THE EFFECT OF STUDENT *LEARNING* OUTCOMES ON TEMPERATURE AND HEAT MATERIAL USING THE *DISCOVERY LEARNING* MODEL

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ABSTRACT

This study aims to determine the effect of the discovery learning model on learning outcomes in the material Temperature and Heat in class XI SMAN 1 Sibolangit T.P 2022/2023. The type of research used is a quasi experiment. The population in this study were all students of class XI SMA N 1 Sibolangit. Sampling was done by cluster random sampling by taking 2 classes out of 6 classes randomly, namely XI MIA 3 as the control class, totaling 30 people and XI MIA 2 as the experimental class, totaling 32 people. The instrument used to determine student learning outcomes is a student learning outcomes test. In testing the normality of the pretest values in the experimental class, it was obtained Lcount < Ltable, so the data for both classes were normally distributed. In the homogeneity test obtained Fcount < Ftable, then both samples come from homogeneous groups. Then given a different treatment, the experimental class with the discovery learning model and the control class with conventional learning. After learning was given, the average value of the posttest experimental class was higher than the average value of the control class. The results of the t test obtained tcount > ttable, so ha was accepted. Thus, it was found that there was an influence of the discovery learning model on student learning outcomes in the subject of temperature and heat in class XI SMAN 1 Sibolangit T.P 2022/2023.

Keywords: Learning models, discovery learning, temperature and heat, learning outcomes

INTRODUCTION

Education is an integral part of development. The education process cannot be separated from the development process itself. Education that is able to support development in the future is education that is able to develop the potential of students, so that they are able to face and solve life problems experienced (Trianto, 2011).

According to Rusman (2017) in an effort to improve the quality of education must be done by mobilizing all components in education. The aspect that must be improved is in the teaching and learning process. The learning process in education units is organized in an interactive, inspiring, fun, challenging, motivates students to actively participate, and provides sufficient space for prakasa, creativity, and independence in accordance with the talents, interests, physical and psychological development of students. Education units conduct learning planning, learning implementation, and assessment of the learning process to improve the efficiency and effectiveness of the achievement of graduate competencies.

Growing the ability and willingness to learn from students needs encouragement or motivation so that students learn more actively and can

understand what they are learning. Learners play an important role in preparing themselves to become actors who are able to display their excellence as figures who are tough, confident, creative, independent and professional in their respective fields (Setyowati, 2012).

Debora's research (2015) also reinforces that physics *learning* achievement with the *discovery learning* model is more able to explore the material and determine physics concepts on their own, thus making students able to develop intellectual skills which include observing skills, formulating concepts, estimating, drawing conclusions and communicating results.

The results of interviews with physics teachers at SMAN 1 Sibolangit show that many students do not pay attention and actively participate in learning activities because students feel bored, saturated and lack of interest in physics subjects which causes learning outcomes not in accordance with the expected learning outcomes. The teacher said that the learning model that tends to be used is conventional learning using the lecture method.

The learning process that takes place should make students get a learning experience. Learning experiences are all processes, events and activities that students experience to gain knowledge, skills and attitudes. After going through the learning process, students are expected to gain knowledge from what they have learned. Physics is one of the studies of natural science or known as science. Physics is considered a lesson of a collection of formulas that make students dizzy with memorizing formulas. However, actually in physics the relationship between concepts is the first and very important step in learning physics (Hosnan, 2014).

The discoverylearning model is applied so that physics lesson planning in learning can be implemented properly and effectively. The *discovery* model is a component of educational practice which includes teaching models that promote active learning, process-oriented, self-directing, self-searching, and reflective. Based on this background, as a prospective Physics teacher in SMA/MA, the researcher is interested in conducting research to find out how the physics *learning* outcomes of students taught by using the *discovery learning* model on the learning outcomes of class Xl students on temperature and heat material at SMA N 1 Sibolangit.

Based on the results of interviews with physics teachers at SMA Swasta PBD Medan, information was obtained that only 40% of students are interested in learning physics and 60% of students consider physics lessons very difficult, because for them physics only explains the formulas so they don't like it. The teaching materials used are also only based on printed books and LKS, so that students' interest in learning physics is very low and it is very difficult to understand the material presented.

One way to make the teaching materials used more attractive to students is to create an interactive product in the form of an electronic module (*e-module*). Electronic Module (*E-Module*) which can be accessed via *smartphone*, laptop or computer. Electronic books are defined as teaching materials published in electronic form which are accessed through electronic devices which include the

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e-ISSN: 2721-1274
p-ISSN: 2721-2718

presentation of text, images or audio (Nurchaili, 2016). The use of electronic books is very necessary in supporting learning activities because it has advantages, namely ease of access anywhere and anytime, and practicality that can be enjoyed by all education starting from primary level to higher education (Divayana, et al, 2018).

Kvisoft Flipbook Maker is a type of professional software that converts pdf files into a book-like form, on the device pages that can be added editing functions, allowing to insert video, numbers, audio, hyperlinks, animated images and multimedia objects (Apsari & Kustijono, 2017).

