THE EFFECTIVENESS OF LEARNING IN THE LABORATORY TO INCREASE THE RESULT STUDIED PHYSICS STUDENTS GRADE X SMA NEGERI 1 KERUMUTAN

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Abstract

This research aims to know the effectiveness of learning in physics laboratory in improving cognitive and psychomotor learning result students, grade X SMA Negeri 1 Kerumutan 2011/2012 academic year on a circuit of direct current subject matter. The research was conducted using posttest-only control design research that consists of a control class and a class experiment. In this study, class X_B as class experiments with applying the learning in the laboratory and classroom control class with the X_C into conventional learning in the classroom. The research instruments used consisted of learning devices and instruments of data collection. Data collection techniques using the techniques of tests (written tests and performance tests).The Data is analyzed using inferensial analysis and descriptive. Through the analysis of inferensial with t test obtained $t_{count} > t_{table}$ or (4,041 > 2,024), so there is a significant difference to the results of the cognitive learning of physics students in class X SMA Negeri 1 Kerumutan who apply learning in the laboratory with a class that implements the conventional learning in class. A descriptive analysis of the results obtained result studied physics students in classes that implement learning in physics laboratory is higher than the class that implements the conventional learning in class. Absorption study of cognitive and psychomotor results are obtained on good category and the effectiveness of learning on effective category. Thus the study of physics aspects of psychomotor-containing effectively carried out in the laboratory.

Keywords: effectiveness of learning, physics laboratory, learning result, direct current circuits

Introduction

Physics Laboratory serves as a place of learning activities that require the special equipment that is not easily presented in the classroom. In other words, laboratories (physics, chemistry, and biology) serves as a learner in an effort to uncover the secret mimicking physicist nature in the form of the learning process. Therefore, headmaster, teachers, students and other related elements must be able to manage and utilize the physics laboratory effectively and efficiently, so as to improve the quality of the process and the results of learning physics for students (Sutrisno in Mahiruddin, 2008).

Laboratory activities in learning is used to achieve a variety objectives including cognitive, psychomotor, and affective objectives (Hofstein and Lunetta in Suma, 2005). Cognitive puspose relate to the learning of scientific concepts, develop problem-solving skills and increase understanding of the scientific method. Psychomotor objectives related to the development of skills in doing physics research, data analysis, communication, and collaboration skills. Affective objectives related to motivation to science, the response and the ability to understand the environment (Suma, 2005). However, the fact shows that there

are still many schools which do not have a complete lab facilities. It is caused by expensive tools and infrastructure for education, especially for the price of a physics laboratory equipment was a factor that most complain about the school (Zulkarnain in Mahiruddin, 2008).

Study result is the behavior occurring in area cognition. Learning process involving cognition includes activities since receipts of an external stimulus by sensory, storage, and processing in the brain information to the notice for information back until when needed to solve problems. Because learning by involving the brain and behavioral change consequently also occurred in the brain in form of ability certain by the brain to settle matters (Purwanto 2011). Next study result of the psychomotor domain is oriented to motor skills related of the body; action, who need coordination between nerve and muscle. So the psychomotor related to coherence, the muscles by cerebration so acquired level certain physical skills, for exaple skill in unpacked and installed engines, refit machine, and others (Yamin 2010). The word psychomotor associated with a motor or sensory perceptual-motor. So, domain psychomotor closely related to working muscle so as to cause motion of the body and its parts (Arikunto 2007).

The fact from the observations and interviews with the physics teacher SMA N 1 Kerumutan, noted that the physics learning activities of the school at low frequencies due to the limited equipment of laboratory appropriate to various subjects. The limitations of the tools in less than optimal utilization of laboratory. In the laboratory of Physics of SMAN 1 Kerumutan, have tools that support learning on the subject of optics and measurement only. So for material that should be loaded with experimental physics not implemented activities laboratory. This resulted in the understanding of students of the subject matter is only a concept, without finding those concepts through scientific work. The result of an interview on some students sman 1 kerumutan, in general also notes that activities carried out in a laboratory of learning which is still very low, so that the atmosphere of learning were tend to be boring and monotone. While modern science education especially of learning physics supposed to be accompanied with the activities of the laboratory, because only by means of committing themselves as this is students can be trained to apply the scientific method and scientific attitude (Irianti, 2006).

Table 1. Results of the test material is a direct current circuit grade X SMA N 1 Kerumutan 2010/2011 year.

