An investigation of conceptual understanding ability K-11 student of linear motion

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Abstract. Identification of conceptual understanding is an important first step in order to learning 21st skill. Understanding concepts is the fundamental ability of students to achieve high order thinking skills. Thus, the student has ability to better acquire a knowledge when learning of high order thinking. The purpose of this study is determining the conceptual understanding ability of the grade 11th in high school. This study has been implemented through a single case study research. Participant in this study are 36 students from a senior high school, consists of 22 female and 14 male students. The instrument used in this study is a test of the ability to understand concepts with multiple choice questions as many as 15 questions. The low ability to understand students' concepts in each indicator with the percentage for indicators exemplifies (72.22%), describes the conclusions (55.56%), interprets (41.67), compares (47.22%), explains (57.64%) determines (72.22%) and classify (61.11%). The result from the study, the student in grade 11st are low ability of concept understanding ability.

1. Introduction

Now, the students need to be prepared with high-level ability, as stated in framework of 21st Century Education [1,2]. But, follow learning high order thinking skill, a student must have a good conceptual understanding ability as a basics level thinking. Conceptual understanding is passage of the in the cognitive learning component. Cognitive learning aims to change students' understanding of the concepts learned. Through the ability to understand the concept in cognitive learning, students are expected to have the ability to understand meaning in a scientific manner, both in theory and its application in everyday life. Conceptual understanding as basics level thinking is very important to be able study physic material in aggregate and correct. Thus, a teacher must practice the ability to understand concepts to students.

In a teacher must practice the ability conceptual understanding to students for all concept in physics teacher. The important part of the concept in physics learning is linear motion. Linear motion is a physics concept that is related to everyday life.

Linear Motion is included as a Translation Motion, which is the movement of a moving object without rotating. Named liner motion because the path is a straight line. For example, we can see in a moving car, the movement of an apple falling from the tree, and on every object that moves on a straight track. This motion is divided into two types based on the presence and absence of acceleration, namely Regular Straight Motion and Regular Changed Straight Motion.
In a flashy motion, students are expected to be able to understand the magnitude of the physical quantities including speed, speed, distance and acceleration. Understand the magnitude - the amount of motion becomes the basis of students to improve understanding of the concept. This study aims to see an overview of the ability to understand students' concepts especially in straight-motion material which is material that is close to everyday life.

2. Methods

2.1. Participant
Participants in this study is 36 K-11 with 14 male and 22 female whose ages was between 16 and 17 years old. Most of them include children with a good economy to middle economic background. The school where they study is also one of the new schools with middle quality schools in a Karawang. The School has not completed facilities to support students learning well in the implementation of classroom learning.

2.2. Instrument
The instrument this research is a test multiple choice conceptual understanding of linear motion. This test was developed based on an understanding indicator that make reference to revised Bloom Taxonomy, which consists of determining, explaining, inferring, comparing and interpreting and concluding. This conceptual understanding test has been validated by experts and has a reliability of 0.83 in the high category. Classification of questions about students' conceptual understanding is represented in table 1.

| An Indicator of Conceptual Understanding | Number of Problems | Questions Number |
|----------------------------------------|--------------------|------------------|
| Explaining                             | 3                  | 1, 6, 15         |
| Concluding                             | 2                  | 2, 11            |
| Interpreting                           | 2                  | 3, 7             |
| Comparing                              | 4                  | 5, 9, 10, 14     |
| Inferring                              | 2                  | 2, 8             |

The test instrument is composed of 15 questions in multiple choice forms. One sampling of a rubric for conceptual understanding tests is represented in Figure 1 below.

| 5. Interpreting mathematical equations of distance and the displacement traveled by an object | A student goes to school using his car. Before arriving at school, a student first stops at a gas station to refuel his car. Then, after the gas station a student stops by a restaurant for breakfast, and after that, the student continues the trip to school. Pictures of the tracks taken by students are shown as pictured! If \(a\) is the distance of the student's home to the gas station, \(b\) is the distance of the gas station to the restaurant, and \(c\) is the distance from the place of food to the school, then the following statement is true... |
|---------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|
| A. The amount of displacement taken by students from home to restaurant is \((a + b)\)                                                                 |
| B. The amount of displacement that students take from home to school is \((a + b + c)\)                                                                |
| C. The distance traveled by students from home to school is \((a + b)\)                                                                 |
| D. The amount of distance taken from home to school is \((a + b + c)\)                                                                 |
| E. The amount of movement taken by students from home to the restaurant\((a + b)\)                                                                   |

Figure 1. A sample of the rubric for conceptual understanding test.

