13 Students' Misconceptions on Properties of Rectangles

by Mega Teguh Budiarto

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Abstract. This research aims to describe students' misconception of junior high school on the concept of the properties of rectangles and the alternative to overcome them. This research was qualitative descriptive research using test with the CRI (Certainty of Response Index) method and interview method. There were three students as subjects in this study who was identified to have the most misconceptions among students in the class . Based on the data analysis, the subjects showed similar misconceptions. One of student misconception was on the properties of rectangles. Student thought that rectangles were always regularly shaped, or in other word no rectangle was irregular shaped. Students' misconception caused by picture given to the problem. The misconceptions may due to the lack of understanding of rectangle properties. Alternatives can be done such as re-explain (remediation) or by using cognitive conflict strategies. In particular, our results indicated that 8th grade students had misconceptions in understanding the properties of rectangles. By knowing the misconceptions, students can possibly know how new knowledge is interpreted as well as having an impact on student's ability to learn correct information in the future.

1. Introduction

Misconception is a concept which has no related idea with the concept of recognized experts [1].If students' misconception is not well cured immediately, and then the students' understanding of the higher topics will be hampered. Misconception is the phenomenon of different conceptions of a person with the conception of the experts [2].This misconception arises from the fact that one before knowing the correct concept they already have their own concept which is formed from reasoning, intuition, culture, or the other. The concept is maintained to explain the symptoms that exist in the vicinity but the concept is different from the actual concept. In addition, studying mathematics is not about studying the concepts and structure of mathematics [3].

Based on research conducted by Suha, who reviewed the misconception on the flat triangle matter in 4th grade of primary school can be seen that misconception may occur in the type of theoretical triangle [4]. In addition, the causes that occur in research is students' interest in learning and less given conceptual understanding. Identification of misconception is defined as a way to detect students' learning which is thought to have misconceptions of concept; in this case the conception of students is different from that of experts. The identification in this study was by using written diagnostic test with Certainty of Response Index (CRI) method. The Certainty of Response Index (CRI) that introduced by Hasan, Bagayoko, and Kelley in 1999, in their journal entitled "Misconceptions and The Certainty of Response Index (CRI)" is a way of measuring the level of confidence or the certainty of respondents in answering each question (matter) that is given [5][6]. In addition, interview diagnosis is also used in identifying misconceptions that occurred.

Most asserts that not all misconceptions can be changed [7], because it takes a fast and deep handling effort to correct and change the concept to be true in a short time. When it is known and affected students, the teacher can give alternatives to overcome the misconceptions. Simple alternatives are commonly done such as re-explaining. This re-explanation allows students to have better understanding of the concept. There are many attempts to overcome misconceptions such as those described by Swedosh and Clark (1997); by demonstrating cognitive conflict. The cognitive conflict approach can create a sense of students' dissatisfaction with the conception that they possess a change in the student's strong conceptions that conform to the scientific conception [8].The effort overcome the misconceptions or misunderstandings is used to emphasize that learning is not only related to conceptual understanding, but also to have better problem solving and have laboratory investigation skills [9][10]. The objects of this project are rectangle. This study involved three students who have most misconceptions among the students in the classroom. After this survey, an eighth grader teacher can analyze students' misconceptions and help them to improve their geometric knowledge. In this paper, it is described some of the causes of the students misconceptions. Students' misconception was caused by picture given. The misconceptions may due to lack of understanding of rectangle properties.This article give the alternative solution to identify the misconception and to overcome them. By identifying the misconceptions, students can comprehend how the new knowledge is interpreted and have an impact on student's ability to learn correct information in the future.

2. Students' misconceptions, causes of misconception , misconception's identify and alternative solution

The conceptual framework is grounded in the students' conception on the concept of rectangle.

2.1. Misconceptions

Misconceptions include understanding and thought that are not based on information that is right, or not understood by many people [11]. Misconception is the phenomena of different conceptions of a person with the conception of the experts [12].This misconception arises from the fact that before knowing the correct concept they already have their own concept which is formed from reasoning, intuition, culture, or the other. The concept is maintained to explain the symptoms that exist in the vicinity but the concept is different from the actual concept.

According to Soedjadi, misconceptions arise because of preconceptions [13]. Preconception is a beginning concepts' of a person who has an interpretation about an object. This initial concept is derived from education formal level. It is not impossible that a student has a different initial view of what he or she is learning. Under these circumstances, preconception becomes a misconception. Based on the opinion of the experts above, it can be concluded in this study that misconception is a conception that is inconsistent with the scientific notion or understanding received by scientists.

