European Journal of Education Studies
ISSN: 2501 - 1111
ISSN-L: 2501 - 1111
Available on-line at: www.oapub.org/edu

doi: 10.5281/zenodo.3678615 Volume 6 | Issue 12 | 2020

SCIENCE PROCESS SKILLS AND COGNITIVE LEARNING OUTCOMES THROUGH DISCOVERY LEARNING MODELS

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Abstract:
This research focused on finding out whether the science process skills and cognitive learning outcomes through discovery learning is higher than the conventional learning model in the VII grade students of State Junior High School (SMP Negeri) 2 in Jeneponto. The population of this research was the VII grade students of State Junior High School (SMP Negeri) in Jeneponto which consist of 5 classes. The population was composed by 160 students and the sample was taken by using random sampling. Descriptive analysis technique was used in processing the data to describe the science process skills and student learning outcomes. The inferential analysis technique was also used to test the research hypothesis. Based on descriptive analysis, it was found that the average science process skills and learning outcomes of students who were taught by using the Discovery Learning model were in the high category. While the average value of science process skills and learning outcomes of students who are taught by using conventional models are in the medium category. The results of the inferential analysis showed that there is an influence of the Discovery Learning learning model on the science process skills and the learning outcomes of the VII grade students of Junior High School (SMP Negeri) 2 in Jeneponto at a significant level $\alpha = 0.05$.

Keywords: discovery learning, science process skill, cognitive learning outcome

1. Introduction

Education is a conscious and planned effort to create an atmosphere of learning and learning process. So, students actively develop their potential to have religion, self-control, personality, and intelligence. The implementation of education is formally carried out in the school environment through a learning process. The learning process is the main task of a teacher to guide students in achieving learning objectives. However,

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the learning process carried out in schools tends to be teacher-centered, causing passive learners and less eager to participate the learning process.

Learning is a process of educational interaction that is bound to the goal, directed at the goal, and carried out specifically to achieve the goal. Through the learning process, what is expected to succeed in achieving the goal is the students themselves. It is students who are expected to interact with the teaching material, process it, and reflect it so that the instructional goals that have been set can be optimally achieved. These objectives are reflected in the expectations of an educational process organized by Indonesia that expects high-quality and highly competitive outputs and outcomes (Ali & Khaeruddin, 2012).

The low quality of the outputs and outcomes of learners demonstrated inability to deliver the educational process of students to the educational goals that have been designed. The implementation of the current curriculum, where one of the learning methods that are often used in schools is conventional learning that is only oriented to the mastery of the material and the learning process in the classroom. Most are still teacher centered rather than student centered, so learning is only directed at the ability of students to memorize information. Students are forced to remember and pile various information without interpreting the information they get. This is not an indication that the students have weak memory skills, but this is more due to the lack of innovation and creativity of educators or parents in educating children. The teacher should be more creative and innovative in presenting the material. Learning strategy has an effect on students' motivation (Mustami & Safitri, 2018).

During this time, the process of learning science tends to be teacher-centered method of learning in which the process tends to be monotonous and less involving the learners in finding a concept in the learning process. That kind of learning raises the self-learners' ignorance and lack of understanding of the students about the process and the attitude of learning science concepts acquired. These symptoms are a common symptom of the results of the educational process. School education is too crowded with children's brain with a variety of teaching materials that must be memorized, education is not directed at developing and building the character and potential of children, in other words, education is not directed at shaping human beings who are intelligent, equip real-life problem solving skills and are not directed at forming human beings (Safitri, et al., 2018). As in the case of class VII SMPN 2 Jeneponto. After the observation on June 9, 2016 as well as interviews with the science teacher and some learners, it is known that the applied learning process can not achieve the learning objectives maximally. The methods applied in the classroom tend to be teacher-centered, such as lecturing, question and answer and discussion but lecturing is the most common used. Such condition affects the minimum completeness criteria (KKM) to the students with below standard score, it is 70,00.

Scientific attitude and the students learning outcomes will be increased if the teacher motivate, guiding and tutoring the students in doing their activities. These will develop the students' interest and curiosity by various learning models. These also help

the students to push their thinking and to work on their own initiative, actively in processing the information and avoid rote learning. One alternative way to solve the problem is by using discovery learning model.

By applying discovery learning model, the students are expected to have the ability to master the concept, improve their creativity and awareness in understanding problems related to environmental conservation. The students' involvement actively this learning strategy help them solving a real problem and respond actively to natural phenomena surround them.

Discovery learning model cannot only trigger the students to be active and enjoy in learning process but is also able affect their science process skills. Moreover, discovery learning model is expected to motivate and encourage the students that they will not be bored during teaching and learning process.

According to Kadri et al (2015), discovery learning emphasizes the importance of understanding the structures or significant ideas related to a discipline through the students actively involvement in learning process. The objectives of using discovery learning model in learning to help the students leaning to discover a concept, encouraging the students to think, to work on their own initiative and to formulate hypothesis by themselves. Improving the students' self-confidence, triggering the students to be actively participating in the leaning process both cognitive and affective and improving their achievement are the other objectives of discovery learning model. The implementation of discovery learning model is expected to improve the student's liveliness and their learning achievement in learning process, especially in science subject.

