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The Effect of the Practice-Based Learning Model on Science Process Skills and Concept Comprehension of Regulation System

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Abstract

The aim of this research was to analyze the influence of practice-based learning model on the concept of regulation system of the science process skills and concept comprehension. Research method was a quasi-experimental with the matching pretest-posttest design. The research population consisted of all students in class XI in one of senior high school in West Sumatra with a total population of 150 students. Sampling technique was a cluster random sampling. Sample consisted of 26 students of class experiment and 26 students of class control. The instrument consist of a science process skills and concept comprehension test. The data was analyzed using the Mann-Whitney test, Normalized gain. The results showed that there was a significant difference in science process skills and concept comprehension between the experimental and the control class. In conclusion, the practice-based learning model on the concept system of regulation improved the science process skills and concept comprehension.

Keywords*: practice-based learning model, concept comprehension, regulation system, science process skills.*

1. Introduction

Science is basically a process of discovery. This is consistent with the background of the importance of science in the (Depdiknas, 2006: 451) which states that the Natural Sciences deals with how to find out (inquiry) about the systematic nature, so that science is not just a mastery of knowledge in the form of a collection of facts, concepts or principles, but also a process of discovery. Learning science should be more emphasis on the process, in which students are active during learning to build knowledge through a series of learning activities that are meaningful to students . Biology as one of the areas of science provides a variety of learning experiences to understand the concepts and processes of science. Learning activities that develop skills important process for students to understand biology as a whole. According to German (1996 in Karamustafaoğlu, 2011: 26) there are two skills that are used in the world of science is basic science process skills related to the ability to conduct empirical - inductive reasoning as well as providing basic skills in conducting scientific investigations and integrated science process skills associated with ability to perform the hypothetico-deductive reasoning. These skills are used to solve problems or conducting experiments. Science process skills can not be separated in practice understanding of the concepts involved in a study and application of science especially biology. However, the reality on the ground suggests that the biology of learning for this still tends to be limited to a collection of facts or concepts comprehension and principles. Based on the results of TIMSS (Trends in International Mathematics and Science Study), in 2007 in Science, Indonesia was ranked 35 of 49 countries and well below the average of the 500 International (Mullis, 2009) and science literacy achievement in PISA (Programme for International Student Assessment) in 2009, Indonesia ranks 60 out of 65 countries (PISA, 2009). This suggests that the processes specific to the skills of science students Indonesia is still low. Learning objectives are built mostly still limited to the dimensions of knowledge (knowledge), while for the process dimension and attitude is still not very developed. Problems created by the teacher also did not bring the skills that students must be developed .

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One way to develop a scientific attitude is the practical based learning. According to Rustaman (2003: 160) practical based learning is an integral part of teaching and learning activities, especially Biology. Based on field observations, the researchers found that the practical activities enhance students' interest in learning biology. This is alongside with the statement from Woolnough & Allsop (Rustaman, 2003: 160) who suggests four reasons for the importance of practical science, namely (1) practical generates motivation to learn Science, (2) practical develop basic skills to do the experiment, (3) practical becomes a means to learn scientific approach, and (4) practical supports subject materials. The concept of the regulatory system consist of the nervous system, sensory organs and hormone systems. This study is limited only to the concept of the nervous system and sensory organs. The concept of the nervous system and the senses are intimately associated and related to daily life, and can be taught through practical based learning. However, based on the observations at several schools in Lima Puluh Kota District West Sumatera revealed that teachers rarely do practical work on this concept due to many reasons such as time constraints, the tools and materials used. In addition, the concept of the nervous system and the senses are considered quite complicated to conduct in practical based learning. However, in this concept there are many problems related to daily life, such as how the eyes can see according to the specific position, how the ear can hear, how the tongue can distinguish the taste of the food, how the nose can smell the food and drink can affect your appetite or drinking, as well as how the skin can feel the touch. The entire process involving the nervous system and sensory organs is important to understand by students as the main base in the process of Science.

The formulation of the problem in this research was how the practice-based learning on science process skill and concept comprehension of the regulatory system?.The general objective of this study was to analyze the influence of practical based learning on the concept of regulation system on the science process skill and concept comprehension.

