

**THE PROFILE OF 10 GRADE STUDENTS' MISCONCEPTION IN EXPONENTIAL DEPEND ON MATHEMATICAL ABILITY****Atika Arfianti Putri**

Mathematics Education, Faculty of Mathematics and Natural Sciences, State University of Surabaya, e-mail: atikarfianti77@gmail.com

**Rooselyna Ekawati**

Mathematics Education, Faculty of Mathematics and Natural Sciences, State University of Surabaya, e-mail: rooselynaekawati@unesa.ac.id

**Abstract**

Understanding the concept is an important aspect in mathematics learning. Every student has differences of understanding the concept because every student has different mathematical ability. If every student can't understanding the concept correctly, they will get difficulty when follow mathematics learning. The student difficulties in understanding the concept can make misconception. Misconception is a condition where student conception is different with scientific conception by scientist. This research was conducted in SMAN 1 Gedangan. This research was a qualitative descriptive research. The purpose of this research was to describe the profile of student grade 10<sup>th</sup> students' misconception in exponential depend on students' mathematical ability, namely high, medium, and low. Student misconception was analyzed based on the paper test result which is completed with CRI (*Certainty of Response Index*) instrument and the result of interview. The subjects of this research were six students which are consist of two students from each category of mathematical ability who had the most misconception. Based on the result of analysis, the students with high, medium, and low mathematical ability had misconceptions when determined the even power result of negative integers and misconceptions when applied a rule as a requirement of the fraction exponent concept. The students with medium mathematical ability also had misconceptions when converted the decimal expression to become the exponential expression. The students with low mathematical ability also had misconceptions when determined the power result of the multiplication of two numbers in the bracket.

**Keywords:** Misconception, Exponential Misconception, Mathematical Ability.

**BACKGROUND**

The concept is a small fragment of an information. The concept construct theories, laws, principles, or procedure. According to Ibrahim (2012) understanding the concept is capability that can allow someone to do something, it can be interpreted that without understanding a certain concept, someone can't do much and maybe his/her survival will be disturbed; otherwise understanding the concept with a good, broad, and deep as owned by a particular scientist, allow a someone or expert concerned apply the control their understanding in variety of purposes. The importance of understanding the concept appears in the curriculum of every level of study that always include an understanding of the concept. One of them is the understanding of the concepts in mathematics learning. Mathematics is one of the lesson that must be learned by students since in elementary schools up to senior high schools.

Understanding the concept is an important aspect in learning mathematics. According to Utari, et al (2012)

understanding of mathematical concept is understood correctly about mathematical concept, namely the students can translate, intrepret, and conclude a mathematical concept based on the construction of their knowledge, not just memorizing. If the students don't have a good concept understanding, they will be difficult to follow the difficult mathematical learning (Antu, 2013). Understanding the concept of each student is different, because each student has different mathematical ability. According to National Council of Teachers of Mathematics (NCTM) (in Nugrahwaty, 2014) mathematical ability is the skills needed to perform various mental activity, thinking, studying, solving the problem of students solve problems in mathematics. The students mathematical abilities divide the students into three groups, there are students who have high, medium, and low mathematical ability (Rofiki, 2012).

The students difficulty or the students error in understanding the concept can give rise to the misconception that will make difficult for students to learn mathematics. Misconception is inaccurate understanding of the concept, clasification of the wrong examples, the use of

the wrong concepts, different concept, a mess of different concepts, and hierarchical relationships of concepts which are not true (Suparno, 2013). The misconception that experienced by each student in a class can be different from each other because of any different factors (Yahya, 2016). One of the factors is the level of students mathematical ability. According to Prasetyorini (2013) the highest amount of misconception occurred at the students with low mathematical ability level and the lowest amount of misconception occurred at the students with high mathematical ability level.

An exponential material in senior high school is a first part of the exponential and logarithm subject. This material often give rise to student misconceptions. According to Cangelosi, et al (2013) found that in solving problem of exponential expressions, the students often do the wrong interpretation of negative sign in exponential expressions. So that, the analysis of the students misconception needs to be done early to find out which part the students often have misconceptions, so in learning activity, teachers can anticipate and give the solutions for the students who are having a misconception.

According to Ibrahim (2012) to know and identify the misconception that experienced by the students that is using a Certainty of Response Index (CRI) instrument. CRI method is quite powerful to use to distinguish between the student who has misconceptions and the student who has lack of knowledge, as well as the process of identifying and analyzing the results did not take a long time (Tayubi, 2005). This research is also done interviews diagnosis to support CRI method and to know the reasons and the consistency of the students who are diagnosed.