Widayanto (2009) said that science process skill is the ability or proficiency to act in learning science that the students are able to create concepts, theories, principles, laws even facts or proves. Teaching process skills to the students means giving them chance to to do something about science. Science process skills must be developed in junior high school students in accordance with the level of thought development. Science learning is built through the development of science process skills for example: compiling hypotheses, carrying out experiments, recording observations, making graphs, analyzing data, concluding and communicating.

Learning Model Discovery learning provides many opportunities for students to carry out activities during teaching and learning activities taking place, especially in activities that train students' science process skills. In this case, a teacher only acts as a facilitator and guide in learning.

As for relevant research related to the discovery learning model that is, from the results of research conducted by Kumalasari, Sdarti & Lesmono (2015) using discovery learning models can improve science process skills. Susanti et al. (2016) stated that using discovery learning models can improve students' science process skills.

Based on the description above, the writer is interested in conducting research with the title "Science Process Skills and Cognitive Learning Outcomes Through

Discovery Learning Models" on the subject matter' Interaction between living things with the environment.

2. Research Methodology

The research design used in this study is a quasi-experiment. This study uses two variables namely the independent variable and the dependent variable. The independent variables in this study are discovery learning models and conventional learning models while the dependent variable is the science process skills and student learning outcomes. Sugiyono (2014) explained the quasi-experiment as in table below.

Table 1: Research Design

Grup	Pretest	Treatment	Posttest
Experiment	O_1	X	O_3
Control	O_2	-	O_4

Source: Sugiyono, 2014.
R= group randomly chosen
X= treated by using discovery learning model
O_1= Pretest score Experiment class
O_2= Pretest score control class
O_3= Posttest score Experiment class
O_4= Posttest score control class

The population in this study was all of the VII grade students at State Junior High Schools in Jeneponto, with a total of 160 students consisting of 5 classes. Sampling was done by randomizing the VII grade State Junior High School students in Jeneponto.

The instruments used in this study were Pretest and Posttest. Student Worksheet (LKPD) is a guide for activities for students related to the material that has been conveyed. LKPD is also equipped with discussion questions so that students can find the concepts learned. This LKPD contains items that aim to apply the discovery learning model in learning. Science process skills test and student learning outcomes in the VII grade of junior high school students conducted before and after the implementation of learning using discovery learning and conventional models or called pretest and posttest. These items are 20 multiple choice questions aimed at measuring the learning outcomes of students, and 5 numbers of essay questions to measure the science process skills which consist of the ability to observe, predict, conclude, and communicate.

Data obtained in this study were processed and analyzed using statistical techniques namely descriptive statistics and inferential statistics. Descriptive statistical techniques are intended to describe the level of learning achievement of students of natural science subjects through the results of the pretest and posttest. Inferential analysis is performed to test hypotheses using t-tests. Before testing the hypothesis, a prerequisite test (normality test and homogeneity test) of the data variance of the two groups was carried out.

3. Findings

N-gain shows the ability of science process skills of students after being taught by the teacher. Based on the N-gain analysis, the results of the science process skills of students who are learned by using discovery learning models and conventional learning models (direct instruction) which can be seen in Table 2 and Table 3.

Table 2: Percentage of N-gain Acquisition of Science Process Skills in Experimental Class

Criteria	Frequency	Percentage (%)
High	17	53,12
Medium	15	46,87
Low	0	0.00

Table 3: Percentage Obtaining N-gain science process skills in classroom control

Criteria	Frequency	Percentage (%)
High	5	15,62
Medium	23	71,87
Low	4	12,5

Based on the two tables above, the experimental class obtained a percentage of 53.12% in the high criteria, 46.87% in the medium criteria and none in the low criteria. Whereas, in the Control class 15.62% high criteria, 71.87% medium criteria and 12.5% low criteria were obtained.

Testing the research hypothesis was done by using t-test. The results of data analysis obtained the value of $t_{count} = 1.33$ and the value of t_{table} at a significant level (α) = 0.05 and db = 36, t_{table} (0.05) (36) = 1.68. This data shows that the value of $t_{count} = 1.33 > t$ table = 1.68 which means that the hypothesis (H_o) is rejected and the hypothesis (H_1) is accepted. Thus, it can be concluded that there is a positive influence on discovery learning models of learning outcomes of students. Based on the results of normality and homogeneity testing, statistical covariance analysis is tested to test the research hypothesis. The test criterion is $t_{count} > t_{table}$ then H_0 is rejected and if $t_{count} < t_{table}$ then H_0 is accepted.

Based on the test results, it was found that the value of $t_{count} > t_{table}$ is $1.33 > 1.68$ which means that H_0 is rejected. Hence, there is an influence of Discovery Learning learning model on science process skills and learning outcomes of the VII Grade students of Junior High Schools (SMP Negeri) 2 in Jeneponto.

4. Discussion

Based on research about the effect of discovery learning models on science process skills and learning outcomes of the VII grade students of Junior High Schools (SMP Negeri) in Jeneponto, it showed that the value of learning outcomes through discovery learning models is better than the value of learning outcomes through conventional learning models.