2. Methods

Research method was a quasi-experimental with the matching pretest-posttest design (Fraenkel, Wallen, & Hyun, 2007: 271). The sampling technique used was cluster random sampling. This research had two variables include: 1) the independent variable was practice-based learning, 2) the dependent variable was a sciences process skill and a concept comprehension of students. The research population consisted of all students of class XI science in one of senior School academic in West Sumatra, amounting to 5 class, with a total population of 150 students in the school year 2012/2013. The sample consisted of two classes including classroom experiments using practice-based learning with 26 students and a control class that uses the verification practical learning by 26 students. Data collection technique was the science process skill test and concept comprehension test in the beginning and at the end. Research analysis using the Mann-Whitney test and Normalized gain (N-gain).

3. Results and Discussion

Results

Research data includes the average scores of the pretest and posttest and N-gain science process skill and concept comprehension. Recapitulation of the results of the study of the average pretest and posttest of science process skill can be seen in Figure 1 below and the recapitulation of the results of the study of the average pretest and posttest of concept comprehension can be seen in Figure 2.

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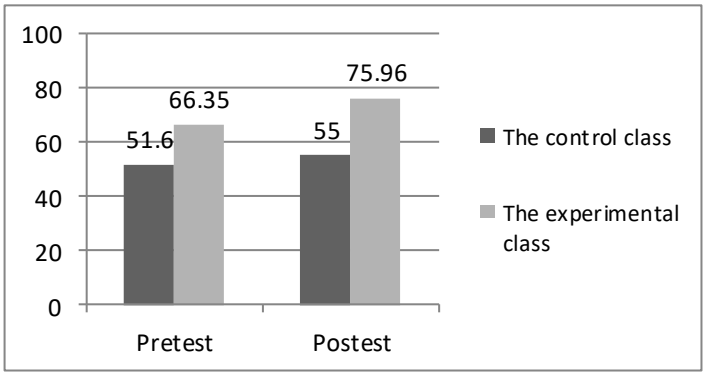

Figure 1. The average scores of pretest and posttest of science process skill

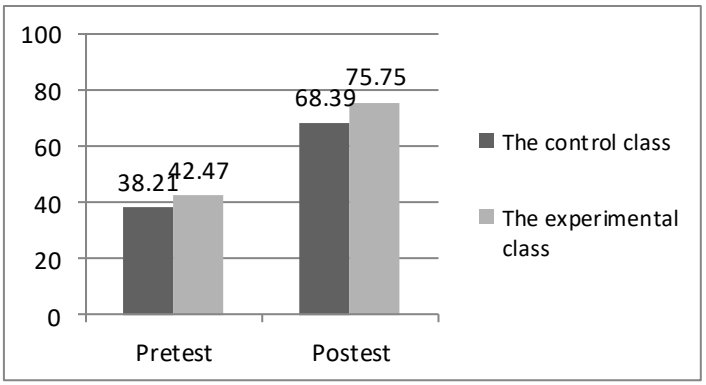

Figure 2. The average scores of pretest and posttest of concept comprehension

The average of N-gain for science process skill in the experimental class was 0.40 with the medium category and the average of N-gain for science process skill in the control class was 0.16 with the low category. These dataindicateN-gain of the experiment class was higherthanN-gain of thecontrol class.For the analysis ofN-Gain each indicatorscience process skillscan be seenin Figure3below. The average of N-gain for concept comprehension in the experimental class was 0.58 with the medium category and the average of N-gain for concept comprehension in the control class was 0.52 with the medium category.

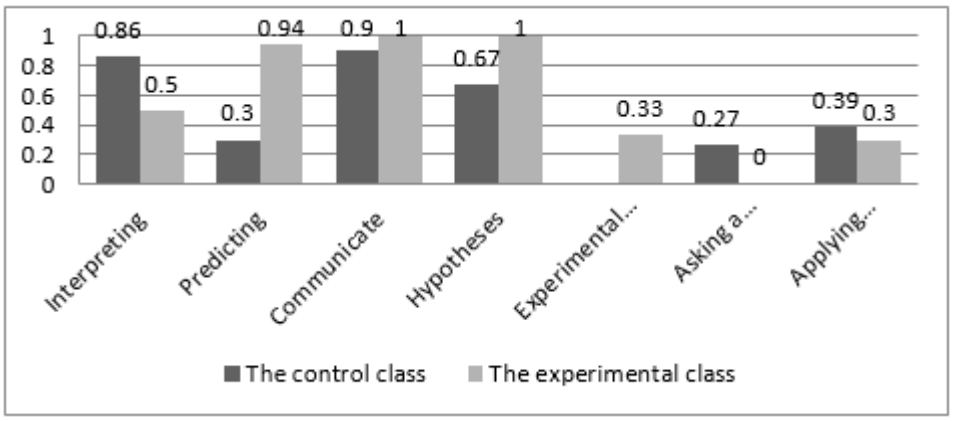

Figure 3. Recapitulation of N-Gain Every Indicator Science Process Skill of the Experiment Class and the Control Class

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The average score ofthe pretestandposttestof scienceprocess skillsandconcept comprehension analyzed with theMann-Whitney testforthe significance ofthe difference in averageas shown in Table1.