This e-module teaching material using the *Kvisoft Flipbook Maker* application is an e-module that can be accessed offline. By using this application, it is expected to provide renewal in the learning process in class. The use of the *Kvisoft Flipbook Maker* application can increase student interest in learning and can also affect student achievement or learning outcomes. The use of this application will also be able to increase understanding and improve the achievement of learning outcomes in students.
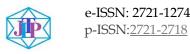
RESEARCH METHODS

The location of this research is at SMA N 1 Sibolangit which is located at Jl. Jamin Ginting No. Km 47, Bandarbaru, Sibolangit District, Deli Serdang Regency, North Sumatra. This research took place from November 2023 in the ganji semester of the 202/2023 school year. The population used in this study which is in accordance with the research objectives is the entire XI class at SMA N 1 Sibolangit for the 2022/2023 school year which consists of 6 classes. The sampling technique used in this study was *cluster random* sampling, namely random sampling of classes. This technique resulted in a sample used in the study consisting of two classes, namely XIMIA 2 class which amounted to 32 people using the *discovery learning* model and XI MIA 3 which amounted to 30 people served as a control class, namely a class that used conventional learning. The experimental research design used was *pretest-posttest control group.* Researchers used a test instrument of 20 multiple choice questions to measure student learning outcomes.

The data obtained are the results of normality, homogeneity and hypothesis tests on *pretest* and *posttest* scores.

This research was conducted at SMA Swasta PBD Medan which is located at Jalan Bilal Ujung NO. 3/145, Pulo Brayan Darat I, East Medan District. This type of research is a quasi experiment, which is research to determine whether or not there is an effect of something that is imposed on the object, namely students. This research uses the discovery learning model developed by Gijilers and Jong (2016) which consists of six stages.

1. *Simulation* (simulation / provision of stimuli), namely at this stage students are faced with something that causes confusion, then proceed not to give generation, so that the desire to investigate for themselves arises.
2. *Problem statement* (statement / problem identification) is to provide opportunities for students to identify as many problem agendas as possible that are relevant to the subject matter, then one of them is chosen and formulated in the form of a hypothesis.

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p-ISSN:2721-2718

3. **Data collection** is providing opportunities for students to collect as much relevant information as possible to prove whether or not the hypothesis is true.

4. **Data** processing is the activity of processing data and information that has been obtained by students either through interviews, observations and so on, then interpreted. All information from reading, interviews, observations and so on are all processed, randomized, classified, tabulated, even if necessary calculated in a certain way and interpreted at a certain level of confidence.

5. *Verification*, at this stage students conduct a careful examination to prove whether or not the hypothesis that has been determined is correct, which will be linked to the results of *data processing.*

6. *Generlazation* (drawing conclusions), this stage is the process of drawing conclusions that can be used as general principles and apply to all the same events or problems. Students must pay attention to the generalization process which emphasizes the importance of mastering lessons on the meaning and broad rules or principles that underlie one's experience, as well as the importance of the process of organizing and generalizing from these experiences.

In this study, the data obtained were analyzed using two techniques, namely in the form of quantitative data and qualitative data. Quantitative data includes scores obtained through questionnaires from material and media expert lecturers, physics teachers, and also students on learning outcomes instruments made by researchers. While qualitative data is classified in the form of input or suggestions from all validators and students. By using the feasibility percentage formula below:

$$P = \frac{\Sigma}{N} \times 100\%$$

Where:

P = Category presentation

∑ = Number or frequency of respondents' answers

N = Total availability of respondents' answer scores (Sudjana, 2007)

Effectiveness data is student learning outcomes data obtained from *pre-test* and *post-test* and calculated with the following formula:
Student learning outcome score formula:

$$N = \frac{jumlah\ skor\ yang\ diperoleh}{jumlah\ skor\ maksimum} \times 100$$

To determine the significant increase in student learning outcomes, quantitative analysis was carried out using the Gain Normality formula.
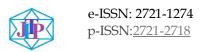
$$N - Gain = \frac{nilai\ post\ test - nilai\ pre\ test}{nilai\ maksimum - nilai\ pre\ test}$$

Description:
N-Gain: Normalized gain
Pre-test: Initial ability score before learning
Post-test: Final proficiency score after learning

RESULTS & DISCUSSION

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p-ISSN:2721-2718

1. *Pretest* **Score Data of Experimental Class and Control Class**

The pretest data obtained the average value of experimental class students of 56.40 and the average *pretest of* control class students of 41. It turns out that from testing the *pretest scores of the* experimental and control classes, both classes have the same initial ability and both classes are homogeneous. In summary, the *pretest* results of the two groups can be seen in Table 4.1 and Table 4.2.

