



Implementation of Physics Learning by Using the Guided Inquiry Method on the subject matter of Ohm's Law and Series-parallel Circuits, Effectiveness in terms of Learning Outcomes, Involvement and Constraints

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ABSTRACT

This study aims to determine: (1) the effectiveness of the learning of physics using guided inquiry methods in terms of improving student learning outcomes, (2) Does the implementation of learning physics using guided inquiry on the subject of ohms law, series and parallel circuits can be involve students, (3) what obstacles or difficulties experienced by students in the implementation of learning physics using guided inquiry on the subject of ohms law, series and parallel circuits and how it can help students to overcome obstacles or difficulties faced by students in learning. The research was carried on in high school Karanu Waikabubak, West Sumba-NTT on 29 April 2011 until 11 May 2011. Object of research are 15 students in select classes Xd researchers based on the results of a pretest that was done of students as treatment or treatment that is given researcher. Data collection includes: pretest, posttest, learning activities with guided inquiry method using worksheets, student involvement Sheet observations, and interviews. The results showed that the learning of physics using guided inquiry on the subject of ohms law, series and parallel circuits: (1) The effectiveness of learning physics using guided inquiry methods in terms of student learning outcomes by using a test analysis of dependent T- test level = 0.05 (2) lack of involving students in all learning activities using the methods of guided inquiry, (3) know the obstacles or difficulties the student and knowing how to cope with natural constraints on students.

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1. INTRODUCTION

Education is an effort to guide and help students reach maturity. Education can also mean influence, assistance or demands given by people who are responsible for students, education can be said to be a process and a result.

Physics or science can be viewed as a unit of processes, attitudes, and results[1]. Physics learning is one of the subjects given at the junior and senior high school levels in Indonesia[2]. Physics is a part of science that studies natural phenomena and phenomena empirically, logically, systematically and rationally which involves scientific processes and attitudes[3]. When studying physics, students will be introduced to physical products in the form of materials, concepts, principles, theories, principles and laws of physics[4]. Students will also be taught to experiment in the laboratory or outside the laboratory as a scientific process to understand various subjects in physics[5]. Things that are also developed during the teaching and learning process of physics are scientific attitudes such as honest, objective, rational, critical skepticism and so on.[6].

Based on the results of observations made by researchers at the Karanu Waikabubak Private High School, West Sumba-NTT, in fact in teaching and learning activities (KBM), teachers in teaching physics materials still use conventional learning using the lecture method where students only listen and record things that are considered It is important and students tend to be required to memorize formulas, theories and laws only which causes students to feel bored and bored so that it has an impact on student understanding that is less than optimal.

Many students experience obstacles or obstacles in the learning process, especially physics subjects on the concept of electricity[7]. The concept of electricity is a concept that is quite important in the physics learning curriculum[8]. But in fact, not a few students experience difficulties, especially in applying the concept of ohm's law, series and parallel circuits in various problems[9]. This is because in teaching at school, students are not directly involved in finding these laws, so that once students are faced with problems that require analysis, students have difficulty solving and finding solutions to why something can happen. In addition, until now the learning methods used by teachers tend to not pay attention to students' thinking skills and do not involve students actively in the learning process.[10]. The learning process applied by the teacher in the classroom greatly affects the success of students in learning[11]. This is influenced by many factors including the use of an inappropriate learning model[12]. Therefore, it is necessary to apply a learning model that can improve student learning outcomes and involve students actively[13].

To overcome the problems above and at the same time provide direct experience to students, as an alternative, one of the constructivist learning methods is to apply the guided inquiry method. Through inquiry learning, students can build their own knowledge and be involved in a series of activities carried out[14]. The guided inquiry approach is an inquiry approach where the teacher guides students to carry out activities by asking initial questions and leading to a discussion[15]. Teachers have an active role in determining problems and the stages of solving them[16]. Guided inquiry is usually used especially for students who have no experience teaching with an inquiry approach[16]. In the early stages of teaching, more guidance is given in the form of guiding questions so that students are able to find their own direction and the actions that must be taken to solve the problems given by the teacher. made in the LKS. Therefore, worksheets are made specifically to guide students in conducting experiments and drawing conclusions[17].

The targets that can be achieved in this guided inquiry method are to explore and raise students' understanding of the learning material being studied and to make students actively involved in the classroom during the learning process.[10]. The use of the guided inquiry method is expected to help students to be more independent, especially in student involvement and understanding the material in physics learning[18]. If the learning activities with the guided inquiry method are carried out properly, it is hoped that the objectives as stated above will be achieved, and it is hoped that they will be able to improve learning outcomes.[10].

