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THE APPLICATION OF GUIDE DISCOVERY LEARNING MODEL IN IMPROVING PHYSIC'S LEARNING OUTCOMES OF STUDENT IN MAS AL-WASHLIYAH MEDAN, INDONESIA

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Abstract:
This study aims to obtain and describe student physics learning outcomes using guided discovery learning models as well as to determine the effect of guided discovery learning models on student physics learning outcomes. Based on its objective, this study used a quasi-experimental method, by comparing the control class and the experimental class. Before the data collection test is performed, the reliability test and the validity test of the questions are obtained first. Then the data is collected by pretest and posttest. Data that has been collected are further analyzed and processed manually using descriptive statistics, tests of normality, homogeneity, and hypothesis testing. The test results show that the learning outcomes of the experimental class taught by using the Guided Discovery learning model are higher than the learning outcomes of the control class taught by conventional learning models. The conclusion from the results of testing the hypothesis using the t test shows is that there is a significant effect of learning using the Guided Discovery learning model on the physics learning outcomes of students in MAS Al-Washliyah Medan.

Keywords: discovery guide, physics, learning outcomes

1. Introduction

Education is one of the changing aspects that can support the advancement of the nation. With a good quality of education, the dignity of the nation can develop. A number of efforts must be made to improve the excellence of education; one of which is through the learning process. The success of the learning process is influenced by the active role of students in learning activities. Various obstacles in student learning activities often transpire such as decreased learning achievement, low learning motivation, learning difficulties, poor behavior towards teachers or schools (Thahir, Hidriyanti, 2014). To

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overcome these impediments, several new concepts and insights about the learning process have emerged and developed as the development of science and technology.

According to Slameto (2010: 2), "*learning is a process of effort by one to obtain new behavior as a whole, as a result of one's own experience in interactions with the environment.*" The learning process occurs through many methods both intentional and unintentional and takes place over time so that it leads to change in the learner. Djamarah (2006: 10) also says that "*learning is the process of changing behavior, owing to experience and training, both concerning knowledge, skills, and attitudes even covering all aspects of the organism or the person*." So, learning is a process of change in behavior which is a result of interaction with the environment in meeting the needs of life.

In the whole educational process, learning activities are the initial undertakings. The success or failure of achieving educational goals depends a lot on the learning process experienced by students, while the learning outcomes achieved by students are influenced by two main factors namely factors within students and factors that come from outside students or environmental factors. This is very closely related to the formulation of instructional goals planned by the teacher before learning.

Physics is a science or natural science in the domain of material and its motion and behavior in the sphere of time and space. The main purpose of learning physics is how to understand the universe work. Understanding of the universe cannot be learned just by reading and seeing but reason and analysis are also looked-for. The development of physics that is increasingly advanced requires teacher's skills in choosing learning methods that are consistent with the material being taught.

According to observations of MAS Al Washliyah Medan students, the low physics learning outcomes obtained by students are due to the ineffectiveness of learning undertaken by the teacher. Conventional learning methods carried out with teachers cause boredom in students so that teachers fail to deliver the subject matter contained in the curriculum. Another cause of this is a factor within the students themselves, which is the assumption that physics is the most difficult lesson to understand because besides having to know and understand theory, they also require to memorize many formulas and possess the power of reason and sharp analysis.

In this study the author attempts to increase the interest and physics learning outcomes of students by using guided discovery learning models. According to Sund in Roestiyah (2008: 20), "*discovery is a mental process where students are able to assimilate a concept or principle.*" In the discovery model students are left to find out or experience mental processes. On the other hand, the teacher only guides and gives instructions. Bruner in Markaban (2008: 9) states that discovery is a process. The discovery process can become a general ability through problem solving exercises, the practice of forming and testing hypotheses. In Bruner's view, learning discovery is learning to find, where a student is expected to have a problem or situation so students can find a way to solve it.

There are two types of discovery models, namely pure discovery models and guided discovery models. The pure discovery model occurs when the problem to be found solely determined by students, as well as the course of the discovery. The pure discovery model is not appropriate for middle / high school students, because if every concept or principle in the material of the syllabus will need to be studied for a long time. It must be remembered that in general, students are too hasty in drawing conclusions and not all students can find their own. Bearing this in mind, a guided discovery learning model emerged as one of the useful teaching models for learning. In the guided discovery model students are encouraged to think so they can find a general principle which is based on materials facilitated by the teacher. In practice, teachers who use discovery models lie along the range between guided discovery and discovery without guidance (linguided discovery).

