it is found that the value of t_{table} = 1.9954. Furthermore, by comparing the value of t_{table} with t_{count} obtained that $t_{count} > t_{table}$ namely 5.4265 > 1.9954. This means H zero is rejected and H the alternative is accepted which states that "There is an influence from the cooperative learning model of the Simulation-assisted Investigation Group type *PhET* on

Elasticity and Hooke's Law material on student learning outcomes ".

Meanwhile, based on the results of the analysis of student responses to learning using cooperative learning models of the Simulation Assisted Investigation Group type *PhET* obtained 7 out of 15 statement items are in the very interested category and 8 questions are in the interested category. The average percentage of student responses answering yes is 86. So based on the criteria the percentage of student responses belongs to the category of being interested in learning physics which is carried out with the cooperative learning model type Investigation Group assisted by simulation *PhET* on the material Elasticity and Hooke's Law.

The learning outcomes in the experimental class research using the investigative group type cooperative learning model were higher compared to the control class using the conventional learning model. *PhET* In this case, students study in groups while carrying out simulation-assisted experiments which make students enthusiastic and fun in learning physics. In contrast to learning with conventional models where learning only focuses on the teacher, this makes students get bored faster in doing learning.

Thus, it is stated that the learning outcomes and interest in learning physics of students who have been taught using a simulation-assisted Investigation Group type cooperative learning model *PhET* better than that taught by conventional models. This means that it can be seen that before the cooperative learning model was applied the Investigative Group type assisted by simulation *PhET* Physics learning activities are still difficult for students to follow and do not attract students' attention. However, after the implementation of the cooperative learning model with the type of Investigative Group assisted by simulation *PhET* the learning process becomes easier and more interesting for students which has a direct effect on student learning outcomes. This is in line with research from Siska Widiawati *And* al, (2018)

and Erpan*And* al., (2021) said that learning physics with the investigative group type cooperative learning model has an effect on student learning outcomes and interest.

Conclusions and recommendations

From the results of the research that has been done, it can be concluded that student learning outcomes using the Cooperative learning model of the Simulation Assisted Investigation Group type*PhET* higher than learning outcomes using conventional learning models. This can be seen from the average value value*posttest* students use the Investigative Group Cooperative learning model of 73.59 and use the conventional learning model of 59.24 with a difference of 14.35. So it can be concluded that learning with the cooperative learning model of the investigative group type has better learning outcomes. This can be seen from the calculation of the t test obtained that t_{count} > t_{table} namely 5.4265 > 1.9954 which states that "There is an influence from the simulation-assisted Investigative Group type cooperative learning model*PhET* on the material Elasticity and Hooke's Law on student learning outcomes.

The advice that I can give to future researchers is that future researchers can add material that is not yet in the simulation*PhET*because not all material in physics can be done by simulation*PhET* only a few materials.

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