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The Application of Guided Inquiry Learning in Improving the Mastery of Concepts and Science Process Skills on Vibration and Wave Material

Juliatriyani[*1], Leny Heliawati[2], Surti Kurniasih[3]

[1]*State Junior High School 2 Cisarua, Bogor*
[2,3]*Pakuan University Postgraduate Program, Bogor*

[*]E-mail: *juliatriyani95@gmail.com*

Abstract: This research is a research that uses a quasi-experimental method with a Nonequivalent Control Group Design which aims to increase the ability to master concepts and science process skills of students who study wave vibrations with a guided inquiry approach and students who study wave vibrations using the demonstration method. The population used in this study was all students of SMPN 4 Cibinong in the even semester of the 2016-2017 academic years. The researcher determined that the population in this study was class VIII even semester who was studying vibrations and waves. The criteria for the success of this research are an increase in the ability to master concepts and an increase in science process skills for students who study wave vibrations using a guided inquiry approach and students who study wave vibrations using the demonstration method. The results of the analysis show that the application of guided inquiry learning can improve students' mastery of concepts and science process skills on vibration and wave material, which is indicated by an increase in N-Gain. The increase in the N-Gain mastery of students' concepts for the experimental class is 58.53% and the control class is 36.29%, while the increase in science process skills for the control class students is 26.43% in the low category, while the increase in the science process skills of the experimental class students is 64.44% in the medium category. In addition, students and teachers gave positive responses to the application of guided inquiry learning.

Keywords: *Inquiry, Concept Mastery, Students' Science Process Skills, and Vibration and Waves.*

INTRPDUCTION

Science learning is an integrated learning, where theory and practical activities play an important role in it. The science curriculum does not look at theory and practical activities separately, but is fully and completely integrated in science learning. Through science learning, students are expected to have an understanding of science concepts and process skills.

The concept of science is a concept that requires strong reasoning and mental processes in a student. The mental process of students in studying science is the ability to integrate knowledge in the form of skills to study natural phenomena through scientific activities (Wisudawati and Eka, 2014)

Science learning applied in schools generally tends to use memorization as a vehicle for mastering science, not thinking skills. The same thing was found in some students at SMPN 4 Cibinong where students tend to be passive, also regarding the selection of learning approaches that are not in accordance with the characteristics of science because students often listen and take notes without being directly involved in obtaining their own concepts so that students are passive. This happens because teachers more often use the lecture method in teaching and learning activities which makes the lack of active participation of students. Students only listen and record what the teacher tells them to do, so that there is less interest in the lesson and many students' scores are below the teaching completeness criteria determined by the school, which are 79 with 60% classical completeness.

The problems faced in science learning were tried to be overcome by demonstration learning, but it did not give satisfactory results so that learning using other approaches or methods was needed, one of which was using guided inquiry learning which was expected to create an atmosphere and learning process that facilitated students in improving the ability to master concepts as well as train and develop students' science process skills. This is in line with the opinion of Wenning (2005) which states that when learning is carried out with an inquiry approach, students have the opportunity to make observations, formulate hypotheses, collect and analyze data, develop scientific principles, synthesize laws, and create and test hypotheses to produce explanation. In addition, in each stage of guided inquiry learning, students will gain hands-on learning experience and in developing knowledge skills and practicing science process skills. Bruner (in Dahar, 2006) argues that inquiry-based learning in accordance with the active search for knowledge by students by itself gives the best results because they are encouraged to find solutions to their own problems so as to produce knowledge that is truly meaningful.

Research conducted by Nworgu and Otum (2013) on the effect of guided inquiry with analogy learning strategies on students' acquisition of science process skills shows that guided inquiry by analogy has a significant effect on students' acquisition of science process skills including asking questions, formulating hypotheses, make observations and draw conclusions from those observations. Furthermore, research conducted by Ergul, et.al. (2011) also stated that the application of inquiry learning can improve learning outcomes and there is an increase in science process skills and science attitudes.

Based on these studies, it can be said that inquiry learning can improve and develop various abilities and potentials of students including the ability to master concepts and science process skills. Therefore, the researchers tried to conduct research, namely by applying guided inquiry learning to obtain information about increasing the concept mastery ability and increasing the science process skills of junior high school students on the theme of vibration and waves. Guided inquiry learning involves students actively with a syntax consisting of orientation and problem-posing stages, formulating problems, proposing hypotheses, collecting data, conducting experiments to test hypotheses, and formulating conclusions (Hosnan, 2004).

