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Students' Science Process Skills Through Generative Learning Model In the Topic of Light

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ABSTRACT

Science process skills is important to developing the quality of students' learning in science. This research aimed to determine the effect of generative learning model on students' science process skills of the topic Light. This type of research was pre-experimental with One Group Pretest-Posttest Design. The population of this research consisted of all students of class VIII in SMPN 5 Singkawang City. The research samples consisted of the students of class VIII E the total number of 20 students and the sampling technique used was simple random sampling. The research instrument used in this research was description test. Data were analyzed by using paired t-test. From the calculation results was obtained the value of $-t_{obtained} < -t_{critical}$ or $-21.36 < -2.093$, then H_0 was rejected and H_a was accepted at the level of significance $\alpha = 0.05$. So it can be concluded that there was an effect of generative learning model on students' science process skills in the topic of Light.

INTRODUCTION

Physics is a science that describes the human's efforts, findings, perception and intelligence collectively [1]. Physics phenomena that appear in the natural surroundings make the student's curiosity increase [2]. In order to gain better comprehension about the concept from physics phenomena, students must actively solving the problems in laboratory activities through observation, formulating the problems, planning the investigations, conducting the experiments, using tools to collect data, finding the answers, and make predictions and communicating the results [3].

To find the solution from problems in an experiment begins with an observation [4]. Students make observations to know the phenomenon or problems that occur directly, then prove it through experiment [5]. From the test results, informations used to solve problems were obtained [6]. The skills to acquire, develop knowledge and solve the problems of a phenomenon are called the science process skills [7]. Science process skills is very important to develop education of science as well as the quality of students' learning both in theory and experimenting ability [8]. One of the problems that exist in the process of physics learning today is the low quality of learning [6][9]. The quality of learning includes the skills of students in finding something new [10].

Physics is also still considered as a difficult subject to learn [11]. Students feel that in addition to understanding the concepts, students are also required to be able to use mathematical formulas to solve the physics problems [3]. One of the physics subject that difficult to learn by students is light subject [11][12]. Students often feel bored with teacher-centered learning [13]. Teachers often use lecture, question & answer, and assignments methods so students can only write and take notes from the teachers, without being directly involved in the process of discovering and developing knowledge according to their own ability [1][14]. Whereas each student has different characteristics, some have quick response and easy to understand, and some have slow response and difficult to understand [15].

Based on the interview results with natural science teachers in SMPN 5 Singkawang City show that students are less active in asking questions while learning in the class, students also rarely doing experiment so the students' science process skills are not developed. Considering the importance of science process skills in developing knowledge, it is necessary to implementing a learning model that makes students understand the subject not only by reading but doing activities to find new things [7][16]. One of the learning models that can be used is generative learning model. The essence of generative learning is that the human brain is not receive information passively, but actively constructing and interpreting information and then drawing conclusions based on that information [13]. Generative learning involves thinking activity [1]. Mentally thinking from someone who is doing generative learning will be reciprocal with his thinking process [15].

The stages of the generative learning model are as follows: 1) Orientation Stage. At this stage, the teacher gives change to the students for identify the topic which will be discussed and gives the idea concern to the topics, then teacher evaluate and classifies the ideas as starting point of learning to suggest the ideas, the students would be connect the experiences of learning which was experienced with the idea on the topic will be studied by themselves; 2) Disclosure of Ideas Stage. At this stage, the teachers direct the students to construct the concepts in accordance with the scientific concepts which will be taught through the digging up the questions; 3) Challenges and Reconstruction Stage. At this stage, the teachers give the opportunity to the students for sharing idea between each students, so the students could be compare his own idea with the others students. The teachers direct the students with give the questions which digging up the knowledge; 4) Implementation Stage. At this stage, the teacher gives the opportunities to the students for using the new conceptual mastery gotten in other contexts, and then students test the validity of the concept through the experiment; 5) Evaluation Stage. At this stage, the teachers make a discussion and the questions answers technique to compare the material studied based on the experiment with the early knowledge before do the experiment [8].

The implementation of generative learning model in learning process is expected to give a significant effect on improving students' science process skills. So this model can be used as an alternative for teachers in physics learning in school.