No.	Score	Achievement of Students (%)
1	≥ 75	36,7
2	< 75	63,3

Based on data of table 1 are obtained from the physics teacher SMAN 1 Kerumutan, shows the results of student learning on the subject of circuit of direct current is still low. From this basis, the research done with the title The Effectiveness Of Learning In The Laboratory To Increase The Result Studied Physics Students Grade X Sma Negeri 1 Kerumutan. The purpose of this study is to: 1) determines the difference between the results study of physics students through laboratory activities in class X SMAN 1 Kerumutan on subjects of direct current with control class 2) to know the effectiveness of the activities laboratory at SMAN 1

Kerumutan in improving achievement studied physics students class X on the subject of direct current circuits.

Literature Review

According to Cockman (2010), The physics laboratory is intended to provide experience in the manipulation of instruments and materials, which is thought to help students in the development of their conceptual understanding. It can be said that the laboratory can form a closed or open. Consortium of educational sciences have formulated definitions of laboratory as a means, the infrastructure and mechanism that support the material in the classroom through hands-on experience in shaping the skills, understanding and insight in teaching, as well as in the development of science and technology. Thus, to find out the effective or whether learning physics at a school by using a laboratory can be seen from the results of the evaluation were held after learning end.

According to a study conducted by Sobiroh (2006) indicating that can increase the laboratory studied the biological Student 2nd grade school district Banjarnegara. Similar results also obtained Listianingrum (2009) that the use of tools can learn physics laboratories increase Grade 7 SMP N 3 Godean Sleman Jogjakarta. According to the research conducted by Hakim et all. (2008) in efforts to improve the quality of learning learn physics by based laboratory is also increasing learning result students.

Research in SMP Kuningan District by Nur (2011) about effectiveness the earning process sains which includes the internal factor, consist of motivation learning sains and external factors related management lab, get that motivation learning students excellent and management category of good. Laily et all (2012) Prove that laboratory activities based learning inkuiri effectively applied to material human respiratory system. Enrique et al.(2012) make research to examines the effectiveness of the collaborative learning environment in the classroom. His find that as the classroom environment becomes more interactive and the classroom quality of interactions increases and students have better understanding of the subject matter.

Based on the results of these findings indicates that the activity of laboratotium especially for subjects of physics will be effective in improving motivation, interaction and laboratory management. In relation to this research focuses on the activities of the laboratory that is effective in improving the outcomes studied physics for high school students on a circuit direct current.

Methodology

This research was carried out in SMA N 1 Kerumutan even semester academic year 2011/2012. This research was quasi experimental research with posttest-only control design (Sugiyono, 2010), because in particular gives the treatment (treatment) to a group of (class) students as in table 2. The treatment given in the form of use of the device in a laboratory of learning physics with experimental methods of cognitive and psychomotor aspects of students. The population in this study are students of class X SMA N 1 Kerumutan consist of 60 students and distributed into 3 parallel classes. Sampling techniques in the research of its

homogeneity testing done on the population. Test results of its homogeneity will be taken two homogeneous class to serve as a control class and a class experiment. Experimental and control classes were determined by the random sampling, the techniques cluster random sampling by means of a raffle (Sugiyono, 2011).

Table 2. The design of research

Groups	**Treatment** (independent variable)	**Posttes** (dependent variabel)
Experiment	X	T_1
Control		T_1

Nazir, 2005.

Description: X = Treatment through learning with the use of cooperative learning in physics laborotory
T_1 = learning Results students

Instrument used on this research which is, learning device consisting of syllabus, lesson plan (LP), worksheet students (WS). Instrument data used is the test study result of the cognitive and performance tests. This instrument aims to know absorption, effectiveness, and cmpleteness learning students. Study result of the test arranged based on an indicator of learning. Data collection techniques in the research of test technique is given to a group of experimental and control, Data is collected from the tests results of the study conducted after learning through laboratory activeities to over.

Analysis of data conducted based on the test given to solve problems research (Nazir, 2005). Analysis of data used is descriptive and inferential analysis. Descriptive analysis with described data has been accumulating to make inferences generally accepted or generalization (Sugiyono 2011). With tell study result of the students learn that includes: absorptiveness, effectiveness, and completeness of learning. Category absorptions and effectiveness learning, were obtained from students study result of the used kritetia from, table 3. Completeness of learning students and indicators were expressed completed if it reaches value ≥ 75 %, while completeness of learning classical and matter learning reach if got ≥ 85 %.

Table 3. Categories of absorption and effectiveness of student learning

Absorption Interval (%)	Absorption Category	Effectiveness of Interval (%)	Categories Of Effectiveness
85 – 100	Very good	91 – 100	Very Effective
70 – 84	Good	81 – 90	Effective
50 – 69	Good enough	71 – 80	Effective Enough
0 – 49	Less good	61 – 70	Less Effective
		< 60	Not Effective

Depdiknas 2006.

