Analysis of Student Learning Ability in Science Teaching Based on Mid Semester Examination

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Abstract. This Research tried to make description about student ability in science concept that had been being touch by the teacher based on mid semester examination. The population of research is the 8th grade of students taken place at Public School in Padang academic year 2016/2017. Then the sample is 3 (three) Sekolah Menengah Pertama (SMP) with 2 (two) categories are: average and the better category. The result of these studies is the ability of the student in science only in average 60% below to the criteria mastery level for student Kota Padang. Based on analysis of the result, some misconception occurred in 4 (four) concepts of Physic and 2 (two) concepts of Biology. This result have to be followed by the other research that which can provide a how to overcome the problem of learning science among

1. Introduction

Learning should be described in terms of its content A highly significant aspect of learning is the variation in what is learned, i.e., the diversity of ways in which the same phenomenon, concept or principle is apprehended by different students [1]. Learning outcomes assessment should be undertaken by an educator, not only for the sole purpose of assigning grades in student report cards, but also can be used for the purpose of mapping the ability of learners in learning a subject. Some cores epistemic practice of science and accordingly claim that the goal of science education must be not only mastery of scientific concepts but also learning how to engage in scientific discourse [2]. Analysis of examination results as an important activity that can be done if educators expect a lot of information that can be collected such as the state of student learning outcomes. Science learning outcomes assessment related closely to students ability understanding the concept in science. Concept in science is some situation like events, fenomenon and other that representing by object and its symbol. The symbol of concept may has a different form by one country to another. Concepts are things, events, situations or traits that have characteristics that are represented in each culture by an object or symbol [3].

One's understanding of the concept of science can differ from one to another, which is called conception. Conception which is not in accordance with the conception of scientists is called misconception [4]. Some studies about student’s misconception have been done. Misconception can be identified using a diagnostic test at the beginning or upon completion of specified science topic [5]. A persistent misconception in biology has been found to have multiple underlying causes which are exploited in a powerful multiple-choice test item [6].
Therefore, the purposes of this study know difficult concepts by students based on the difficulty index, knowing the pattern of student answers to the questions given, and knowing the misconceptions by the students based on answers to questions. Students' ability to learn science will be reflected by their ability to answer questions in the exam. If a student fails to answer a question, they are experiencing misconceptions in the science lesson. In this research, the formative assessment investigated is the result of midterm semester which is conducted simultaneously by Education Office of Padang City (Dinas Pendidikan Kota Padang).

2. Experimental Method

The type of this research is a descriptive or expose facto study that gives a descriptive illuminative of the phenomenon being investigated. This research tries to describe the situation based on past data like the midterm exam. The population of this study is the students of 8th grade Junior High School (SMP) Negeri Padang registered in the academic year 2016/2017. While the sample of this study are three schools, each of which is SMP N 15 Padang, SMP N 25 Padang; and SMP N 34 Padang. The data of this research is the result of midterm exam in odd semester 2016/2017. While the instrument to collect the data is midterm exam issued by the Education Office of Padang City (Dinas Pendidikan Kota Padang).

The first step is analysis of difficulty index. The analysis of the difficulty index and distinguishing problem tends to lead to the analysis of items. Therefore, in accordance with the purpose of this study, the analysis is done only the analysis of the difficulty index to see the problems that students are difficult, and the questions according to students easy. A difficult question will relate to the mastery of students on concepts related to science subjects. Problem-level analysis of difficulty will determine very difficult questions; quite difficult (moderate); and the questions are too easy. Thorndike and Hagen provide the limits of very difficult-and-very easy questions are as follows if the difficulty index \((P)\) less than 30\%, so it is a very difficult problem, if the difficulty index \((P)\) from 30\% to 70\% so it is a more difficult problem, and if the difficulty Index \((P)\) more than 71\% so it is very easy problem.

Then, the distribution of student answers is analyzed to see the tendency of misconceptions experienced by students on certain concepts. From the distribution of answers can be proven like what the mindset of students in understanding the science concepts their studied. This analysis is more directed to physics concepts than biological concepts. After that, the analysis of each question related to the misconception that occurs when the student answers the question. The analysis is done qualitatively and presented clearly.

3. Result and Discussion

3.1. Data Description

The number of samples of this study is shown in table 1.

| School        | The Number of Students |
|---------------|------------------------|
| SMP Negeri A  | 181                    |
| SMP Negeri B  | 253                    |
| SMP Negeri C  | 327                    |
| Total Number  | 761                    |

Table 1 show the number of related samples in this study were 761 students from 3 (three) Public School (SMP) in 2 (two) categories are: average category and the better category. One of school taken place in the center of Town and 2 others faraway from it. The average of learning ability of student is shown at table 2. Table 2 shows two schools having a similar average of 61.42 and 63.01, and
one school having a lower average of 54.38. If connected with the minimum passing level (KKM) for Science Subject at SMP Kota Padang 80, then the total number of students who mastery level in midterm semester only 6 people.