The guided discovery model as a learning model of the many existing learning models as Eggen and Kauchak (2012: 177) suggest that it is a teaching approach where the teacher gives students examples of specific topics and guides students to understand the topic. An effective guided discovery model is to encourage student involvement and motivation while helping to gain an in-depth and clear understanding of topics. The guided discovery model requires the teacher to be an expert in asking questions and guiding students' thinking.

This study aims to obtain and describe student physics learning outcomes using guided Discovery learning models and to determine the effect of guided discovery learning models on student physics learning outcomes. In accordance with the objectives of the research conducted, it was determined a hypothesis that reads, "there is a significant influence between the guided discovery learning model on the physics learning outcomes of class X MAS Al Washliyah Medan"

2. Application of the Model Guide Discovery (Guided Discovery)

According to Bruner in Wahyu (2011: 40) learning by discovery is an examination-based approach. Students are given a question to answer a problem to be solved or observations to explain, direct themselves to complete assignments, draw conclusions according to findings, and "find" conceptual knowledge based on facts desired in the process. Estimate, intuition, and trial and error should be recommended. The teacher acts as a guide to help students use ideas, concepts, and skills that have been learned beforehand to get new knowledge. Asking the right questions by the teacher will stimulate student creativity helping in 'discovering' the new knowledge. Novel knowledge will stay longer if students are directly involved in the process of understanding and 'constructing' their own concepts or knowledge. The guided discovery model can be done individually or in groups. The extent and depth of thought must be used for the solution and depends on the level of ability of students. If students are highly capable, questions are also weighted in order to provide stimuli that are affordable to students and intermediate difficulty for students. If students are lacking abilities, questions that will have to be filled tend to be resulted in a low level of thinking.

2.1 Stages of Guided Discovery Model

Phase 1: Introduction

After observing, phase 1 is when teachers begin the lesson. Phase 1 is intended to attract students' attention and provide a conceptual framework on what must be followed.

Phase 2: Open - Ended Phase

The open-ended phase aims to encourage student involvement and ensure initial student success. The teacher can start the open-ended phase in various ways, including the following:

- Give examples and ask students to recognize patterns in examples.
- Carry out lessons in classroom situations; give students an example and ask students to observe and illustrate it. Then ask questions. Because many different answers are obtained, the teacher will call on students who have different answers to encourage the level of student involvement in the lesson.
- Give one example and non-sample and ask students to compare.
- Start with a non-example and ask students to describe.

The lesson continues by asking students to respond to open-ended questions. It is done as an effort to ensure students to respond successfully. Open-ended questions have at least two advantages:

1) Questions are easy to ask, making it at ease for teachers to quickly call different students. The greater number of questions will encourage student attention and student involvement and increase achievement.
2) Open-ended questions increase the participation of cultural minorities.

Phase 3: Convergent Phase

The open-ended phase is designed to ensure student success and increase student involvement and motivation. To achieve learning goals, the teacher must narrow the range of student responses and help students identify the main characteristics as when teaches concepts or identifies relationships or if the teacher is rooted in generalizations. Because the teacher guides students so that their responses are uniform to a specific learning goal, this is called the convergent phase. In the convergent phase, students actually build their knowledge of concepts and generalizations.

Phase 4: Closing and Application

Closing occurs when students verbally express the characteristics of a concept or verbally describe the relationships that exist in a generalization. Phase 4 also provides an opportunity to help students develop the ability to recognize irrelevant information, namely thinking skills. The application phase generally includes assignments at home. The lesson is completed when students are able to define concepts or express relationships in generalizations and apply topics to new situations and in everyday life.

For the implementation of the guided discovery model to run effectively, the following steps must be taken:

a) Formulate the problem that will be given to students with sufficient data. The formulation must be clear, avoiding questions that lead to misinterpretation so that the direction students take is not wrong.

b) From the data provided by the teacher, students process, organize, and analyze the data. Teacher guidance can be given as far as is needed. Teacher guidance should direct students to move in the direction they want to go through questions.
c) Students are invited to estimate the results of the analysis conducted.
d) If deemed necessary, the conjecture made by the student is examined by the teacher. It is important to make sure the students' predictions are correct, so that they will be going in the direction they want to achieve.
e) If certainty has been obtained about the truth of the estimate, then the verbalization of the estimate should also be left to students to feed. Besides, it also needs to be evoked that induction does not guarantee 100% correctness of the estimate.
f) After students find what they are looking for, the teacher should provide practice questions or additional questions to check whether the findings are correct.