2.3. Technique of Analyses data and Instrument
Before being implemented, the test instruments were tested for validity both in statistical analysis and expert validity. Based on the results of the instrument test, improvements were made to the problem. Based on the results of the test the instrument is then made improvements to the test. The measurement validity was using an alpha-Cronbach correlation test with SPSS-24. The result represents that the alpha
value find is .825 greater than the r-table with a significance of 5%. That is, the items on the test instrument used can be said reliable on the high category [3]. Thus, the Cronbach alpha value represents shows a good category of the items used. In addition, the results of student test scores analysed by calculating the percentage of students' understanding of concepts by the following equation (1).

\[ Z = \frac{\sum \text{acquisition score}}{\sum \text{maximum score}} \times 100\% \]  

(1)

Classification of test results follows table 2 below

| Score range (%) | Category   |
|-----------------|------------|
| 66.68 ≤ Z ≤ 100 | High       |
| 33.34 ≤ Z ≤ 66.67 | Medium    |
| 0 ≤ Z ≤ 33.33   | Low        |

2.4. Research Design
The method used in this research was a single case study, namely embedded design. This design is not only to one type of analysis ones but allows for heterogeneity of methods that may be applied, quantitative or qualitative method [4]. The research was done by taking data by provide the conceptual understanding ability test on linear motion once. This test is offer to students who have grade previously studied the concepts. The result, were statistically and analyse. Then the results prepared statistically and then analysed. The study procedure performed is presented in Figure 2 below.

![Figure 2. Procedure Research.](image)

3. Results and Discussion
The result of the students' conceptual understanding ability test on the linear motion material is shown by the average student score in general, that is 57.74. While the maximum means score if all students answered correctly is 100. Thus, the students' conceptual understanding ability gained from the test results were only 57.74%. Table 3 shows the average score of each aspect of conceptual understanding ability.
Table 3. Result of student Conceptual understanding test.

| Aspect of Understanding | Presentation Test |
|-------------------------|-------------------|
| Explaining              | 62.22             |
| Concluding              | 55.56             |
| Interpreting            | 57.64             |
| Comparing               | 52.22             |
| Inferring               | 51.11             |

Based on these results, it appears that students still do not understand the concept as a whole. Students are only able to understand a concept limited to giving examples and determining it. The ability to understand concepts in the exemplary and decisive aspects is an aspect that is only related to memory. Even though the meaning of understanding has a broader concept of not just memorizing memories but being able to catch food from concepts learned from various points of view.

The weak ability to understand students' concepts will influence the learning process of students. In the curriculum demands students should have been taught 21st century skills. It just that if the conceptualization of students is reduced, then 21st century learning will be less than optimal.

Learning processes 21st will be optimal if a teacher can improve the ability to understand concepts. Difficulties can get the better, one of them is in explaining the material, students demonstrate with other objects to feel the linear motion. Integrating sensory motion that is pushed back in instruction can straight connect this particular aspect of linear motion to the real-life experiences of students and may make it more meaningful to them and more easily understood [4]. To be able to understand the concepts in a physical material, the learning process does not have to be done in a fast way. Teaching physics and science, in general, must be slow. Sometimes, it means sacrificing definition learning and formulas for a deep understanding of concepts [5]. The learning process to train students' conceptual understanding can be done by group discussions that involve interaction between groups, students and teachers and students [6-9].

4. Conclusion

Based on the study that had been conducted, it is known that the teacher had provide conceptual understanding ability in Physics learning activities. Students have not been able to have a good understanding of concepts. Students' conceptual understanding ability is generally low, indicated by the average score of 57.77 or 57 % of the maximum score.

5. References

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