The learning materials in this research are vibrations and waves. In general, the characteristics of this material contain concepts related to various phenomena in life that are directly related to students, so that the learning carried out by students will be contextual in nature which is expected to provide magna for those who solve problems in everyday life.

METHOD

The method used in this study is a quasi-experimental method with a nonequivalent Control Group Design (Sugiyono, 2013). The characteristics of the quasi-experimental method are characterized by the presence of an experimental group and a control group who are both given a pretest and posttest and the experimental and control groups receive different treatments (Fraenkel, 2012).

The experimental class will be given treatment through the application of guided inquiry learning, while the control class will carry out activities with demonstration learning.

RESULTS AND DISCUSSION

1. Description of the Implementation of Guided Inquiry.

The methods used in guided inquiry learning in general are questions and answers, practicum, exercises and group discussions.

The results of observations from observers on the implementation of guided inquiry learning were carried out 100%, meaning that students in learning activities carried out activities in accordance with the steps of guided inquiry learning which consisted of: 1). Asking questions, 2). Making a hypothesis, 3). Designing an experiment, 4). Conduct observations and collect data, 5). Data analysis, 6) Making conclusions.

2. Increasing Student Concept Mastery

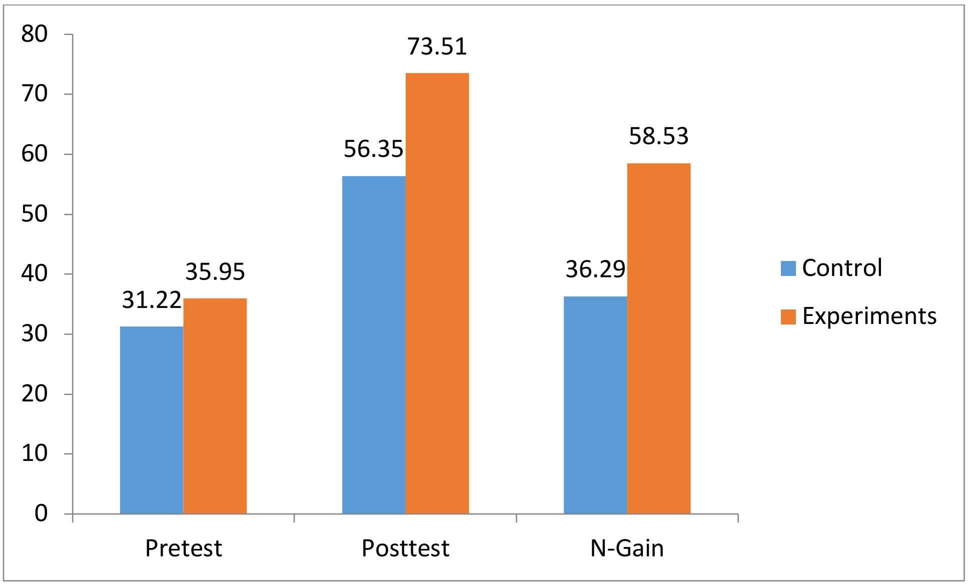
Concept mastery data in the experimental class and control class were obtained from the results of the pretest-posttest which were analyzed and then obtained a description of the characteristics of the data including the mean, median, mode, standard deviation, maximum score, minimum score and total score.

The increase in students' mastery of concepts was obtained from the results of the pretest-posttest after participating in learning in the form of normality gain.

The average pretest score obtained in the control class is 31.22% after learning; the posttest average value is 56.35%, while the experimental class has an average pretest score of 35.95% after learning is 73.51%.Student Concept Mastery Learning Outcomes can seen in table 1.

Table 1 Student Concept Mastery Learning Outcomes

Class	**Statistical Parameters**	**N**	**Score**		**N-Gain**	**Category**
			Pretest	Post		
Control	Average	37	31.22	56.35	36.29	Medium
Experiments	Average	37	35.95	73.51	58.53	Medium



Picture 1. Graphic of the average score of N-Gain Guided Inquiry Learning

In general, students experienced an increase in the average N-Gain result of the pretest in the control class 36.29%, while in the experimental class 58.53% so that the category with moderate value showed that students experienced an increase in mastery of concepts after learning.