Analysis inferential through test normality to see if samples normally distributed or not. Data are normal distribution if significance > 0,05. While test homogeneity variance aims to see if third group population selected have variance homogeneous or not. Next value F obtained compared with F_{tabble}. Testing criteria if $F_{count} < F_{tabel}$, then variance data homogeny and $F_{count} \geq F_{tabel}$,; hence variance data not homogeneous. Test hypotheses used is t test to independent-sampel. The tested hypothesis Ho: there was no significant relationship between cognitive learning results students class X SMA N 1 Kerumutan with use of the physics laboratory. Ha: there is a significant relationship between the cognitive learning of physics students of class X SMA N 1 Kerumutan with use of the physics laboratory. Ho accepted if $t_{count} \leq t_{table}$, furthermore Ho is rejected.

Research Finding

Absorption experiment and control groups of students on a series of direct current subject matter according to table 4.

Table 4. Absorption of students on the subject matter of direct current

Description of subject matter	Experiment class		Control class	
	Absorption (%)	Category	Absorption (%)	Category
Meeting I	80,00	good	50,83	good enough
Meeting II	86,67	Very good	67,00	good enough
Meeting III	80,00	good	64,17	good enough
Average absorption (%)	81,45	good	59,70	good enough

Based on table 4 can be seen that absorptiveness students at each meeting occurring change on experiment class and control class. On class experiment average absorptiveness overall is 81,45 % with good category. While in class control average absorptiveness is 59,7 % with good enough category. It means that average absorptiveness from the experiment class better than to control class.

The effectiveness of learning are determined based on the students absorbtion, so the obtained the effectiveness of learning in subject matter direct current circuits in class experiments and control as shown in table 5.

Table 5 Effectiveness of learning

Description of subject matter	Experiment class		control class	
	Absorption (%)	Category	Absorption (%)	Category
Meeting 1	80,00	effective	50,83	effective enough
Meeting 2	86,67	very effective	67,00	effective enough

Meeting 3	80,00	effective	64,17	effective enough
Average absorptiveness (%)	81,45	effective	59,70	effective enough

Based on Table 4 and 5 the students average absorbtion in class experiments overall is 81,45% with the highest effectiveness and effective category occurred at a meeting with a percentage of 86.67% by very effective category. While in class control the students average absorbtion is 59.7% with effective enough category and the highest effectiveness occurs at a meeting 3 as big as 67% with effective enough category. So learning the subject matter direct current Circuits in class experiments better when compared to the control class.

Completeness cognitive learning results of students in the class and grade control experiments are shown in table 6. Here shows that in class experiments, students study classical completeness is 75% and included into the category of not completely. While in the control class, Completeness klasikalnya is 5% and is included in the category are not completely well. But from the amount of the percentage completeness, note that students who master the subject matter on a class experiment a lot more compared to the control class. completeness for the purpose of learning can be seen in Table 7.

Table 6. Student learning outcomes completeness

subject matter	Experiment class		control class	
	Complet (%)	Not complet (%)	complet (%)	Not complet (%)
meeting 1	60	40	20	80
meeting 2	70	30	25	75
meeting 3	60	40	20	80
Classical completeness	75	25	5	95

Table 7. Cognitive indicator learning completeness

Indicator	Learning Completeness					
	Experimen Class			Control Class		
	Students completed	Completenes s (%)	Category	Students completed	Completeness (%)	Category
1	15	75	c	5	25	nc
2	16	80	c	9	45	nc
3	19	95	c	13	65	nc
4	18	90	c	11	55	nc
5	17	85	c	15	75	c
6	11	55	nc	8	40	nc
7	17	85	c	13	65	nc
8	16	80	c	12	60	nc
9	19	95	c	13	65	nc
10	17	85	c	17	85	c
11	17	85	c	16	80	c

12	11	55	nc	9	45	nc
13	15	75	c	6	30	nc
14	19	95	c	17	85	c
15	16	80	c	11	55	nc
subject matter completeness		86,7	c		27	nc

Description: c = complet, nc = not complet

Based on Table 7 can be seen that the percentage of completeness learning materials in experiment class was 86,7% with the number of indicator has been completed as many as 13 indicators and 2 indicators not completeness. While the control class completenes indicator is 27%. Indicator subject learning in the experiment class was completenes because the percentage of completeness as big as 85%. While in the control class, Indicator subject learning was found not completenes due to the percentages completenes as big as 85%.

Students on absorption through the psychomotor learning physics laboratory seen in Table 8.

Table 8. Psychomotor absorption

Percentage (%)	**Absorption category**	**Effectiveness category**
84,01	good	effective

Table 8 shows that the average absorbtion psychomotor skills class X_B in the category of good, i.e. 84,01%. It means students ability to absorb or over subject direct current circuit of 84,01%. Individually almost 50% of the 20 students that mastery of the material is included in the category very well so it can be said the learning material can be absorbed students for good. Categories of learning effectiveness, based on the average absorbtion of the student psychomotor skills according to Table 8. The table shows the rate of success of learning through activities of the physics laboratory at any indicator, where the average absorbtion students included in the effective category.

