The validity of conceptual knowledge test on mechanics topic

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Abstract. This study aims to analyze the validity of conceptual knowledge test on mechanics topic. The research method used four stages that was Preliminary Research, Prototyping Stage, Summative Evaluation, Systematic Reflection and Documentation. This article report is focused on preliminary research and prototyping stage that is to arrange conceptual knowledge test and analyze validity of test by Content Validity Ratio (CVR) method. Based on the data analysis, it was concluded that the test was valid and feasible to use on students.

Key Words: Validity, Conceptual Knowledge, Mechanics.

1. Introduction

Mechanics is one of the topics of General Physics courses in Physics Education Study Program Department of Physics, State University of Medan. This topic discusses the movement of objects that are divided into two, namely the motion of objects without regard to the causes of motion is called kinematics and the motion of objects that pay attention to the causes of its motion is called dynamics. The learning achievement of this topic is students can apply the concept of motion to solve problems in everyday life. Therefore students must be able to understand the concept of mechanics correctly. Efforts to determine the level of student understanding of the concept of mechanics are carried out by the assessment process using test instruments.

Assessment is an important component that cannot be separated from learning activities. Assessment is a process for making decisions based on measurement results using a set of instruments guided by the objectives set [1]. The purpose of assessment is to determine the level of achievement of learning objectives and see the effectiveness of the learning process [2]. The Assessment uses test instruments that must be standardized to be used properly. A good test is a test that meets the requirements of validity, reliability, practicality, objectivity, economics and usefulness [3].

Before the test instrument is used, the test should be validated through either content validation or construct validation. The test instrument is able to achieve a high level of quality, when the test instrument can provide reliable and valid information about student achievement [4]. Based on observations in the assessment process of the General Physics course in the Physics Education Study Program, there are a number of problems such as the majority of tests are still a matter of calculation, the test has not focused on mastering physics concepts and the test has a grid of questions but is not validated. Especially for test instrument problems, the majority of which are in the form of calculation questions that are not in accordance with the characteristics of physical material which should be
concept based. In order to be able to answer questions in the form of counts, making students only memorize formulas without interpreting the meaning and function of formulas so that students cannot fully understand the concepts of physics. Students use plug and chug and memory-based approaches in solving physics problems [5]. The influence of students' ability in forming cause and effect relationships to the ability to build new concepts will be difficult to emerge. So, indirectly students consider physics material difficult [6].

Therefore, the preparation of test instruments uses conceptual knowledge because mechanics contains many concepts of motion that students must understand in order to be used to solve problems in everyday life. Conceptual knowledge has become the main topic of learning in science [7]. Conceptual knowledge is an important element for solving problems [8]. Conceptual knowledge includes knowledge of categories, classifications and relationships between two or more categories or classifications [9]. Therefore conceptual knowledge is the basis for the preparation of test instruments on mechanics topic. Conceptual knowledge is based on the development carried out by Anderson from Bloom's Taxonomy theory.

Based on the description of the problem, development instrument are applied to compile and validate the test instrument on Mechanics. The test instrument is limited to the type of objective questions based on conceptual knowledge and validation analysis with the formulation of Content Validity Ratio (CVR) who developed by Lawshe.

2. Experimental Method

The research method was a research development with the stages of Van den Akker [10], namely the Preliminary Research stage, the Prototyping Stage, how to Summative Evaluation, Systematic Reflection and Documentation. However, to achieve the research objectives in this article, the steps taken are the Preliminary Research and Prototyping Stage. In the Preliminary Research stage, the initial data collection and research needs was collected, the preparation of the test instrument preparation and the test instrument validation sheet. Whereas at the Prototyping Stage, the items were designed and validated by the Expert Team and got analysis of the validation results and final revision.

At the initial data, document collection stage and the research needs obtained test instrument data that have been used so far are still in the form of calculations and do not train students' conceptual knowledge. Furthermore, the preparation of the test instrument was begun by making the instrument lattice adjusted to the indicators and cognitive domains of conceptual knowledge [9]. Then the feasibility instrument was made by a team of experts covering the material, construction and language domains. After the test instrument was finished, validation is done using the validation instrument. The validation results were analyzed by the formulation of Content Validity Ratio (CVR) proposed by Lawshe [11]. To determine CVR, a number of Subject Matter Experts (SMEs) were asked to assess whether our items were essential for the operationalization of the theoretical construct of the test. An essential item means that the item is well represented by measurement objectives. After calculating and producing a CVR, the results were said to be essential by looking at the characteristics table of the validity of Lawshe [11].

3. Result and Discussion

From the preliminary research and prototyping stage, expert validation instruments have been produced with three domains of testing, namely material, construction and language. In the material aspect consists of 6 indicators, the construction aspect consists of 13 indicators, and the language aspect consists of 4 indicators. The validation sheet also provides a place for validators to fill in comments and input as well as conclusions for instrument validation.
The test instruments compiled amounted to 15 items in accordance with indicators of conceptual knowledge capability, namely five items of knowledge about classification and categories, five items of knowledge about principles and generalizations, and five items about theoretical knowledge. Models and structures with cognitive levels of C1 to C6.

The instrument was validated by 5 validators and the following is a summary of the results of the revision of 5 validators: (1) Improve the sentence with good grammar, (2) Make a description of the discussion that leads to the answer, (3) Adjust the problem with indicators and cognitive level, (4) Fix some questions that do not fit the concept of Mechanics. After a revision in accordance with the validator's suggestion, the validation score of each question item was analyzed using the CVR index and 13 items were obtained valid and could be said to be essential with a score of the number of SMEs being 5. While two items were invalid with a score of the number of SMEs being 4. This means that the validator agreed that 13 items had met the material, construction and language aspects so that it was appropriate to be used to train conceptual knowledge on Mechanics. Test instruments that have fulfilled content validity and validity testing are appropriate for the future test [12].

4. Conclusion
Based on research result has produced 13 items that have fulfilled the content validity. Therefore, it concluded that the concept of Mechanics was feasible to use.

5. References

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