METHOD

Research Type and Design

The type of this research was quantitative research. The method used was pre experimental design. The design of this research was one group pretest posttest design. The population of this research was all students of class VIII SMPN 5 Singkawang City. The sample in this research was 20 students of class VIII E and the sampling technique used was simple random sampling [17].

Variables in this research consist of independent variables and dependent variables. The independent variable in this research was generative learning model, while the dependent variable was students' science process skill. The test used was 15 items of description test to know the students' science process skills. The data collecting instruments used were pretest

and posttest sheets. Before used in this research, the instruments were tested first [18]. Then the data from the instrument trial test was processed and analyzed.

Data Analysis Technique

To determine whether the data is normally distributed, To For testing of data normality, Chi-square test was used [19] as in equation 1.

$$\chi^2 = \sum_{i=1}^k \frac{(f_o - f_e)^2}{f_e} \tag{1}$$

Where f_o is the observation frequency and f_e is the expected frequency. The test criterion used at $df = (k-3)$ with significance level $\alpha = 0.05$ is if $\chi^2_{obtained} < \chi^2_{critical}$, then the data is normally distributed.

To find out how far the formulated hypothesis was supported by the collected data, then the hypothesis must be tested. If the data is normally distributed, then the obtained data is analyzed by using paired t-test [19] with the hypothesis as follows:

H_o : There is no effect of generative learning model on students' science process skill in the topic of Light

H_a : There is effect of generative learning model on students' science process skill in the topic of Light.

The equation used was:

$$t_{obtained} = \frac{X-Y}{\sqrt{\frac{S_x^2}{n_x} + \frac{S_y^2}{n_y} - 2r\left(\frac{S_x}{\sqrt{n_x}}\right)\left(\frac{S_y}{\sqrt{n_y}}\right)}} \tag{2}$$

with the test criterion: H_o was accepted if $-t_{critical} \leq t_{obtained} \leq t_{critical}$ at significance level $\alpha = 0.05$ and $df = (n-1)$ as well as for other t values H_o was rejected. However, if the data distribution was not normal then non-parametric statistical test is used [20].

RESULTS AND DISCUSSIONS

This research data is obtained from pretest and posttest results, as shown in table 1.

Table 1. Pretest and Posttest Results

	Pretest	Posttest	Difference
Average Score	57.33	68.67	11,34
Standard Deviation	6.78	6.92	
Highest Score	73.33	86.67	
Lowest Score	40	53.33	

From table 1 shows that the average posttest score of 68.67 is higher than the pretest average score of 57.33. This shows that students' science process skills were improved after being treated by using generative learning model.

After all data is obtained, the next step is to analyze the data. The first step is checking whether the analyzed data is normally distributed so parametric statistics can be used. The summary of data

normality test results of pretest and posttest can be seen in table 2.

Table 2. The Summary of Data Normality Test Results of Pretest and Posttest

χ^2_{obtained} Pretest Score	χ^2_{critical} Pretest Score	χ^2_{obtained} Posttest Score	χ^2_{critical} Posttest Score	Normality test
3.021	5.991	1.638	5.991	Normal

From table 2 it was found that the students' pretest and posttest scores are normally distributed. After all the datas were confirmed as normally distributed, then paired t-test was used. From the calculation, it was found that $-t_{\text{obtained}} < -t_{\text{critical}}$ or $-21.36 < -2.093$, then H_0 rejected and H_a received at the level of significance $\alpha = 0.05$. So it can be concluded that there was an effect of generative learning model on students' science process skills in the topic of Light in class VIII SMPN 5 Singkawang City. This was supported by Wijaya *et al* [21] who stated that the generative learning model had a significant effect on the students' science process skills. This is also supported by Tuada *et al* [22] who stated that the implementation of generative learning model was effective in improving the ability to do experiment.

CONCLUSION

Based on the result and discussions, it can be concluded that there was an improvement in students' science process skills in grade VIII SMPN 5 Singkawang City in the topic of Light after the generative learning model was implemented. This can be seen from the science process skill average score before the treatment (pretest) which was 57.33, and after the treatment (posttest) which was 68.67.

There was an effect of generative learning model on students' science process skill in class VIII SMPN 5 Singkawang City in the topic of Light. This can be seen from the hypothesis test where the value of $-t_{\text{obtained}} < -t_{\text{critical}}$ or $-21.36 < -2.093$ with significance level of 5%.

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