Table 9. Psychomotor Learning Indikator Completeness

Indicator	**Total Student Complet**	**Completeness (%)**	**Category**
1.	20	100	Complet
2.	17	85	Complet
3.	13	65	Not complet
4.	14	70	Not complet
5.	15	75	Complet

Based on Table 9 there are three indicators of learning achieved over 75% have obtained the students. That is, the third indicator of learning has been completely by students. Since there are only 3 from the 5 indicators has been completed, then the completeness subject matter by learning through this physics laboratory activities are still under 85%. On the experimental class is students who do not complete because the students are still awkward with the activities of the laboratory, and have the ability to calculate who is still weak.

Implication

Laboratory activities on the learning process every material that is taught to help students to better understand the material in depth. While in class without the activities of the laboratory, students have difficulty to understand. Students in the control class accepts material from teachers only, in the absence of laboratory activities as supporting understanding of students. Students tend to understand about the material being taught while still in the classroom. So eskperimen class have absorbtion higher than the control class. Thus learning through effective laboratory activities compared to learning without subject matter lab activities on direct current circuits.

Classical completeness for learning indicator on subject matter circuit direct current to experiment class obtained 86,7 % with complet category and control class not complet category as big as 27 %.

The cause is not the completeness of 2 indicators of learning. Indicators of learning is applied the equations of electrical resistance in resolving the question a matter related to electrical resistance. Based on the criteria of completeness, this matter is not complet. This problem is included in the application problem (C3). This can be overcome by giving an example problem about enough and provide homework that supports student understanding of the application of the formula. Iindicator learning 12 includ domain of knowledge, the students could make the principle of parallel obstacles to some closed. Ketidaktuntasan due to understand the principle siswa less parallel and series of obstacles. So if given a choice question about parallel series principle, the students difficult to classification in accordance. The cause this can be overcome with provides guidance maximal in doing an experiment.

The interview with students who do not succeed, five students declare not used after learning through laboratory activities namely two students only for laboratory activities by a demonstration, three students prefer laboratory activities removed and replaced by an explanation by teachers and multiply exercise it. Thus indicating although most students learning well able to follow in the laboratory, but there are some small low psikomotornya aspect.

Overall student learning activities can be said to be good, enthusiasm and passion in the following learning activities. Students are also actively interact with the teacher and fellow students are also among themselves. So learning is said to be effective if viewed from a learning process in which occurs the interaction between teachers and students. The results obtained are also in line with the research Sobiroh (2006), Listianingrum (2009) and the Hakim, et al (2008).

From the data obtained, although absorption has not been categorized very well and is very effective. Completeness also has the results obtained largely support the research from (Laily et all 2012; Nur 2011; Enrique 2012).

Analysis inferential by test hypotheses

The testing of hypotheses done by means of statistical through the independent-sample t-test. This test to see whether there are differences between the class learned by the application of learning through a laboratory with class by the application of conventional (learning without activity laboratory). Obtained the result of reckoning 4,041 = t count. While t_{table} in accordance with provisions formula t-test pooled variant for making significance 5 % is t_{tabel} = 2,024. Based on criteria testing against the results obtained t_{count} > ttabel (4,041 > 2,024); so based on comparative t value, so that Ho rejected and H1 accepted. So it can be noted that there is a significant difference between the results of the cognitive learning of physics students of class X SMA N 1 Kerumutan in learning through laboratory activities with the learning activities without a laboratory. The application of learning through laboratory activities can be effective because the application of learning through laboratory activities shows that there is a significant difference.

Conclusion

Based on the analysis of data research that has been performed by applying learning through its laboratory physics on the subjects of the circuits direct current obtained conclusion 1). The effectiveness of learning of students in experiments class have effective categories. While the effectiveness of learning of students in controls class were effective enough. 2). There is a significant difference between the results of the cognitive learning of students of class X SMA N 1 Kerumutan with learning through activities of the physics laboratory of learning without laboratory activities. 3). based on the analysis of descriptive and inferensial, learning through laboratory activities were effective.

Suggested of all this research; 1) the application of learning through its laboratory supposed held to material physics load with activities experiments in the learning process, that would give skill psychomotor and improve study result of the cognitive students. 2) learning through its laboratory need guidance intensive from a teacher for students from in experiment and helped students in discussion class that students understand the link between his experiments with concept taught. 3) management time and granting sheets that adequate required to attain completeness learning students. 3) teacher should be creative for making tools experiment simple.

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