Table 4.1. Experimental and control class *pretest* data

Experiment Class			Control Class		
Value	Frequency		Value	Frequency	
30 - 38	3		25 - 31	8	
39 - 47	5	$\bar{X} = 56{,}40$	32 - 37	5	$\bar{X} = 41$
48 - 56	5	$S = 14{,}71$	38 - 43	5	$S = 10{,}43$
57 - 65	2		44 - 49	3	
66 - 74	12		50 - 55	6	
75 - 83	5		56 - 61	3	
$\sum$ = 32			$\sum$ = 30		

2. *Posttest* **Score Data of Experimental Class and Control Class**

After the two classes were given different treatments, the two classes were then given a *posttest with the* same questions as the *pretest questions. The* results obtained were the average *posttest score of the* experimental *class* after applying the *discovery learning* model of 84.68 with a standard deviation of 7.17. While in the control class, the average student score was 75.16 with a standard deviation of 7.13. In summary, the data on the *posttest scores of the* experimental and control classes can be seen in Table 4.2.

Table 4.2. *Posttest* **Score Data of Experimental Class and Control Class**

Experiment Class			Control Class		
Value	Frequency		Value	Frequency	
75 - 78	7		65 - 68	6	
79 - 82	6	$\bar{X} = 84{,}68$	69 - 72	5	$\bar{X} =$
83 - 85	7	$S = 7{,}17$	73 - 76	7	75,16
86 - 90	6		77 - 80	6	$S = 7{,}13$
91 - 94	0		81 - 83	0	
75 - 83	5		84 - 87	6	
$\sum$ = 32			$\sum$ = 30		

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From the *pretest* and *postest* research data in the experimental class and control class, the average data value, standard deviation and variance can be seen in Table 4.3.

Table 4.3. Summary of Mean, Standard Deviation and Variance Calculation Results

Description	Experiment Class		Control Class	
	Pretest	*Posttest*	*Pretest*	*Posttest*
Average	41	75,16	56,40	84,68
Standard Deviation	10,43	7,13	14,71	7,17
Variance	108,96	50,83	216,50	51,51

3. Normality Test Results

This normality test is carried out to determine whether the data is normally distributed or not. Researchers used the *Kolmogorov Smirnov* test to test the normality of the research data with the results shown in Table 4.4.

Table 4.4 Research Normality Test Results

Group	Test	Sig Value	Significance Level	Description
Experiment	*Pretest*	0,200	0,05	Normally Distributed Data
	Posttest	0,067		
Control	*Pretest*	0,136	0,05	Normally Distributed Data

Data homogeneity testing was carried out to determine whether the data from the two sample groups came from a homogeneous population or had relatively the same ability. This test was carried out using the *levenestatistic* test at a significance level of 0.05 with the help of the *SPSS 25 For Windows* program as in Table 4.5.

Table 4.5 Homogeneity Test Results

Test	Variables	Variance	F_{hitung}	F_{tabel}	Conclusion
Pretest	Experiment	216.50	0.560625	1.834937	Homogeneous
	Control	121.37			
Posttest	Experiment	51.5121	0.986823	1.834937	
	Control	50.83333			

4.2.3 Hypothesis Test Results

After the normality test is carried out where the research data is normally distributed and has met the requirements for hypothesis testing, then to continue the t test is carried out in seeing the effect of using the *discovery learning* model on student learning outcomes with the results can be seen in Table 4.6.

Table 4.6 Hypothesis Test Results

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Paired Samples Test

		Paired Differences					T	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Pretest - Posttest	-28,281	14,844	2,624	-33,633	-22,929	-10,778	32	,000

Based on the calculation results in Table 4.6 *paired sample test* obtained significance = 0.000 less than the significant level (α) = 0.05, then it is H_0 rejected. This means that there is a significant difference between the average before treatment and the value after treatment. In the table above, it can be seen that the value of $_{thiutng}$> t_{tabel} where -10.787> 2.036. This indicates that there is a difference in the average value between student *learning* outcomes before being taught using the *discovery learning* model and student learning outcomes after being taught with the *discovery learning* model. So that in this study Ha is accepted and Ho is rejected, meaning that there is an effect of the *discovery* learning model on the learning outcomes of temperature and heat at SMA N 1 Sibolangit in the 2022/2023 Learning Year.

CONCLUSIONS

Based on the results of the research and discussion that has been described, the conclusions in this study are as follows:

1. *The discovery learning* model affects learning outcomes on temperature and heat material for students at SMA N 1 Sibolangit in the 2022/2023 Learning Year. Evidence can be seen from the results of hypothesis testing, namely tcount> t_{tabel} (10.778> 2.036). This research Ha is accepted and H_0 is rejected and the *discovery learning* model has a better influence on student learning outcomes compared to conventional learning.
2. The learning outcomes of students taught using the *discovery learning* model obtained an average value of 84.687 which is included in the very good category and with a maximum value of 95, a minimum value of 75 and a standard deviation of 7.177.
3. The learning outcomes of students taught using conventional learning obtained an average value of 75.166 and with a maximum value of 85, a minimum value of 65 and a standard deviation of 7.130.

LITERATURE

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