Table 2. The Average of Learning Ability of Samples

| School          | Average (%) | The Lower | Upper  |
|----------------|-------------|-----------|--------|
| SMP Negeri A   | 61.42       | 37.50     | 80.00  |
| SMP Negeri B   | 63.01       | 32.50     | 82.50  |
| SMP Negeri C   | 54.38       | 27.50     | 77.50  |

The question is why the value of report cards is still high? The answer is that the value of the report card is not only the value of the semester exam course (cognitive) but has been combined with daily test scores, performance exams and attitude aspect values to the science. Based on the results of problem difficulty level analysis, obtained 6 (six) problems that are very difficult, 18 problems are more difficult; and 16 problems are very easy such table 3.

Table 3. The Analysis of Difficulty Index for the very difficult problem

| Problem Number | Sum of Student Of True Answer | Total of Student | Difficulty Index | Difficulty Categorized |
|----------------|-------------------------------|------------------|-----------------|------------------------|
| 9              | 68                            | 761              | 0.09            | Very Difficult         |
| 16             | 109                           | 761              | 0.14            | Very Difficult         |
| 32             | 154                           | 761              | 0.20            | Very Difficult         |
| 4              | 166                           | 761              | 0.22            | Very Difficult         |
| 20             | 191                           | 761              | 0.25            | Very Difficult         |
| 23             | 207                           | 761              | 0.27            | Very Difficult         |
| 18             | 233                           | 761              | 0.31            | More Difficult         |
| 21             | 236                           | 761              | 0.31            | More Difficult         |
| 19             | 247                           | 761              | 0.32            | More Difficult         |
| 14             | 260                           | 761              | 0.34            | More Difficult         |
| 36             | 261                           | 761              | 0.34            | More Difficult         |
| 38             | 322                           | 761              | 0.42            | More Difficult         |
| 7              | 324                           | 761              | 0.43            | More Difficult         |
| 25             | 335                           | 761              | 0.44            | More Difficult         |
| 35             | 367                           | 761              | 0.48            | More Difficult         |
| 34             | 378                           | 761              | 0.50            | More Difficult         |
| 12             | 407                           | 761              | 0.53            | More Difficult         |
| 5              | 431                           | 761              | 0.57            | More Difficult         |
| 11             | 433                           | 761              | 0.57            | More Difficult         |
| 15             | 481                           | 761              | 0.63            | More Difficult         |
| 39             | 482                           | 761              | 0.63            | More Difficult         |
| 8              | 506                           | 761              | 0.66            | More Difficult         |
| 17             | 534                           | 761              | 0.70            | More Difficult         |
Table 3. Cont

|   |  |  |  |   |
|---|---|---|---|---|
| 24 | 534 | 761 | 0.70 | More Difficult |
| 13 | 541 | 761 | 0.71 | Very Easy |
| 27 | 549 | 761 | 0.72 | Very Easy |
| 6 | 556 | 761 | 0.73 | Very Easy |
| 10 | 560 | 761 | 0.74 | Very Easy |
| 26 | 571 | 761 | 0.75 | Very Easy |
| 37 | 584 | 761 | 0.77 | Very Easy |
| 30 | 639 | 761 | 0.84 | Very Easy |
| 31 | 641 | 761 | 0.84 | Very Easy |
| 33 | 645 | 761 | 0.85 | Very Easy |
| 22 | 647 | 761 | 0.85 | Very Easy |
| 40 | 670 | 761 | 0.88 | Very Easy |
| 3 | 673 | 761 | 0.88 | Very Easy |
| 28 | 673 | 761 | 0.88 | Very Easy |
| 1 | 721 | 761 | 0.95 | Very Easy |
| 29 | 735 | 761 | 0.97 | Very Easy |
| 2 | 736 | 761 | 0.97 | Very Easy |

Table 3 illustrates 6 very difficult questions, 18 difficult question and 16 very easy question. Problem Number 09 with difficulty (P) = 9%. It is about understanding the weight and understanding of the masses. Students are given a matter of weight differences with the masses. The related concepts are gravity, vector quantity; scalar quantity; units of mass and unit of weight. From this problem it can be concluded that students have not mastered the concept: mass; weight; material; vector; scalar; and units. It is therefore recommended that teachers should have to pay attention to these concepts and explain them to students.