Table 1. Result of Test Mean Difference

Aspect	Test type	Level of significance	Criteria significant value	Conclusion
Science process skill	Pretest	0.275	0.05	Did not differsignificantly
	Posttest	0.001	0.05	Significantly different
Concept comprehension	Pretest	0.088	0.05	Did not differsignificantly
	Postest	0.049	0.05	Significantly different

Discussion

Based on analysis of data about science process skill in experimental class and control class, it can be seen that there was an influence of practice-based learning on science process skill and concept comprehension, the explanation about this result will be discussed in further report.

Science Process Skills

Based on calculations of data in Table 1 it can be seen that there is no significant difference in pretest of science process skills between the control class and the experimental class. On the contrary, there is significant difference in posttest of science process skill between the control class and the experimental class. The average N-Gain of science process skills on the experimental class higher than the control class. In the experimental increased science process skill shown by the average N-Gain of 0,40 with the medium category. While the control class was also an increase science process skill shown by N-Gain value of 0, 16 with a low category.

Practical based learning in the experimental class can improve science process skills because students are required to learn actively, where students find themselves learning concepts of direct experience through practice-based learning. This is in accordance with the opinion of Rustaman (2003: 101) that there is a close link between skills development process with the students' learning experience. Basic process skills and integrated process skills will be obtained by students through practical activities. It is also consistent with the theory put forward by Semiawan, Belen, & Tangyong (1986: 11) that what students gained through work activities, seek, and find out for yourself will not be easily forgotten, it will be embedded in the hearts and minds of students, the students will happy if they are given the opportunity to channel operation capability. Furthermore, learning through a practical made students got an achievement in science process skill, it was suitable with the result of study from Afinidar & Hamda (2017) that showed that the students achieved a good level (74.52%) in integrated science process skill through experiment in laboratory in chemistry concept; volumetric titration.

Analysis of N-Gain value of each science process skill indicators show the experimental class N-Gain has a value higher than the control class in indicators: prediction, communicating, hypothesize and experiment planning. However, the experimental class had N-Gain lower than controls class on indicator interpretation, asking questions and applying the concepts. Further analysis for some indicator science process skills in more detail are as follows:

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a. Interpretation

This ability is captured by using science process skills test in the form of multiple choice . Based on the analysis of the average N - Gain each indicator looks average N-Gain on the experimental class is quite low . It in because of the ability of the interpretation of the students have done quite well before learning that occurs after learning improvement is not so significant. Students have previously been able to interpret a series of observations contained in the instruments used. Interpretation capability is the ability to record any observations of a link between the observations, finding patterns or regularities from a series of observations (Rustaman, 2003: 94).

b . Prediction

Predictive ability is controlled by the ability of students to observe patterns or trends of the data to be able to apply assumptions or forecasts (Rustaman, 2003: 94). Based on the analysis of the average N-Gain indicator each science process skills class experiments have shown that the average N-Gain higher than the control class. This is because the experimental class students are accustomed to using the patterns of observations to draw conclusions.

c . Communicating

Indicator of ability to communicate is the ability to change a particular form of presentation to other forms of presentation, such as in narrative form to the form of tables or graphs and vice versa (Rustaman, 2003: 96). This indicator is captured by using science process skills test and observation sheets science process skills . On communication skills is seen if students can explain the experimental results and discussion questions well, discussing the results of the experiment and the discussion about the teacher. Based on the analysis of the average N-Gain experiment shows that the class has a higher gain values than the control class because for learning in the experimental class students are required to be able to present the results of his observations in the form of tables or graphs.

d . Hypothesize

Hypothesize a fundamental indicator of the ability to make a reasonable estimate to explain an event or a particular observation (Semiawan et al., 1986: 25). Based on the analysis of the average N-Gain experiments have shown that a class of N-Gain values higher than the control class as long as the learning activities students are required to be able to make provisional estimates of the phenomena to be observed during practical activities.

