Students Ability Analysis to Complete the TIMSS Test of Light Content on Eight Class Level of Junior High School

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Abstract. This research aims to identify students' ability to complete the TIMSS test of light content. This research is a qualitative descriptive research. Data were obtained from 95 students in 3 different classes. The TIMSS test that was given to the student consisted of 5 multiple choices and 2 essay. The results of this research show that the student’s ability are good in completing the TIMSS test of light content with the right answer of multiple choice percentage is higher that the percentage of either wrong answer or not answer. The result of essay also shows the percentage of the appropriate answer, appropriate and complete answer are higher that student’s inappropriate answer, not quite appropriate or not answer.

Keywords: TIMSS; Light content; Student ability

1. Introduction

Education is a milestone in the development of a nation. The quality of education of a nation can be an indicator of the progress of the nation. The quality of education can be seen from various surveys carried out by competent international institutions. One of them is the Trends in International Mathematics and Science Study (TIMSS).

Trends in International Mathematics and Science Study (TIMSS) is an international study sponsored by the International Association for Evaluation of Educational Achievement (IEA) to find out the achievements of students' mathematics and science in the world at the level of fourth-grade elementary school and eighth -grade junior high school [1]. The basics of mathematics and science achievement assessment by TIMSS is categorized into two domains, namely content and cognitive [2]. Content domains for science are chemistry, physics, biology, and earth science. Each content domain includes several main topics. Each topic has a specific purpose to assess learning topics that must be achieved by students. Each question that was tested used a verb intended to assess the cognitive domain in TIMSS, namely knowing, applying, and reasoning [1]. The first domain is knowledge regarding the ability of students to remember, recognize and explain concepts, facts and procedures in science. The applying domain is related to the use of knowledge in generating explanations and solving problems. The third domain of reasoning is concerned with the use of evidence and scientific understanding to analyze, synthesize, and generalize in complex contexts [3,4].
Indonesia has participated in TIMSS five times [1]. In the final year of the assessment of the junior high school level in 2011, Indonesia obtained 406 IPA score with a middle scale value of TIMSS of 500 [1]. From these data, it can be said that Indonesia is still below the limit value set by TIMSS. In general Indonesian students are judged to only be able to remember scientific facts, terms, laws and use them in drawing simple conclusions [5]. For TIMSS 2011, the percentage of Indonesian students who reached low, medium, high and advanced levels in the field of science were 54%, 19%, 3%, and 0% respectively. Further successive correct answers in the domain of knowing, reasoning and applying students, Indonesia only gained 36%, 20%, and 27%, [2,3]. This study aims to determine the ability of students in solving TIMSS test on light content.

The rest of this paper is organized as follow: Section 2 describes the proposed research method. Section 3 presents the obtained results and following by discussion. Finally Section 4 concludes this work.

2. Research Method

The method used in this study is a qualitative descriptive method. This research was conducted at SMP Negeri 1 Jaten Karanganyar in the even semester of 2017/2018. Sampling was done by cluster random sampling in class 8 with three classes with 95 students. Data obtained through TIMSS test were given consisting of 5 multiple choices and two essays of light content and interviews with teachers and students to strengthen the TIMSS test data. The mapping of the test given is described in Table 1 as follows:

| Domain | Number Test | Type Test |
|--------|-------------|-----------|
| Knowing | 2.3 | Multiple Choice |
| Reasoning | 1.5 | Multiple Choice |
| Applying | 4 | Multiple Choice |
|          | 7 | Essay |

Analysis of students' ability to answer test is done by giving an assessment of students' answers. In multiple choice, each student's answer is grouped into each answer choice which is the percentage. In the essay, students answer scale with a scale of 0-4 is then grouped on the scale of the answer and percentage. Details of the answers to essay are described in Table 2 as follows:

| Scale of Answer | Criteria |
|-----------------|----------|
| 0               | Not answer the question |
| 1               | Inappropriate answer |
| 2               | Not quite appropriate |
| 3               | Appropriate answer |
| 4               | Appropriate and complete answer |

3. Result and Discussion

The results of qualitative data from student answers are as follows:

3.1 Multiple choice

Table 3 presents the percentage of student answers per item question number.

| Test Number | A (%) | B (%) | C (%) | D (%) | Not Answer |
|-------------|-------|-------|-------|-------|------------|
| 1           | 94    | 0     | 3     | 3     | 0          |
| 2           | 0     | 0     | 2     | 98    | 0          |
| 3           | 27    | 59    | 13    | 1     | 0          |

Answer Key

A
D
B
3.2 Essay
Table 4 presents the percentage of student answers according to the answer scale.

| Test Number | Percentage of student answers |
|-------------|-------------------------------|
|             | 0 (%) | 1 (%) | 2 (%) | 3 (%) | 4 (%) |
| 6           | 3     | 29    | 11    | 41    | 16    |
| 7           | 19    | 11    | 20    | 12    | 38    |