Thus, based on the description of the problem above, is the learning process using the guided inquiry method?[19]able to involve students in the learning process and their effectiveness in terms of student physics learning outcomes as well as the constraints experienced by students in the implementation of the guided inquiry method[20]. This will be investigated in this study. So based on the description above in this study the researcher gave the title "Implementation of Physics

Learning Using Guided Inquiry Methods on the subject of Ohm's Law, Series and Parallel Circuits, Effectiveness in terms of Learning Outcomes, Engagement, and Obstacles".

The objectives to be achieved through this research are to increase the effectiveness of learning outcomes, the involvement of class Xd students at SMA Swasta Karanu Waikabubak, West Sumba through learning the subject matter of Ohm's law, series-parallel series with guided inquiry methods and knowing the obstacles and how to overcome them. The benefits of the research are: 1. For teachers and prospective teachers, this research can be used as an additional insight in managing physics learning using the guided inquiry method, especially on the subject of Ohm's law, series and parallel circuits and as teacher input in improving the quality of education in his class. 2. For students, this research is expected to be an experience for them in building their own concepts and knowledge, especially in learning physics. 3. For schools, the results of this study serve as information material for schools in an effort to improve the quality of education, especially in learning physics.

2. RESEARCH METHOD

2.1 Instruments for collecting data

2.1.1 Student Engagement Observation Format

2.1.2 Written test, there are two kinds of written test instruments, namely: 1. Pre-Test, 2. Posttest

2.2 Data analysis technique

2.2.1 Student learning outcomes

The increase in student learning outcomes is known by comparing the results of the pretest and posttest. Students' answers in the pretest and posttest were checked and scored for each question[21]. After students' answers are scored, then the scores obtained by students are entered in the following table: Then the data obtained were analyzed using the dependent T-Test with the following mathematical formula:

$$T_{\text{depen}} = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{\sum(D)^2 - \frac{(\sum D)^2}{N}}{N(N-1)}}} \quad (1)$$

Information :

= Average score of pretest

= Posttest average score

D = The difference between the scores of each subject (X - X) N = Number of pairs of scores

Df = N - 1

2.2.2 Student engagement

2.2.2.1 Student involvement in all group activities

The percentage of each student is calculated by the equation:

$$\text{Percentage} = \frac{\text{skor seluruh kegiatan}}{\text{jumlah seluruh kegiatan}} \times 100\% \quad (2)$$

The average percentage of students in the group is calculated by the equation:

$$\text{Percentage} = \frac{\% \text{ rata-rata siswa}}{4} \times 100\% \quad (3)$$

2.2.2.2 Student involvement based on the type of activity in the group

The level of student involvement in the group can be qualified into five levels, namely very high, high, sufficient, less, very less[22].

2.2.2.3 Quality Involvement of students in groups for each correct answer

For the percentage of the quality of student involvement for each correct answer can be calculated as follows: $\% = \frac{\text{skor seluruh kegia tskor total jawaban siswa yang benar}}{\text{skor maksimum}} \times 100\%$ (4)

2.3 Interview

To find out the student's constraints, it is done with an interview format in learning by using the guided inquiry method.

3. RESULT AND DISCUSSION

3.1 Student learning outcomes

Table 1. Data on the pretest and posttest scores of class Xd students.

Student Code	Pretest score (X ₁)	Posttest score (X ₂)	D = pre-post	D ²
	55	89	-34	1156
4	53	91	-38	1444
12	32	93	-61	3721
14	68	79	-11	121
15	57	73	-16	256
19	25	70	-45	2025
23	34	60	-26	676
26	55	86	-31	961
29	37	68	-31	961
31	30	85	-55	3025
32	39	92	-53	2809
34	31	76	-45	2025
41	47	115	-68	4624
35	36	79	-43	1849
= 14	=599	= 1156	= -557	= 25653

Based on the calculation results obtained the value of $T_{real} = 9.087$ while at a significant level of 0.05 from table T, the critical value is 2.110. Because $T_{real} > Critical$. So it can be concluded that there is a significant increase in learning outcomes. Therefore, it can be said that learning with the guided inquiry method is effective.