e . Experimental planning

The ability to plan an experiment is the ability to propose ideas regarding the tools and materials to be used , the object to be studied and the factors or variables that need to be considered (Semiawan et al., 1986: 27). Based on the analysis of the average N-Gain experiment shows that the class has a higher gain values than the control class for practical activities done before students are required to be able to determine which tools and materials to be used and the variables to be measured, then at the end of the activity was also conducted discussion of the variables that affect the experiment. This causes the students in the experimental class have the ability to plan experiments better than the control class.

g . Applying concept

Ability to apply concepts related to students' ability to explain events using the new concept that has been owned. (Rustaman, 2003: 96). This indicator is captured by using science process skills test. Based on the analysis of the average N-Gain seen that the value of N-gain low -class experiments. This is because there are some concepts such as the concept of the lens of the eye associated with the poorly understood physics lessons before

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students do so after learning there were still some students do not understand the concept clearly.

Overall average value of N-Gain classroom experiments using practical -based learning is more increased in the control class appeal. This fact shows that the science process skills can be developed through practical activities, in accordance with the opinion of Rustaman (2003: 101) that the practical is the best tool for the development of science process skills, because the practicum students are trained to develop all senses. It is also consistent with the results of research conducted by Firgiawan (2010: 94) which states that there is an increase in science process skills in class with semi- guided practicaloratory activities on the concept of the respiratory system.

Moreover, this result was also supported by Yadav & P.S.K.M (2013) that had a report about the impact of Laboratory Approach on achievement and process skills, he showed that the development of process skill were higher in the student who were taught by laboratory approach. Therefore the laboratory approach should be used in teaching and learning in Biological sciences. The students studied through laboratory approach were better in process skills, achievement and in practical test also. Ghumdia (2016) also said that there is significant difference between the science process skills acquisition test scores of students taught biology using practical activities method and those taught using lecture method.

Concept Comprehension

Based on the measurement and analysis of the data showed that the initial concept mastery of experimental class and the control class did not differ significantly, meaning that the two classes have not mastered the concept of regulatory systems. Later in the final test shows that there are significant differences between the control class with a class experiment. The average value of the experimental class was 75.75 , while the average value of the control class 68.39. This proves that the acquisition of control of the class concept experiment is higher than the control class . The acquisition of a higher concept comprehensions in the experimental class is believed to have students actively required to understand the concept of learning through a practicum. This is consistent with the implications of the constructivist view that knowledge can not be transferred intact from the mind of the teacher to student , but actively constructed by the students themselves through actual experience (Rustaman, 2003: 20). In practical -based learning students construct their own learning concepts that are tailored to the concept that has been there before. This is in accordance with the opinion of Ausubel (in Dahar, 1996: 112) which states that in order for a study to be meaningful, the new concept or new information to be obtained by students must be associated with the concepts that already exist in the cognitive structure of the students . This fact is also in accordance with that proposed by Semiawan et al. (1986: 14) which states that if the teacher just cram all of the facts and concepts to students as a result the students have a lot of knowledge but are not trained to find knowledge, are not trained to find a concept, not trained to develop science.

Through practical -based learning students participate actively to solve the problem and find a concept that accompanies a trial. This is consistent with the discovery learning theory Brunner (in Dahar, 1996: 103) which states that learning starts to look for solutions and the accompanying knowledge, generating knowledge that is really meaningful in and of itself gives the best results. In addition, the learning is done in groups so that students can discuss, exchange ideas and opinions with friends. Such learning more fun and not stressful for students. With the creation of fun and not stressful conditions, is expected to lead students to be more interested in learning the material regulatory system so that the concepts can be studied more easily understood. Results of other studies that support the increasing concept comprehensions through practical -based learning such as research Solehudin (2010: 72) about the problem-solving practical activities on the topic of sensory organs obtained results with the gain increased concept comprehensions by 0.71 in the high category. In this study, the researcher used a laboratory with problem solving activities to develop creative thinking, scientific attitude and concept comprehension. The result showed

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that a laboratory learning can develop that indicators. Therefore, it can be concluded that practical based learning can improve students' concept comprehension.

4. Conclusions

Based on the researchthathas beendone, itcanbeconcludedthat the practice-based learningdevelopscience process skills and concept comprehension.Based on the conclusionsthat have beendrawn, some recommendation can be made. Firstly, teacher should give additional assignments to students to make them more understand about the concept, Secondly, to other researchers, design a simple and attractive learning to improve students' science process skill. Thirdly, develop science process skill test in other biological materials to enrich students' science process skill in whole biology concepts.

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