Student’s Preconception and Anxiety When They Solve Multi-Representation Concepts in Newton Laws, And It’s Application

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Abstract. The purpose of this study was to describe preconceptions and anxieties students in solving the representation concepts in newton laws, and it’s application. This research was conducted for junior undergraduate student’s in physics department (36 Students) and physics education (31 Students). The method of this study is a qualitative descriptive. The data was collection using test for multi representation concept, questionnaires for anxiety, and interviews. Based on the analysis it can be concluded that (1) the higher is anxiety, the higher is inconsistency (67.16%), (2) the higher is anxiety, the higher is consistency but wrong answer (29.85%), (3) the lower is anxiety, the higher is consistency of right answer (2.98%). Mostly students have understood fewer physics concept in newtons laws.

1. Introduction

Conceptions, misconceptions have become an important part of the study of physics. Understanding of both to be important in learning physics, because it affects the overall understanding of the physics [1]. Problem solving is important to be studied, but should not memorize how to solve it, but how to find a solution. Problems in physics can be presented in various presentations, which have the same concept of meaning. Presentations were presented in the form of a problem, will be represented again by students in the form of conception. The conception of student representation is the result of information processing in itself and can be used as a benchmark of the concepts of physics understanding [2]. Misconceptions experienced by students need to be clarified [3], so it can be the cause of misconceptions. Clarifying misconceptions can be done through interviews and provide arguments. Source misconceptions can be derived from student experience, books, language, and teachers [4]. The use of language becomes a source of misconceptions because they could create representations. It can be consistent or not. So that the test of consistency can also be used as a tool for identifying the cause of misconceptions.

In this study, it is assumed that students understand the concept if students are correct and consistent in representing a concept. Multi-representation test questions adapted from the Force Concept Inventory (FCI) [5] and Representational Force Concept Inventory (RFCI) [6]. the instrument has been used for identification understanding of the concept [1,2,7]. In solving problem, the students experienced the anxiety. Anxiety is a factor that also affects the students in solving the problems [8,9]. The initial assumption that students understand the concept well, if they solve the problems will be solved with the low anxiety level (confidence) and the answer is correct.
2. Method

The method used in this study is a qualitative descriptive. The data was collection using test for multi representation concept, questionnaires for anxiety, and interviews. Multi-representation of test consisted of six items that represent Newton's laws I, kinematics, and Newton III. Each material is represented by two questions with a different representation (visual and language representation). Students categorized as inconsistent if more than two pairs of the test are inconsistent, then the student is classified consistent with the wrong answer if there are more than two pairs of test that are consistent, students categorized correctly consistent if all test questions are given consistently and correctly. Indicators of anxiety [10] The questionnaire was developed to create an indicator of anxiety. Interviews are used to strengthen the argument conclusions and clarify students answer. This research was conducted for junior undergraduate student’s in physics department (36 Students) and physics education (Students).

3. Result and Discussion

The description of the consistency of the student's answers and the level of anxiety (Table 1).

| Consistently Level                      | Percentage (%) | Anxiety Level |
|----------------------------------------|----------------|---------------|
| inconsistent                           | 67.16          | High          |
| correctly                              | 2.98           | High          |
| consistently                           | 29.85          | Low           |
| with the wrong answer                  |                |               |

Based on (Table 1) concluded that 67.16% of the students are not consistent with the answer. Based on interviews, the change is due to answer the student does not understand and confused by the graphic representation, verbal, or do not understand the concept of kinematics and dynamics. Comparison of “wrong answers” between visual and verbal representations (Figure 1)

![Figure 1 Comparison of “wrong answers” between visual and verbal representations](image)

Figure 1 shows that based on Newton's laws I found a lot of answers consistent but wrong, in kinematics, many of which are not consistent, verbal representations are found errors, whereas the laws of Newton III, better than the verbal representation of a visual. Questions used is a modification
of test FCI number 25. Students who answered correctly, can explain and describe uniformly accelerated motion well, for those students who answered incorrectly, could not explain and describe uniformly accelerated motion, even if only partially explains. Results anxiety questionnaire and interview process gave the information that the students are anxious when faced with two problems of the different types of answers, many who understand verbally about the change of pace but misrepresent the form of a graph (Figure 2).

Based (table 1) it can be concluded that 2.98% of the students answered consistently and correctly. The initial assumption that students can be said to understand the concept, but after the triangulation with interviews obtained information that in high school, it turns out the student had practiced doing about FCI and RFCI. based on the debriefing also obtained information that the students do not mention the word net force in interpreting the sigma symbol of force, but a force in the verbal pronunciation of Newton's laws. based on the results of the description of Newton's laws of understanding obtained information that the student is only a partial understanding of Newton's laws, by writing newton first law \( \sum F = 0 \) and \( \sum F = \text{constant} \) has the same meaning (Figure 3).
There is a difference in meaning between "0" and "constant." Making of the physical is not yet understood by the students. Constant has a fixed value and magnitude, certainly different from the number "0". Mathematical language learning should be emphasized in physics so that students are able to understand well the laws of physics that is written in the form of an equation.

Next results, based on (Table 1) was 29.85% of the students are the consistent answer, but it is wrong. Newton's first law is most prevalent consistent answers wrong, even 88.89% of students are categorized as inconsistent (table 1), the answer is wrong consistently in this case. Visual and verbal representation present many mistakes. For representation of verbal and visual, the term constant speed on the motion of objects, (synonymous with about FCI number 18) has not been understood by the students, so that students choose answer vector direction y positive have a greater magnitude than the vector direction y negative (Figure 4).

These results (Figure 3), providing information that the representation of visual and verbal does not affect the student's understanding, understanding students more influenced by intuition and experience that already exists, that the direction of motion of the object produces a force, so the object is to move in the direction of the force, has a larger force than others. The concept of physics is not all easily be found in everyday life. The concept of constant speed, for example, would be hard to find in everyday life. The use of the laboratory is very important to clarify this concept.

In the third law of Newton the inconsistent arise because of anxiety, students feel the weight influence the magnitude of the force in action and reaction (FCI No. 11). On the other without involving the representation of weight, the student answered correctly.

4. Conclusion

From the analysis and discussion, it can be concluded that the students only a partial understanding of concepts, even though there are two students (2.98%) answered correctly and consistently, based on interviews and descriptions of the concept is obtained that the student does not understand it correctly. Test multiple representations of concepts consistency has not been able to measure student understanding of concepts, but if equipped concept description written by the students, and supported by interviews, will obtain more accurate data than just testing the consistency of representation. The visual representation (graphs) and important mathematical introduced to the students [1], [2], to overcome the inconsistent concept (Figure 2) and the problems that arise in Figure 3 and 4. The use of laboratory to demonstrate the object move with constant velocity (newton's laws I). The emphasis of the concept of kinematics and dynamics need to be reviewed again at the end of
the course so that students can clearly distinguish and determine the relationship between these two concepts.

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