3.2 Student Engagement

Table 11. Involvement of each student for all activities in the group

Amount activity	Group name	Student code	Total involvement in all activities				Number of involved an	Percentage (%) rounded up
			Worksheets 1	Worksheets 2	Worksheets 3	Worksheet 4		
Worksheet 1 6 keg	Ex. 1	4	4	6	-	-	10	34
		14	5	7	8	7	27	90
		15	5	5	-	-	10	34
		41	6	8	8	-	22	73
Worksheet 2 8 keg	Ex 2	19	5	7	7	5	24	80
		32	6	7	8	5	25	83
		26	-	7	-	7	14	47
		31	-	2	4	3	9	30
Worksheet 3 8 Keg	Ex. 3	34	5	7	7	5	24	80
		21	4	2	-	6	12	40
		1	-	7	7	7	21	70
		35	-	7	8	7	22	73
Worksheet 4 8 keg	Ex 4	12	5	7	7	-	19	63
		23	5	8	5	7	25	83
		29	4	7	7	6	24	80
		= 30						

Table 12. Qualifications for involvement in the whole group

Group name	Student code	Number of engagements	Percentage (%) rounded up	Percentagegroup (%)	Qualification	% average (rounded up)
Ex. 1	4	10	34	58%	Enough	
	14	27	90			
	15	10	14			
	41	22	73			
	19	24	80			
Ex 2	32	25	73	60%	Enough	
	26	14	47			
	31	9	30			
	34	24	80			
Ex. 3	21	12	40	66%	Enough	65%
	1	21	70			
	35	22	73			
Ex 4	12	19	63	75%	Tall	
	23	25	83			
	29	24	80			

Table 13. Qualification criteria for the level of involvement in all activities in the group

Engagement qualification	interval	Group engagement	%
Very high	76 - 100		
Tall	66 - 75	1	25%
Enough	56 - 65	3	75%
Not enough	36 - 55		
Very less	<35		

Based on student involvement for all activities (table 11-13) above, the level of student involvement in all activities in the group is only one group whose involvement is highly qualified in all activities, namely group 4 with a percentage of 75%. Meanwhile, groups 1, 2 and 3 are categorized as quite involved in all activities carried out using LKS, the percentages are 58%, 60%, 66%, respectively. For overall student involvement in the group the total percentage obtained is 65% qualified enough to involve students in groups in the implementation of learning using the guided inquiry method on the subject of Ohm's law, series and parallel circuits.

3.2.1 Student involvement based on the type of activity in groups

Table 14. Engagement sheets for each type of activity

Type of activity	Students who are involved in each activity in the group				Frequency	% (rounded right)	
	Worksheet 1	Worksheet 2	Workshee t 3	Worksheet 4			
1 Reading worksheets	11	12	11	10	44	94	
2 Formulate a hypothesis	-	8	3	5	16	45	
3 Answer the question	7	-	-	-	7	64	
4 Measuring equipment used	-	10	10	7	27	73	
5 Designing experiments	-	11	-	-	11	73	
6 Assembling and assembling tools	10	15	11	8	44	94	
7 Doing an experiment	8	12	9	8	37	79	
8 Observing the experiment	11	15	11	10	47	100	
9 Analyze data	-	9	8	9	26	72	
10 Draw a conclusion	6	-	9	4	19	63	
=10 students for each activity	11	15	11	10	□whole: 47		
% average						77%	

Table 15. Qualifications of student involvement for each type of group activity

no keg	Frequency	% (rounded)	qualification
1	44	94	Very high
2	16	45	Not enough
3	7	64	Enough
4	27	73	Tall
5	11	100	Tall
6	44	94	Tall
7	37	79	Tall
8	47	100	Very high
9	26	72	Tall
10	19	63	Enough

Table 16. Student involvement in terms of correct answers in groups

no keg	Type of activity	No correct questions in every activity in Group				freq
		No activity				
		Ex. 1	Ex. 2	Ex. 3	Ex. 4	
Worksheet 1	1.a Build the concept of strong current	1.1		1.1	1.1	3
		1.2				1
			1.3		1.3	2
		1.1		1.1	1.1	3
	1.b Building the concept of stress	1.2				1
		1.3	1.3	1.3	1.3	4
	1.c Building the concept of Barriers	1.1	1.1	1.1	1.1	4
		1.2				1
		1.3				1
	Worksheet 2	1. Formulate a hypothesis	2.1			
		2.2				1
		2.3				1
	2. Designing an experiment	2.a		2.a	2.a	3
		2.b	2.b	2.b	2.b	4
		2.c			2.c	2
	3. Experimenting		2.1		2.1	2
	4. Data analysis		2.1		2.1	2
		2.2			2.2	2
Worksheet 3	1. Summing up the steps activity		3.1			1
	2. Formulate the hypothesis	3.1			3.1	2
		3.2				1
		3.3				1
		3.4				1
	3. Analyze data	3.1		3.1	3.1	3
		3.2	3.2		3.2	3
			3.4	3.4		2
			3.5	3.5	3.5	4
			3.5			4
Worksheet 4	1. Formulate a hypothesis	4.1				1
			4.2			1
		4.3	4.3			2
			4.4			1
	3. Analyze data	4.1	4.1	4.1		3
		4.2	4.2			2
		4.3		4.3	4.3	3
		27	15	11	16	3
			44			
		correct answer all questions percentage Average (%)	61%	34%	25%	40%
			40%			