The explanation above shows that there is a significant difference in the increase in mastery of concepts both in the control class and in the experimental class achieved by students. Student responses during learning are quite good because students play an active role in learning; students do not hesitate to work together in groups to solve problems through group discussions and do not hesitate to ask the teacher.

The wave vibration material studied in the control and experimental classes consist of several sub-concepts, namely: 1). Identifying Vibrations and Waves in daily life, 2). Measuring the period and frequency of a vibration, 3). Investigating the characteristics of transverse and longitudinal waves, 4). Describe the relationship between wave propagation speed, 5). Relate the concept of waves to everyday life. Measurement of mastery of concepts using multiple choice questions as many as 20 questions given to the control class and experimental class.

Comparison of the value of mastery of the pretest concept in the experimental class, the highest sub-concept identifies vibration and describes the relationship between wave speed, frequency and wavelength of 38.92 and the lowest value in the sub-concept investigating transverse and longitudinal wave characteristics is 30.63, while the presentation of the pretest value in the control class is the highest, on the sub-concept Measuring the period and frequency of a vibration of 36.94 and the lowest value on the sub-concept Investigating the characteristics of transverse and longitudinal waves 22.52. The presentation of the acquisition of concept mastery scores in the posttest experimental class was the highest in the sub-concept Measuring the period and frequency of a vibration of 77.48 and the lowest value in the sub-concept of Identifying Vibrations and Waves in everyday life 67.57 while in the control class the highest value presentation measured the period and frequency of a vibration 61.26 and the lowest in the sub concept Investigating the characteristics of transverse and longitudinal waves 34.23. Based on the description above, it turns out that there is an increase in mastery of concepts in each sub-concept in the experimental class and control class.

Overall the N-gain value for the sub-concept mastery of concepts in the experimental class is higher than the control class. The increase in mastery of the highest concept in the experimental class is in the sub-concept of investigating the characteristics of transverse and longitudinal waves, which is 64.41%, while the lowest concept mastery is on indicators measuring the period and frequency of a vibration, which is 42.67%. As for the control class, the highest increase in students' conceptual mastery was found in the sub-concept of investigating transverse and longitudinal wave characteristics, which was 39.64%, while the lowest increase in concept mastery was in the concept of describing the relationship between wave propagation, frequency and wavelength, which was 27.84%. Based on the results of the N-gain on the average mastery of the concept of the experimental class is higher than the control class, it shows that students with guided inquiry learning have a greater increase in mastery of concepts than students with conventional learning.

Judging from the cognitive level which consists of C2 (understanding), C3 (applying), and C4 (analysis), furthermore, the acquisition of the ability of each student's cognitive level. The highest ability increase was at the C3 level (applying) in the experimental class and control class and the lowest level at the experimental class was obtained at the C4 level (analyzing) while the control class was at the C2 level (understanding).

The presentation of N-Gain comparison in each domain of concept mastery is C1, C2, and C3. The highest N-gain presentation in the experimental class is 62.66% in the C3 domain (apply) and the lowest is in the C4 domain (analyzes) which is 48.2%, while in the control domain the highest domain is obtained in the C3 domain (apply). 36.71% and the lowest in the C2 domain (understand/understand) at 23.92%. So overall the experimental class has a higher N-Gain concept mastery ability than the control class.

3. Improving Students' Science Process Skills

Data on science process skills of students in the experimental class and control class students were obtained from the results of the pretest-posttest which were analyzed and then obtained a description of the characteristics of the data including the mean, median, mode, standard deviation, maximum score, minimum score and total score.

The average pretest score for the control class was 66.59 after learning, the average posttest score was 75.35, while the experimental class had an average pretest score of 71.75 after learning 90.70.

In general, experimental class students and control class students experienced an increase with an average N-Gain of 45.44 in the medium category.

Furthermore, the average pretest score in the control class was 66.59 and the posttest average was 75.35, while in the experimental class the average pretest score was 71.57 and the posttest average was 90.70. This difference indicates that students experience an increase in science process skills after the application of guided inquiry learning.

Student learning outcomes for science process skills in the experimental class and control class are limited to several indicators including: 1). observation, 2). Measure, 3). Hypothesize, 4). Processing data, 5). Communicate.

The presentation of the acquisition of science process skills scores for the pretest in the experimental class was the highest on the communicating indicator of 73.24 and the lowest on the measuring indicator of 69.19 while in the control class the average pretest score was highest on the measuring and communicating indicator each of 67.84 and the lowest on the hypothesized indicator. that is equal to 65.14.