2.2. Causes of Misconception

According to Sodjadi (2000) there are 4 things that cause misconception. The first is the meaning of words, the second is practical aspects, the third is simplification, and the fourth is images [13]. Suparno (2005) explains that there are five factors that causes misconceptions in students namely students, teachers, textbooks, context, and way of teaching [12].

2.3. Misconcepton's identify

One of identification of misconception is open-ended questions in an essay test that can make it easy to detect students' misconceptions, because the students tend to answer according to their thinking [12]. Certainty of response index (CRI) is a way introduced by Hasan to measure the level of confidence or certainty of respondents in answering each given question [6]. The function of CRI is A diagnostic tool that allows teachers to modify the way they teach [5]. When a concept has been clearly articulated by the teachers, the student can accept the concept appropriately and there won't be misconception, therefore, it can be said that teaching or learning process has been successfully applied. But if the opposite happens, then the teacher must earlier identify to what is actually the cause of learning is not as expected, then can modify the way of teaching.

2.4. Rectangle

A rectangle is a special parallelogram. It is an equiangular parallelogram. The relation among the special parallelogram can be described in the Figure 1 by using a circle to represent each set. [14]

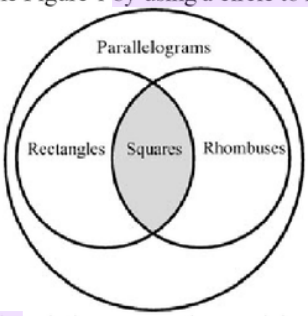

Figure 1. The relation among the special parallelogram

Since every rectangle and every rhombus must be a parallelogram, the circle for the set of rectangles and the circle for the set of rhombuses must be inside the circle for the set of parallelograms. Since every square is both a rectangle and a rhombus, the overlapping shaded section must represent the set of squares. Here are the principles involving properties of rectangle:

Principle 1: A rectangle has all the properties of parallelogram.

Principle 2: Each angle of a rectangle is a right angle.

Principle 3: The diagonals of a rectangle are congruent.

After knowing misconception and causes that occurs in students' case, it can be given an alternative to overcome misconception. Alternative is the simplest thing like describing frequent. Matter is possible be informed about the restarted in order for students to have better understanding of the concept.

2.5. Alternative solution

After knowing misconception and the cause of that which is occurs in students, it is possible to have alternative to overcome misconception. Alternative is the simplest thing like describing frequent. Matter is possible to be informed about the restarted in order for students to have better understanding of the concept. There are a lot of efforts in addressing misconception as presented by Swedosh and Clark (1997), which demonstrates to cognitive conflict. It is a cognitive approach conflict that can create a sense of dissatisfaction of the students of conception [8]. Based on the results of research conducted by Adnyani, Sadia and Natajaya where there is a difference in misconception a significant between the strategies of the cognitive conflict than the strategy of conventional sense. The strategy of the cognitive conflict is superior in providing the misconceptions to students when compared with a conventional learning strategy [15]. This strategy of the cognitive conflict will facilitate students to construct and explore their knowledge of the encountered phenomenon. The strategy of conventional rarely implemented the strategy of activation of knowledge and to be on the matter and the completion of the curriculum. By a strategy of cognitive conflict, teachers can change students to construct the initial conception of students who are not in accordance with the conception with the conception of experts.

3. Method

This research is a qualitative descriptive research using test method and interview. In this study, students were given written diagnostic test. The subject of this study was based on the results of the diagnostic tests written about misconceptions. After the test, three students who had misconceptions of 17, 16 and 16 questions from 21 questions become the research subject.

Those three research subject were given misconception test. The material of misconception test was about rectangular concept such as the definition and properties. The rectangular includes square, rectangle, rhombus, parallelogram, kite, and trapezoid. The misconception test arrange in the question of diagnostic tests consisting of 21 questions such as "Look at the following geometry. Build any kind of which is a rectangular figure! Why?"

The misconception test analyzed using certainty of response (CRI) method. Every question had column of CRI score. Student gave CRI score in 0-5 scale for each question. The CRI score was a students' belief in giving answer for every question. Student gave 0 score for lowest belief and 5 score for highest belief. The CRI score can diagnose the misconception. The information of misconception test result and the cause of student misconception known by interviewing after the misconception test were done. Analysis result and discussion used for describing student misconception, the causes, and the alternative to handle it.

4. Results and Discussion

Written diagnostic misconception test was given to second grade in junior high school. Based on the results of misconception tests, three students were selected as the subject of research. Table 1 presents the subjects in this study.

Table 1. List of Eighth Grade Student of Misconceptions Test Results

No	Research subject	Misconceptions calculation
1.	RAD	17
2.	PB	16
3.	MAA	16

The analysis of misconception tests is in Figure 2 which showed that each subject had different misconception on the concept of definition and characteristics of the rectangular figure and the student misconception causes. In addition, alternative solutions can be given to overcome the misconception that happened.

