Implementation of Case Based Learning (CBL) to Improve Scientific Reasoning Skill on Simple Harmonic Vibration Topic

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Abstract. This research aim to describe the increase scientific reasoning skill and the responses learners toward of implementation Case Based Learning (CBL) in SMA Negeri 1 Puncu. The type of this research is pre-experimental with one group pretest-posttest design use 1 implementation class and 2 replication class. The data analysis used analysis implementation of learning and analysis pretest-posttest use t-pair test, analyze n-gain and ANAVA. The result show that the scientific reasoning increase in SMA Negeri 1 Puncu are medium category, The replication class 1 with a value $g$ of 0.6230, The replication class 2 with a value $g$ of 0.6002 and The implementation class with a value $g$ of 0.6020 with the result that increase in these class are consistent. Based on the results, it can be concluded that there was improvement scientific reasoning skills after implementation of Case Based Learning (CBL) on simple harmonic vibration topic.

1. Introduction
The curriculum 2013 is a new curriculum that was implemented in the 2013/2014 school year. This curriculum is the development of a pre-existing curriculum, both the competency-based curriculum that was pioneered in 2004 and the education unit level in 2006. The emphasis of this 2013 curriculum is an increase and balance between soft skills and hard skills which include aspects of attitude competence, skills and knowledge [1].

Learning in schools should develop scientific reasoning skills that can help young people deal with existing problems in the surrounding environment, so students can think and reason properly [2]. In addition, scientific reasoning skills are important to know because they represent a collection of skills needed to solve problems in the process of scientific inquiry [3].

The subject matter of physics taken in this study is a simple harmonious vibration on a simple swing and spring. This is based on basic competency 3.11, which is analyzing the relationship between force and vibration in everyday life where the basic competency is suitable for high-level thinking, one of which is improving scientific reasoning skills. In addition, simple harmonic vibration material there are several concepts that must be understood by students and there are also many natural events that are interesting to investigate [4].

Based on research at Puncu 1 High School about learning that has been done there concerning Case Based Learning (CBL) and scientific reasoning that is using a questionnaire for students. Based on students answers 93% of students have never heard the term CBL and 7% have heard of the term.
However, students have done several learning activities that lead to CBL learning indicators. This is like a discussion activity 75% of students have done it. Then for physics learning that is linked in everyday life only 14% is done and others only once or twice never even. Then identify the facts and connect the facts with related physics concepts only 21%.

The term scientific reasoning 95% of students have never heard that term. Patterns of scientific reasoning such as determining correlational reasoning, proportional reasoning and probabilistic reasoning have never been taught. This is evidenced by some scientific reasoning questions on the measurement material tested on students namely 72% of students answered the question with reasons but not related, 24% of students answered without reason and only 4% of students answered questions with supporting reasons.

In this regard, one of the efforts made in the learning process that is able to make students active in the learning process is to use a Case Based Learning (CBL) model. CBL is a learning model that uses real cases that have been well documented as a learning tool. Learners must explore and find the problems and solutions of the given cases under the direction of the teacher in a discussion activity.

Based on research conducted by Azka Azzahra about the effect of the CBL model on Biology learning outcomes of students on the concept of mushrooms and Eti Rimdhani on identifying the scientific reasoning abilities of high school students on the material temperature and heat, namely CBL learning has been done a lot, but in the field of physics there is not yet. While scientific reasoning skills have also been done but in Puncu 1 High School has never been done.

This underlies researchers to conduct research on "Case Based Learning (CBL) to Improve Scientific Reasoning Skills on Simple Harmonious Vibration Materials in High Schools" so that students better understand and understand them. In addition, scientific reasoning skills are one of the important 21st century skills that are trained on students.

2. Method

This type of research is a pre-experimental design with one group pretest-posttest [5], with the following design. This research was conducted in SMA Negeri 1 Puncu in the even semester of 2018/2019 school year with two meetings. At the beginning of the meeting was conducted to find out the improvement of the students scientific reasoning skills. The independent variable is learning implementation of CBL. The dependent variable is responses student after implementation of CBL and the control variable are object, theory of learning, teacher and time allocation.

3. Result and Discussion

In this study the results obtained increase in skills and responses of students. Improved students scientific reasoning skills can be analyzed using pretest and posttest sheets that have been answered by students with parametric tests. While the responses of students are obtained from questionnaires that have been provided by researchers who act as teachers to be filled in by students.