Engagement qualifications for the correct answers in groups on each activity are in the following table:

Table 17. Qualifications of involvement in terms of correct answers in groups

No. Group	Number of correct answers	% (rounded off)	Qualification Answer
Group 1	27	61	Currently
Group 2	15	34	Very low
Group 3	11	25	Very low
Group 4	16	40	Low

Table 18. Engagement qualification criteria for each correct answer in the group

Qualification involvement	interval	Number of groups	%
Very high	76 - 100		
Tall	66 - 75		
Enough	56 - 65	1	25%
Not enough	36 - 55	1	25%
Very less	<35	2	50%

Based on the results obtained in table (16-18) for each correct answer for each activity in the group, only one group is qualified enough to answer the correct questions in the group, namely group 1 with a percentage of 61% while for group 4 in less qualifications with a percentage of 40%, group 3 and group 2 are very poorly qualified to answer questions correctly with percentages of 34% and 25%, respectively.

3.3 Discussion

From the research that has been carried out at the Karanu Waikabubak Private High School, West Sumba-NTT, learning physics using a guided inquiry method approach on the subject of Ohm's law, series and parallel circuits assisted by LKS is a very good method or suitable to be applied to students. especially for students who have never received physics lessons with this guided inquiry method. Here students are given the opportunity to be able to work independently and be actively involved in learning activities using LKS. Although in this school the inquiry method is still difficult to apply due to various obstacles or obstacles experienced both from the school and from the ability and willingness of the students themselves. From school, because of the limitations of tools or facilities that do not support it, while some students still find it difficult and difficult to want to be involved in the learning process activities. However, some of the obstacles faced did not become a barrier in the implementation of this guided inquiry method.

4. CONCLUSION

Based on the data and the results of the research analysis, it can be concluded as follows: (1) The implementation of physics learning on the subject of Ohm's law, series and parallel circuits using the effective guided inquiry method, this is seen in terms of the learning outcomes obtained by class Xd students. Karanu Waikabubak Private High School, West Sumba-NTT. (2) The implementation of physics learning on the subject of ohm's law, series and parallel circuits in terms of student involvement is still sufficient to involve students in learning activities based on the results of data analysis obtained: a. Involvement for all activities is still sufficient to involve students in groups where the overall percentage obtained is 65%. This is because students are not familiar with the application of this guided inquiry method so that some students are still difficult to engage in learning activities. b. Student involvement in this type of activity can only involve students in reading LKS, designing experiments, installing and assembling tools and observing experiments with a

percentage of 94% each, installing and assembling tools 94% and observing experiments 100% qualified very high on activities while measuring equipment, conduct experiments. designed experiments with the percentages of 73%, 79% and 73% being highly qualified, respectively. Meanwhile, for other types of student activities, it is still qualified to be quite involved, namely answering questions and drawing conclusions, the percentage is 64% and 63%, less involved, namely formulating a hypothesis with a percentage of 45%. For the overall percentage obtained by students for this type of activity, 77% is highly qualified in involving students in OKM law learning activities, series and parallel series. d. Students have not been able to draw conclusions correctly to conclude the properties of series and parallel circuits.

The implementation of learning with the guided inquiry method: effective in terms of student learning outcomes, while in terms of involvement it is still sufficient to involve students to be active in all activities and answer the correct questions in this worksheet because students are still not accustomed to carrying out a series of activities with this guided inquiry method. so that students experience many obstacles and difficulties in addition to the limitations of tools that do not support the achievement of the expected goals in the implementation of this guided inquiry method. With the guided inquiry method helping students in overcoming the difficulties and obstacles they face, it is recommended for schools to provide supporting facilities or facilities, especially for experimental tools and for teachers or prospective teachers to be able to apply this guided inquiry method as an alternative in physics learning at school.

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