7. Which image included rectangle?

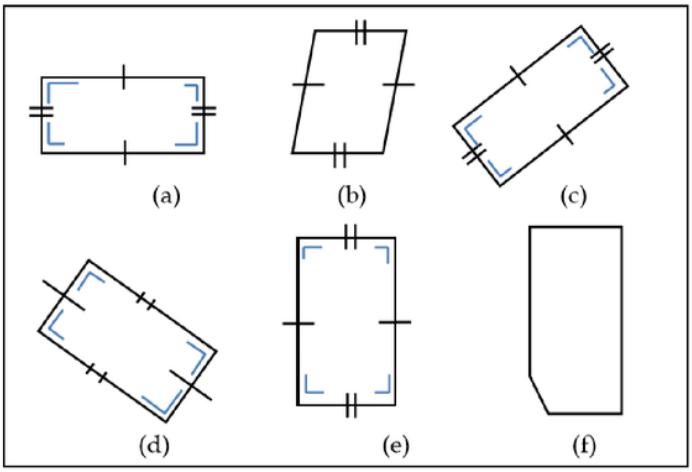

Figure 2. Question Number 7 in Misconception test

In this study, the first, second, and third subject gave 5 CRI score for their answer in seventh question. A score of 5 indicates the high level of student confidence in answering questions [5]. They answer questions with the correct knowledge or concepts without any hesitation at all. These values are true values without any notion at all. In question number seven, subjects gave a wrong answer and high CRI score; it indicates the student misconception [5].

The research subjects had misconception in the properties of rectangle. Figure 2, Figure 3, and Figure 4 showed the results of the response of the students' answers. They assume that the rectangle was always in the same position and has the same shape as any other rectangle. In this case, they were experiencing

misconceptions to the concept of the properties of rectangle. This was in accordance with the theory described by Suparno, who stated that misconception is a concept that is not in accordance with scientific concepts or concepts established by experts[1].

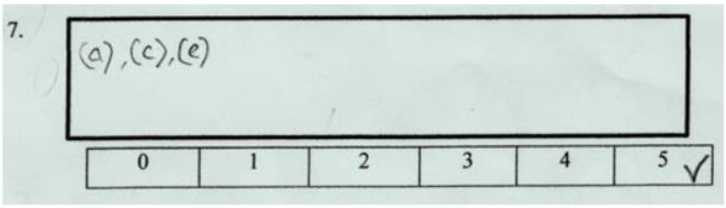

Figure 3. First Subject answers

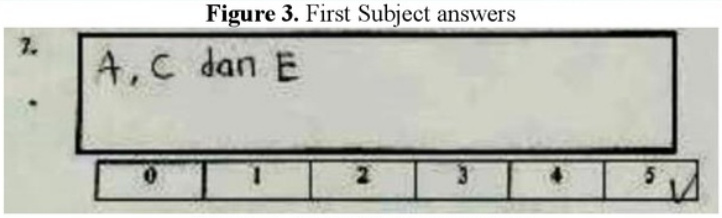

Figure 4. Second Subject answers

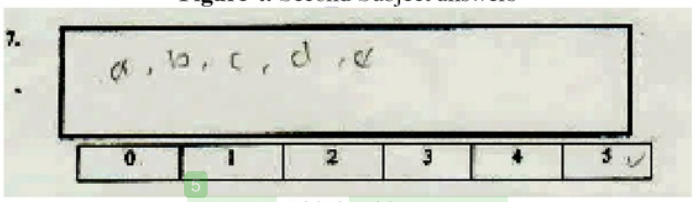

Figure 4. Third Subject answers

Based on these misconceptions it can be seen that students' misconception occurred because the students did not recognize the image given. In this case the students did not really understand the properties of the rectangle correctly. They only see the rectangle always in a two-dimensional figure presented by a picture that rose in order to know the misconception of the students to the concept of rectangles. Alternatively, the treatment can be used to overcome the causes of these misconceptions is to use cognitive conflict approach and re-explanation (remediation).

Misconception happened in whole concept which relates to the distinctive features. Hopefully, the teachers can give and transfer the concept based on the definition and distinctive features of square. Therefore, the students will comprehend it well rather than only memorizing it.

5. Conclusion

There were many kind of students' misconception in rectangular concept such as identifying the rectangle properties, identifying the similarity of rectangle and parallelogram properties. This students' misconception caused by the given picture. The alternative that can be given to this students' is by using conflict cognitive approach in learning mathematics. By knowing the misconceptions, the students can comprehend how new knowledge is interpreted and have an impact on students' ability to learn correct information in the future.

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