3. Research Methods

3.1 Research Design

This study belongs to the Quasi Experiment study, which aims to find out whether there is a significant influence of something caused by the subject, namely students. This study was divided into two classes, namely the experimental and control classes:

1) Give treatment to both classes, the first class is the experimental class with a guide discovery learning model, while the control class uses Conventional Learning;
2) The teacher / researcher gives a pretest to both classes to find out the student's ability before the lesson is carried out.

3.2. Population and Samples

The population of this research is 180 students of MAS Al-Washliyah Medan, consisting of 4 classes. While the sample in this study uses 2 classes, which will be taught using guided discovery learning models and conventional learning models.

3.3 Variables and Indicators

3.3.1 Variable

The variables in this study are:

a) The independent variable (X1) is teaching that uses the guided discovery model.
b) Free Variable (X2) is teaching that uses conventional learning models.
c) The dependent variable (Y) is the student's physics learning outcomes.

3.3.2 Indicator

Indicator is a picture or state of research to clarify variables. In this case the indicators can help illustrate the variables so that the data collected is information about the variables, then this study is an indicator, namely:

a) The independent variable indicator (X1) is the RPP that uses the guided discovery model.
b) The independent variable indicator (X2) is the lesson plan that uses conventional learning models.
c) The dependent variable indicator (Y) is a physics learning achievement test score.

3.4 Research Instruments

To obtain the data needed in research, a tool which is a test instrument is needed. The test used in this study is multiple choices with 5 answer options, where each correct answer will be given a score of 1 and the wrong one is given a score of 0. Questions numbered 20 items, so that the highest value obtained by students is 20 and the lowest value is 0.

3.5 Data Collection Technique

Before conducting a test for collecting research data, the test for instruments made to students outside of the research sample is conducted. The test consists of:

3.6 Test Validity Test

Calculation of the validity of the test used biserial point correlation (correlation point biserial), namely:

$$\gamma_{pbi} = \frac{M_P - M_t}{S_t}\sqrt{\frac{p}{q}}$$ (Arikunto, 2012:93)

3.7 Test Reliability Test

To determine the reliability of the test used the formula Kuder and Richardson (K-R. 20), namely**:**

$$r_{11} = \left(\frac{\mathrm{n}}{\mathrm{n}-1}\right)\left(\frac{\mathrm{S}^2 - \sum \mathrm{pq}}{\mathrm{S}^2}\right)$$ (Arikunto, 2012:115)

The next step in collecting data is:

1. Provide pre-test (initial test) for the control class and the experimental class
2. Provide treatment using guided discovery learning models in the experimental class and conventional learning models in the control class.
3. Give a post test (final test) to the experimental class and the control class.

3.8 Data analysis technique

The data that has been collected is then analyzed using the following formula:

Average calculation calculated by the formula:

$$\bar{X} = \frac{\sum f_1 X_2}{\sum f_1}$$ (Usman, dkk, 2006 : 90)

Standard deviation is calculated by the formula:

$$S^2 = \frac{n\sum fiXi^2 - (\sum fiXi)^2}{n(n-1)}$$ (Usman, dkk, 2006: 95)

3.9 Normality test

Take the greatest absolute price between the absolute differences. Call the biggest price L0, then compare L0 with the critical value tested by Liliefors. If the price of L0 <Ltable, then the sample is normally distributed. If L0 <Ltable, then the sample is not normally distributed.

3.10 Homogeneity Test

Homogeneity test serves to determine whether the two samples come from homogeneous populations. Testing Criteria are: H_o is rejected if $F_{count} \geq F_{1/2\alpha}(v_1,v_2)$ with $F_{1/2\alpha}(v_1,v_2)$ is obtained from the list of distribution F with α = 0,10, while degrees of freedom v_1 and v_2 correspond to the number dk numerator and dk variance denominator. (v_1 = dk numerator – 1, v_2 = dk denominator - 1). And if $F_{count} \leq F_{1/2\alpha}(v_1,v_2)$ then H_o is accepted.

3.11 Hypothesis test

To determine the effect of the Guided discovery learning model in improving student physics learning outcomes, the following t test formula is used:

$$t = \frac{\overline{X_1} - \overline{X_2}}{s_{gab}^2\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

In accordance with the use of the test, it can be formulated as the following hypothesis (Ha) is accepted if $t_{count} > t_{table}$, where the t_{table} value is obtained from the t distribution value, with dk = (n1 + n2-2) at the significance level (α) = 0.05 or 5 % so the level of trust = 95%. For other prices the hypothesis t (Ha) is rejected.