Overall students' answers can be said to be good because in multiple choice the percentage of right answers is higher than the percentage of wrong answers or not answering. Likewise, in the essay, the percentage of students who answered appropriate and appropriate and complete answer was higher than the percentage of students who did not answer, not quite appropriate or inappropriately. More details can be seen in Table 5:

| Test Number | The Answer Criteria |
|-------------|---------------------|
|             | Right | Wrong or not answer | Appropriate or appropriate and complete answer | Not answer, not quite appropriate or inappropriate |
| 1           | 94%   | 6%                | -                 | -            |
| 2           | 98%   | 2%                | -                 | -            |
| 3           | 59%   | 41%              | -                 | -            |
| 4           | 83%   | 17%              | -                 | -            |
| 5           | 79%   | 21%              | -                 | -            |
| 6           | -     | -                | 57%              | 43%          |
| 7           | -     | -                | 50%              | 50%          |

The problem with the cognitive domain of knowledge consists of questions number 2 and 3. It is found that the percentage of students who answered right was greater than students who answered wrong or did not answer. In question no. 2 the answer of the student who answered correctly was more dominant than the one who answered wrongly or did not answer. This is because the problem is related to a constant that is about a velocity of an object or wave. Many books have provided information about these constants, such as the speed of light and sound. Therefore students choose the choice of answers C or D because students have obtained information about the speed constants of light and sound. Thus students can answer question No. 2 well.

Problem 3 relates to objects that have their own light. The percentage obtained from student answers is almost balanced. Where students who answered right got 59% and students who answered wrong or did not answer were 41%. This is because students have difficulty in defining the meaning of objects that have their own light. Therefore the choice of answers offered is a consideration for students with answers to each answer choice. This shows students still lack understanding about the concept of light sources. Concept understanding is the ability to grasp understandings such as being able to express a material that is presented in a form that is better understood, able to provide interpretation, and able to apply it [6]. One of the causes of students not understanding the concept is the existence of teacher-dominated learning and the absence of reciprocity in the form of questions from students [6;7]. If it is connected between question number 3 and events in the field through interviews, the teacher only shows the events and characteristics of light without knowing that the meaning of light and light sources so that the understanding gained by students is still lacking.
Problems with cognitive reasoning domains consist of questions no. 1, 5, and 6 where test are more directed at students' analytical abilities. In problem 1, the right answer is more dominant than the wrong answer or not answer. This is based on the learning process in the classroom, where according to the interview conducted to the teacher it was stated that at the time of learning the light content students displayed animation reflection through powerpoint. Thus the help of animated media can help students in learning. The learning process can run in accordance with the goals one of which is influenced by the existence of the media [8]. Animation media is very helpful for students in learning so that learning outcomes increase. Research by Aksoy [9] stated that animation media is more effective than traditional teaching methods in increasing learning outcomes. Likewise, by Kadek Sukiyasa [6], it was found that student learning outcomes and student learning motivation were higher using animation media than using only powerpoint media.

Questions 5 and 6 are test of reasoning that require a high logic because they imagine an indirect process. This means that students are required to predict the shadows of objects produced. Where students are asked to describe the images of objects produced in the mirror. This type of problem should be trained continuously so that students are familiar with similar problems. Reasoning refers to association learning theory, namely the ability to group various ideas and associate various events to then incorporate them into memory fragments in the brain and experiences stored in the memory of the brain interact with prior experience [10]. On the other hand, learning can be defined as an experiential process resulting in a relatively permanent change in behavior that cannot be explained by a temporary state of nature, on innate response tendencies [11]. This is in accordance with the results of the study which stated the correct answers in a row in the domain of knowing, reasoning and applying students, Indonesia only obtained 36%, 20%, and 27%, [2; 3].

Problems with the application domain consist of questions no. 4 and 7 where test are related to daily life events. The percentage of student answers appropriate, appropriate and completely in question 7 is the same as the percentage of students' answers that are inappropriate, not quite appropriate or not answering. This is because in teacher learning less emphasis on authentic problems. Based on interviews with students, it was found that the teacher only taught appropriate content in the book, rarely gave examples in everyday life. Whereas on the other hand, there are many learning models that emphasize authentic problems, one of which is problem-based learning. Problem-based learning can facilitate students in solving problems during learning [12]. The problems given are authentic problems that can help students in the cognitive domain of application. According to Ausubel learning can be classified into two dimensions. The first dimension relates to the way information or subject matter is presented to students through acceptance and discovery. The second dimension concerns the way in which students can link that information to existing cognitive structures. The cognitive structure is the facts, concepts, and generalizations that students have learned and remembered [13]. The meaning that if learning is associated with authentic problems it will help students to learn and impact on long-term memory. Likewise on the problem number 4 with the percentage of answers to students who answered correctly was 83% while those who answered incorrectly or did not answer were 17%. On the other hand, it was known that the choice of answers from students was almost evenly distributed except for choices D because student think sunlight has a fast speed than others.

4. Conclusion
This paper has identified students' ability to complete the TIMSS test of light content. The ability to complete test is based on the knowledge gained by students. If students get good knowledge, students can complete problems well. Many factors that influence students' ability to complete problems include learning models and methods that teachers do in class and lack of practice test. Students of SMP Negeri 1 Jaten in class 8 can completing TIMSS test of light content well, where the percentage of answers to right multiple choice is higher that the percentage of wrong or not answer, as well as essay with the appropriate, appropriate and complete percentage of answers higher that the students' inappropriate answer, not quite appropriate or not answer

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