The problem number 16 with difficulty (P) = 14%. It is about the kinetic energy of moving objects. Given two objects A with mass 5kg and object B with mass 6kg. The object is being described with a speed of A = 1 m / s and B = 2m / s. Asked the kinetic energy comparison A and B. 86% amount of students answered incorrectly to this question. They did not understand the comparison of quadratic equations. The related concept is the definition of kinetic energy, kinetic energy formulation, comparing kinetic energy of A and kinetic energy of B.

The problem number 32 with difficulty index (P) = 14% th question about some concept of Biology. There are osteon bones; Cartilage; Prone to hyaline; And prone to fibrous. Eighty percent of students are unable to answer the characteristics of bone with respect to the ratio of the lime (phosphorus) and the adhesive substances that these bones possess.

The question number 32 with difficulty level (P) = 22%. It is a matter of adding force vectors. Given two forces and one force as a resultant. They form an angle of 60° to each other in the direction specified such as figure 1.
Eighty percents of students were not able to sum up vectors in a triangular way. Therefore in the future, teachers should be concerned that for this simple concept, students cannot do it.

The problem 20 difficulty Index (P) = 25%. This problem is due to the effort made by a force on a flat plane like the figure 2. Seventy five percents of students fail to find solutions to this problem because they do not care about the unit, and do not change units to uniform units.

Students forget that in doing the first problem must be equated unit. 120 cm distance must be changed first to 1.2 meters. The second possibility of student error is not being able to distinguish between concepts and mathematical formulations of: effort, force, density and acceleration. Students are ambiguous in determining what mathematical formulation of that problem.

Problem Number 23 with difficulty index (P) = 27%. Problem refers to genetic engineering. Students may not understand what is called genetic engineering. Or other possibilities of the given lesson have not provided information about this concept. The related concept is the hormones given to plants that can change (engineer) the genetics of the plant. The question is what is hormone that can change the habits of plants.

3.2 Misconception Analysis

Student have many problem about sum vectors as a triangle methode. Many students answered A, to the key point about C. This proves that students are still misconception about vector quantities, and how vector summing is. Because vector has a mount and direction, so the sum of two vector have to follow some special way. Some of physics quantities have two quantities there are scalar quantity and vector quantity. Physics concept such as velocity, acceleration, force, momentum, have two scalar dan vector quantities. Vector analysis can help student to discribe the diagram according to some fenomena was given. Some vector marked by an arrow, so teacher have to explain that the arrow pointed the direction as the direction of vector [8].

Student also have some problem when they answer the question about comparison the kinetic energy of two object that have different velocity. Also discussion about the law of conservation of energy (energy conservation), it appears that students have misconceptions about the law of conservation of energy, so students are still have misconceptions about the concept of kinetic energy. They know that kinetic energy is energy related to motion, but forget the mathematical operations. Especially the mode of quadratic operation and the comparison of two prices in the quadratic ratio. Kinetic energy have a direct relation to the Work (W) which have a scalar quantity only so they did
not have a direction (vector quantity). Because of this two concept are the scalar, its more simple to solve the problem about this concept according to teacher. But in reality its not simple by the student.

This study also found some other misconception that happen to the student. When the researcher asked the student: “ If two or more cars start at the same time in the same point. How about its velocity? Almost all of student answer the velocity of these cars are same. It also when the researcher ask the student. When two car in the same direction, and one car in one time in position side by side by the other car. How about their velocity at that time? Almost all of student answer, their velocity at that time in same. That found gave a warning to us; as a teacher; let star lesson from the pre-conception of the student, in order to over come this misconception. State that “the coactivation of the misconception at the same time as the correct conception should support recognition of a discrepancy between the accurate input sentence and the entire misconception network. Detecting conflict may prompt a revision or replacement process that could weaken the representation of incorrect conceptions in memory. Encountering an elaboration or explanation about the correct concept could also help to increase the coherence and stability of the representation of the accurate concept in memory [9].

4. Conclusion
Based on analysis of the results, student had some problem in learning science it’s proven by the student learning ability. They learning ability only below to the minimum passing level KKM. Some misconception that happened to the student never thought by teacher before. Teacher had surprised to relized that the student had misconception on a very simple concept according to the teacher. The Minimum passing level (KKM) 80 for science need to be reviewed, considering that it is difficult for the students to achieve. Student should not be manipulated, so that they dont care about the lesson. They believe that they can get the good mark although the did not pass the examination in the passing level. Its is several effort can be planed improving student competence by teachers, principals, supervisors or the other educational practitioners. Start with good intentions, work systematically base on the programme for the adventage of young generation.

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