The hypothesis to be tested in this study is:

Ha : $\bar{x}_1 \neq \bar{x}_2$: There is a significant influence on the use of Guided Discovery learning models on the physics learning outcomes of MAS Al Washliyah Medan students.

H_0: $\bar{x}_1 = \bar{x}_2$: There is no significant effect on the use of Guided Discovery learning models on the physics learning outcomes of MAS Al-Washliyah Medan students.

4. Research Results and Discussion

4.1 Research Result

From the results of tests conducted on MAS Al-Washliyah Medan students, data was obtained about learning using the Guide Discovery model and learning using conventional models. Data obtained from subsequent studies were analyzed to find out the raw scores obtained from the final teaching tests on electromagnetic waves, which were then processed for hypothesis testing.

4.2 Data Analysis

A. Experimentation Class

To find out the average scores and standard deviations in the results of the experimental class tests students are taught by using the Guide Discovery model as follows:

Table 1: Frequency Distribution of Experiment Classes

No	Interval Class	f_i	x_i	$(x_i)^2$	$f_i\, x_i$	$f_i\, x_i^2$
1	3-5	1	4	16	4	16
2	6-8	3	7	49	21	147
3	9-11	2	10	100	20	200
4	12-14	7	13	169	91	1183
5	15-17	12	16	256	192	3072
6	18-20	5	19	361	95	1805
Total		**30**		**-**	**951**	**432**

$$\overline{X} = \frac{423}{30} = 14{,}1000$$

$$S_1{}^2 = \frac{30\ (\ 432) - (951)^2}{30\ (\ 30 - 1\ )}$$

$$S_1 = \sqrt{15{,}817} = 3{,}977$$

B. Control Class

To find out the average scores and standard deviations of the results of the test control class students are taught using the conventional model as follows:

Table 2: Control Class Frequency Distribution

No	Interval Class	f_i	x_i	$(x_i)^2$	$f_i\, x_i$	$f_i\, x_i^2$
1	5-6	5	5,5	30,25	27,5	151,25
2	7-8	4	7,5	26,25	30	225
3	9-10	3	9,5	90,25	28,5	270,75
4	11-12	7	11,5	132,25	80,5	925,75
5	13-14	6	13,5	182,25	81	1093,5
6	15-16	5	15,5	240,25	77,5	1201,25
Total		**30**	**-**	**-**	**325**	**3867,5**

$$\overline{X} = \frac{325}{30} = 10{,}8333$$

$$S_1{}^2 = \frac{30\,(\,3867{,}5) - (325)^2}{30\,(\,30-1\,)}$$

$$S_1 = \sqrt{11{,}9540} = 3{,}4574$$

To calculate the combined deviation of groups of students who are taught by using the Learning Discovery Guide Model with the Conventional Learning Model using the following formula:

$$S^2{}_{gab} = \frac{458{,}693 + 346{,}666}{58}$$

$$S_{gab} = \sqrt{13{,}8855} = 3{,}7263$$

3.3 Normality Test

To test whether the group of students taught using the Guide Discovery model and those taught using conventional models derived from a normally distributed population, it can be seen the calculation method for the normality test as follows,

Table 3: Test the normality of the experimental class

N	Xi	F_i	F_k	Zi	F(Zi)	S(Zi)	$\lvert F(Zi - S(Zi) \rvert$
1	4	1	1	-2,53	0,0057	0,033	0,0273
2	7	3	4	-1,78	0,0375	0,133	0,0955
3	10	2	6	-1,03	0,1515	0,200	0,0485
4	13	7	13	-0,27	0,3936	0,433	0,0394
5	16	12	25	0,47	0,6801	0,833	**0,1529**
6	19	5	30	1,23	0,8907	1,000	0,1093

The Lilliefors test table for n = 30 in the real level (α) 0.05 is the critical value for the Lilliefors test is 0.161. The highest price of absolute prices in the above table is L_{count} found value of L_{count} = 0.1529. While the critical value of L_{table} for the liliefors test for n = 30 and the real level of α = 0.05 is 0.1617. Therefore, $L_{count} < L_{table}$ is 0.1529 <0.161, then the sample comes from normally distributed.

4.4 Control Class (conventional)

Table 3: Normality Control Class Test

No	Xi	F	F_k	Zi	F(Zi)	S(Zi)	F(Zi)-S(Zi)
1	5,5	5	5	-1,54	0,0615	0,1667	0,1052
2	7,5	4	9	-0,96	0,1686	0,3000	**0,1314**
3	9,5	3	12	-0,39	0,3483	0,4000	0,0517
4	11,5	7	19	0,19	0,5754	0,6333	0,0579
5	13,5	6	25	0,77	0,7794	0,8333	0,0539
6	15,5	5	30	1,35	0,9115	1,0000	0,0885

The highest value of absolute values in the above table found the value of L_{count} = 0.1314. While the critical value of L_{table} for the Lilliefors test for n = 30 and the real level of α = 0.05 is 0.1617. Therefore, $L_{count} < L_{table}$ is 0.1314 <0.1617 then the sample is normally distributed.