The score of students' science process skills for the posttest in the experimental class was the highest on the communicating indicator, namely 92.97 and the lowest on the data processing indicator of 86.76. Meanwhile, in the control class, the highest presentation was on the hypothesized indicator of 80.00 and the lowest was on the indicator of data processing of 70.08.

In general, the N-gain value in the science process skills of the experimental class students was higher than the control class.

4. Student Response

Student responses can be seen from the provision of questionnaires about the application of guided inquiry learning which aims to collect data on student responses to the learning, so that attitude tendencies are obtained after students finish learning in the experimental class.

Student responses to the application of guided inquiry learning of 50.62% agree and 44.48% strongly agree with the application of guided inquiry learning, this shows that more than half of the class consisting of 39 feel happy about learning science with the application of guided inquiry while 3.09% disagree and 2.47% disagree.

The comparison of the percentages of each student's responses varied but most of the students in the experimental class gave a positive response and agreed to the application of guided inquiry learning (guided inquiry) in science learning on the theme of vibrations and waves.

5. Teacher's Response

The teacher's response to the implementation of guided inquiry learning is done by asking for help from the science teacher at the school to fill out the teacher's activity observation sheet on the implementation of learning in accordance with the observed aspects.

The teacher's response to the implementation of guided inquiry learning is carried out 100% in accordance with the expected aspects of learning activities.

CONCLUSION

Based on the results of research and data analysis that has been done previously, it can be concluded that:

1. The application of guided inquiry learning on vibration and wave materials can improve students' mastery of concepts. The increase in students' mastery of concepts is shown in the difference in N-gain between students who study vibrations and waves using a guided inquiry approach of 58.53% in the medium category, while the N-gain of students who study vibrations and waves using a conventional learning approach is 36.29 % with medium category.
2. The application of guided inquiry learning can also improve the science process skills of students who study vibrations and waves. The improvement of students' science process skills is shown in the difference in N-gain. The increase in the N-gain of the experimental class students was 64.44% in the medium category, while the increase in the N-gain of the control class students was 26.43% in the low category.
3. Overall improvement in the implementation of guided inquiry learning there is a significant difference between students' mastery of concepts and science process skills of students who study vibration and wave material with the

approach of applying guided inquiry learning with students who apply conventional learning.

4. In general, the responses of students who study vibration and wave materials with the application of guided inquiry learning gave positive responses to the application of learning. In addition to students, teachers also gave positive responses to the application of guided inquiry learning.

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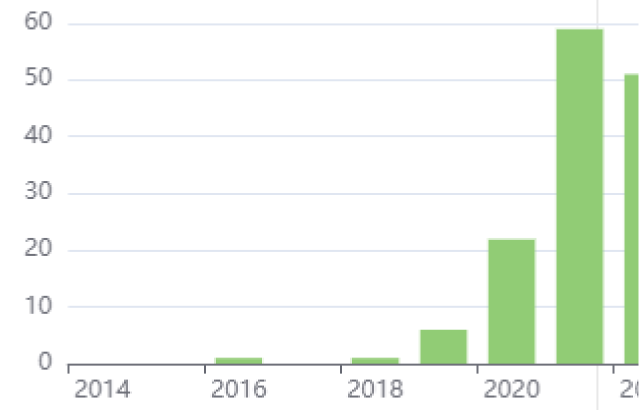

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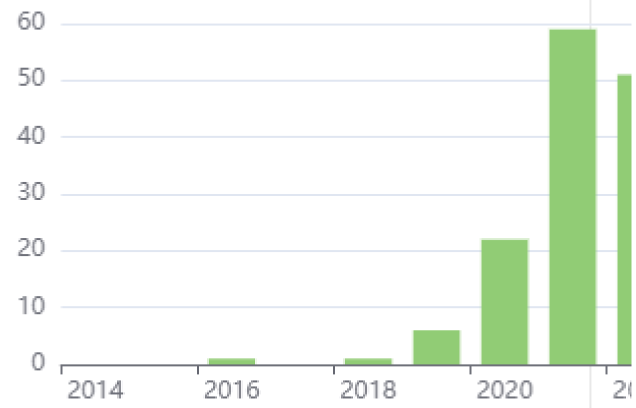

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