N-gain test is performed to compare the results of the pretest and posttest from the experimental class and the control class. From the N-gain comparison data, we can see that the difference in improvement in the learning process skills achieved by the experimental class is higher than the control class. Comparison of students' N-gain test data results in the experimental class is included in the medium and high categories. In the control class there were 4 students who fall into the low category so that the control class falls into all categories.

The percentage of achievement in science process achievement indicators is explained in table 4.9 where each indicator in the experimental class is superior to the control class, the average achievement of the posttest process skills indicator both classes have increased in the experimental class in the high category with an average of 84.33% while in the Control class are in the medium category with an average of 65.90%.

The highest percentage of indicator achievement in the experimental class in science process skills is the grouping and classification indicator with the percentage achieved in the experimental class that is equal to 88.57%. This is clearly seen in the LKPD they are working on as well as the results of the Posttest questions that have been done, where students recording each observation, looking for differences, comparing and classifying appropriately. In addition, at presentation, one group is given the opportunity to present the results of their experiments. Each group is able to exchange information about the results of experiments based on grouping and classification that has been done. The highest percentage of achievement indicators in the control class in science process skills is the communicating indicator with the percentage achieved in the control class that is equal to 73.81%. This was clearly seen at the presentation; one group was given the opportunity to present their assignments while the other groups responded and gave questions. Each group was able to respond and gave questions to the presenters. This proves that students in the control group are trained enough to communicate.

In the experimental class, the lowest percentage of science process skill indicators is the prediction indicator. Where in the experimental class, students were expected to provide a prediction based on the given discourse. However, the predictions made by the students were not correct despite the explanation given at the beginning of the meeting. In the control class, the lowest percentage of achievement indicators in science process skills is grouping and classification indicator with a percentage of 61.9%. This is clearly seen in the results of the Posttest they worked on. In this class, the learning model used is conventional learning model where learning is centered on the teacher. The teacher only explains by lecturing in front of the class so that students still do not understand how to design an experiment. This proves that students in the control class are still lacking in designing experiments.

Based on data from the calculation of the average N-gain in this study, 0.73 was obtained in students who were taught using discovery learning models and 0.49 in students who were taught using conventional learning models. This shows that the improvement of science process skills of students is in the "high" category of students

who are taught using discovery learning models and the "medium" category in students who are taught using conventional learning models (Mubarok & Sulistyo, 2014).

In the percentage of achievement of each indicator on existing learning outcomes, the experimental class is superior compared to the control class. This means that in the mastery learning of the experimental class taught by using the discovery learning model of learning is better and can influence student learning outcomes compared to using conventional learning models (Yasa, Syahruddin & Margunayasa, 2014).

In the analysis of the estimated population of student learning outcomes in the experimental class and the control class, the average score of the experimental class using the discovery learning model is higher than the control class using the conventional learning model.

To strengthen the results of descriptive analysis, an inferential statistical analysis was carried out to prove the hypothesis proposed using the t-test statistics. Before using the t-test, normality and homogeneity tests are carried out first. Data normality test is used to test the normality of value data while the homogeneity test is used to test whether the data is homogeneous or not. The normally distributed data if χ^2_{count} is smaller than χ^2_{table} and the data is homogeneous if $F_{count} \leq F_{table}$. Based on the results of the normality test of the experimental class and the control class, it is obtained that χ^2_{count} is smaller than χ^2_{table}, this means that the data for the experimental and control class are normally distributed. Based on the homogeneity test results there is data where $F_{count} \leq F_{table}$ for both classes (experimental class and control class) this means that the data for the experimental and control class come from a homogeneous population.

The results of inferential analysis using the t-test for learning outcomes obtained t_{count} of 1.33, this value is higher than the t_{table} value of 1.68. As for the science process skills, the t_{count} is 2.18 and the t_{table} is 2.201. These results indicated that t_{count} is in the area where H_o is rejected and H_1 is accepted. Then, it can be stated that there is a positive influence on discovery lerning learning models on science process skills and learning outcomes of the VII Grade students of Junior High Schools (SMP Negeri) in Jeneponto on the subject of interactions between living things and the environment rather than using conventional learning models. Based on the description above, it shows the science process skills and student learning outcomes in the experimental class are higher than in the control class. This means that the completeness and success of learning in the experimental class is higher than in the control class. Thus, it can be concluded that there is a positive influence on discovery learning learning model on learning outcomes of the VII Grade students of Junior High Schools (SMP Negeri) in Jeneponto on the subject of interaction between living things and the environment.

As for relevant research related to the discovery learning model that is, from the results of research conducted by Kumalasari (2015) using discovery learning models can improve science process skills. Likewise, stated by Susanti et al, (2016) that using discovery learning models can improve students' science process skills.

5. Conclusion

Based on the results of data analysis and discussion, it can be concluded that there is an influence of science process skills and student learning outcomes that are learned using discovery learning models compared to using conventional models of the VII Grade students of Junior High Schools (SMP Negeri) 2 in Jeneponto.

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