4.5 Homogeneity Test

To find out whether the two groups of research data were homogeneously tested then an F test was carried out namely:

$$F = \frac{15,817}{11,9540}$$

$$F = 1,32$$

At the significance level (α) = 0.05, obtained:

F_{count} = F ½. 0,1 (30 – 1, 30 – 1)
F_{count} = F 0,05 (29,29)
= 1,46

By using table F obtained = 1.85

From the calculations obtained $F_{count} < F_{table}$ = 1.46 <1.85, thus it can be said that student learning outcomes data using Guide Discovery learning and Conventional learning have the same variance (homogeneous).

4.6 Hypothesis Testing

After obtaining the values of the two learning models, thus the hypothesis test is carried out using the t test as follows:

$$t = \frac{14,100 - 10,833}{3,7263 \sqrt{\frac{1}{30} + \frac{1}{30}}}$$

$$t = \frac{3,267}{3,7263 \, .0,245}$$

$$t = \frac{3,267}{0,913}$$

$$t = 3,578$$

In accordance with the rules of using the t test, it can be formulated: The hypothesis is accepted if $t_{count} > t_{table}$ where t_{table} is obtained from the t distribution value by:

dk = ($n_1 + n_2 - 2$).
= (30 + 30 – 2)
= 58
Df = 40 in the distribution table t is 1,68
Df = 60 in the distribution table t is h 1,67

Df = 58 with the following formula:
(58 – 40) : (60 – 40) = (x – 1,68) : (1,67 – 1,68)

$$\frac{18}{20} = \frac{x-1,68}{-0,01}$$

20 (x – 1,68) = (18) (-0,01)
20x – 33,6 = - 0,18
20x = -0,18 + 33,6
20x = 33,42
x = 1,671

From the analysis of the difference in the average count obtained is the t-value = 3.578 while the value of the table for the significant level of 0.05 and 58 degrees of freedom is 1.67 means 3.578> 1.67. Then the hypothesis is accepted. In other words the data shows that the physics learning outcomes of students taught using the Discovery learning model are better than the physics learning outcomes of students taught using conventional learning models.

5. Discussion

From the description of the results of the study, it was seen that the learning outcomes of students of class X-2 (experimental class) obtained $\bar{X}_1$ = 14.1000 and S1 = 3.977. While in class X-3 (control class) obtained $\bar{X}_2$ = 10.8333 and S2 = 3.4574. So, we get Sgab = 3.7263. In normality testing, the experimental class calculation results obtained Lo = 0.1529. While the critical value of L for the Liliefors Test with n = 30 and the actual level α = 0.05 is 0.1610. Whereas the control class obtained Lo = 0.1314. And the critical value of L for the Liliefors Test with n = 30 is 0.1610. Therefore, both samples come from populations that are normally distributed.

In the homogeneity test obtained F_{count} = 1.46 while F_{table} values obtained from the F distribution with α = 0.1 and dk (29.29) is 1.85. Therefore, both samples come from homogeneous or equal populations. Hypothesis testing from the analysis of the difference in the average count obtained t_{count} = 3.578. While the value of the table for the significant level of 0.05 and the degree of freedom 58 is 1.67. This means t_{count}> t_{table} (3,578> 1.67). Then it can be said that the hypothesis is accepted. In other words, the data shows that the physics learning outcomes of students taught using the Discovery learning model are better than the physics learning outcomes of students taught using the conventional model.

The above facts indicate that learning by using the Guide Discovery model is better and effective for learning physics. This has been proven to improve student learning outcomes. This is understandable because through learning activities using the Guide Discovery model, students can help each other in solving problems and students can express problems faced using question paper so that the learning outcomes achieved are better than learning using conventional models that merely expected students to see and listen the teacher explanations.

6. Conclusion

Based on the results of research obtained from data analysis and hypothesis testing, it can be concluded that there are differences in student physics learning outcomes using guide discovery models to conventional models. An increase in student physics learning outcomes after applying the guide discovery learning model can thus be concluded that learning using the Guide Discovery model affects student physics learning outcomes at MAS Al-Washliyah Medan.

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