Before conducting parametric test pretest and posttest data students must be analyzed using prerequisite tests pretest was given to know the students initial skills and then given a CBL learning treatment and at the end of the meeting a posttest first. The prerequisite tests are the normality test and homogeneity test as follows. If data had known that all three classes have $X_{2\text{count}} \leq X_{2\text{table}}$ so that, $H_0$ is accepted. The conclusion that can be drawn is that the data to be tested using the t-test (as parametric statistics) has been normally distributed and homogeneous data. Thus the prerequisites for statistical analysis using the t-test have been met.

Based on table 1, it was found that $t_{\text{count}}>t_{\text{table}}$ for the three classes treated was applied to the CBL learning model. Thus, the hypothesis $H_0$ is rejected in all three classes. This proves that there is a significant increase in scientific reasoning skills of students after being treated, namely the CBL learning model.
Table 1. The result T-test Pair

| Class                        | t_count | t_table |
|------------------------------|---------|---------|
| Replication I (X MIA 1)      | 20.31   | 2.040   |
| Replication II (X MIA 2)     | 18.02   |         |
| Implementation (X MIA 3)     | 16.59   |         |

To find out the increase between the pre-test and post-test values can be analyzed using the n-gain score. The average n-gain of all three classes can be seen in the following table.

Table 2. The Result of n-gain

| Class                        | <g>  | Raising Category |
|------------------------------|------|------------------|
| Replication I (X MIA 1)      | 0.6232 | Medium          |
| Replication II (X MIA 2)     | 0.6002 | Medium          |
| Implementation (X MIA 3)     | 0.6020 | Medium          |

One-way analysis of variance or ANAVA is used to determine the comparison of the average results of students scientific reasoning skills in all three classes.

Table 3. The Result of ANAVA

|                  | Sum of Square | df | Mean Square | F     | Sig.  |
|------------------|---------------|----|-------------|-------|-------|
| Between Groups   | 0.14          | 2  | 0.007       | 0.298 | 0.743 |
| Within Groups    | 2.222         | 93 | 0.024       |       |       |
| Total            | 2.236         | 95 |             |       |       |

Based on ANAVA test results using the SPSS basic decision making there are two ways, namely if the significance value (p-value) > 0.05 then H₀ is accepted, which means that an increase in scientific reasoning skills in the three classes there is no significant difference or an increase occurs consistent.

Table 4. The Result of Evaluating Scientific Reasoning Skill

| Class     | Pattern              | Sr   | Si   | S_max | N-gain | Category |
|-----------|----------------------|------|------|-------|--------|----------|
| X MIA 1   | Correlational Reasoning | 16.75| 31.41| 40    | 0.63   | Medium   |
|           | Proportional Reasoning | 4.16 | 12.19| 27    | 0.35   | Medium   |
|           | Probabilistic Reasoning| 3.38 | 11.88| 33    | 0.30   | Low      |
| X MIA 2   | Correlational Reasoning| 16.00| 31.66| 40    | 0.65   | Medium   |
|           | Proportional Reasoning | 4.13 | 11.06| 27    | 0.30   | Low      |
|           | Probabilistic Reasoning| 4.06 | 11   | 33    | 0.24   | Low      |
| X MIA 3   | Correlational Reasoning| 14.88| 31.25| 40    | 0.65   | Medium   |
|           | Proportional Reasoning | 4.81 | 11.25| 27    | 0.29   | Low      |
|           | Probabilistic Reasoning| 4.16 | 10.94| 33    | 0.24   | Low      |

Based on the research that has been done, it can be concluded that the average students are able to work on the category of scientific reasoning well, especially in the correlational reasoning pattern because in bloom taxonomy the cognitive domain of correlational reasoning patterns is still in the C4 category while proportional reasoning and probabilistic reasoning are in the C5 category. This is also
in accordance with previous research conducted by Rimadani et al [6], where the results of the study also showed that the average student could answer the question of correlational reasoning pattern categories with levels 1-5. Where as in the proportional reasoning and probabilistic reasoning patterns the students emptied the answers more, then the others only reached level 1-3 categories of proportional reasoning and 1-2 categories of probabilistic reasoning.

4. Conclusion

Based on the data that has been obtained and analyzed, in this study it can be seen that the increase in scientific reasoning skills in SMA Negeri 1 Puncu is in the moderate category with a value of <g> replication class 1 of 0.6230, replication class 2 of 0.6002 and implementation class of 0.6020 so that improvement in all three classes is said to be consistent. So it can be concluded that through the application of CBL can improve the scientific reasoning skills of students in Puncu 1 High School on simple harmonic vibration material.

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