Based on the description above, then the researcher did a study entitled "The Profile of 10 Grade Students' Misconception in Exponential Depend on Mathematical Ability". The purposes of this study is to describe the profile of exponential misconception of 10 grade students who have high, medium, and low mathematical ability. By the existence of this study, both a researcher or teachers can find out the profile of students misconception in exponential. So that, this study become the information and the input that can be used as consideration in choosing and determining the learning model when teacher will teach exponential material to senior high school students.

## METHOD

This study is a descriptive study that used a qualitative approach. The aims of this study were analyzed and describe the profile of 10 grade students' error in exponential depend on mathematical ability. This research was conducted in two classes of senior high school in Gedangan. The instrument data are paper and pencil test and interview data. There are two paper and pencil tests,

namely mathematical ability test and exponential misconception test.

Mathematical ability test was aimed to classify the students' mathematical ability into three levels, namely the students with high mathematical ability, the students with medium mathematical ability, and the students with low mathematical ability, this test consisted of 16 items. In this study, the way to classify the students into three levels based on standard deviation, as follows.

Exponential misconception test was aimed to show and identify misconception in exponential which are experienced by the students, this test consisted of 7 items. Exponential misconception test was completed with CRI instrument which was aimed to show the students confidence when solving each problem on the test. The possible answers students in exponential misconception test with CRI that was introduced by Hasan, et al (1999), as follows.

Table 1. Combination of Students Answer

| Answers Criteria | Low CRI (< 2.5)                                                    | High CRI (> 2.5)                                                 |
|------------------|--------------------------------------------------------------------|------------------------------------------------------------------|
| Correct          | Correct answer and low CRI, means lack of knowledge (lucky guess). | Correct answer and high CRI, means knowledge of correct concepts |
| Wrong            | Wrong answer and low CRI, means lack of knowledge                  | Wrong answer and high CRI, means misconception                   |

After the students have done paper and pencil test, then chosen the students as the subjects of this study which are consisted of 6 students. The 6 subjects consisted of two subjects of each mathematical ability levels who had misconception in exponential material. The 6 subjects was conducted an interview after they having paper and pencil test.

## RESULTS AND DISCUSSION

### Results

Based on the result of mathematical ability test of 68 students, there are 7 students who had high mathematical ability, 54 students who had medium mathematical ability, and 7 students who had low mathematical ability. Six students as subjects consisted of two students that had been chosen from each mathematical ability.

Based the results of the data analysis that includes the reduction of data, the presentation of the data and checking the data, obtained that for every subject had misconception in exponential. The students with high, medium and low mathematical ability have misconception in exponential concept, especially in integer exponential concept and fraction exponential concept. The tables below are represented the list of exponential misconception of students with high, medium, and low mathematical ability.

Table 2. The list of exponential misconception of each mathematical ability of students

| Item | Mathematics Ability of Students                                                                                                                                                                        |                                                                                                                                               |                                                                                                                                                                        |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|      | High                                                                                                                                                                                                   | Medium                                                                                                                                        | Low                                                                                                                                                                    |
| 2a   | They were think that negative sign in basis can moved to that exponent, so, they said $-8 = 2^{-3}$ .<br><br>They did the wrong simplification of exponential expression, because they said $-2^2 = 4$ | They did the wrong simplification of exponential expression, because they said $-2^2 = 4$                                                     | They did the wrong simplification of exponential expression, because they said $(-2^3)^{2/3} = -2^{6/3}$ and $-2^2 = 4$                                                |
| 2b   | They ignore a rule of fraction exponential concept, because they can determine the simplification of expression $(-4)^{3/2} = -1/8$                                                                    | They ignore a rule of fraction exponential concept, because they can determine the simplification of expression $(-4)^{3/2} = -8$             | They ignore a rule of fraction exponential concept, because they can determine the simplification of expression $(-4)^{3/2} = -8$                                      |
| 2c   | -                                                                                                                                                                                                      | -                                                                                                                                             | They couldn't applied the concept correctly, because they said expression $8^{(-1/3)}$ can't simplified.                                                               |
| 3    | -                                                                                                                                                                                                      | They couldn't converted the decimal expression to become exponential expression correctly, because they said $0,000216 = 2,16 \times 10^{-6}$ | They did the wrong simplification of exponential expression and they couldn't apply the concept correctly, because they said $(6 \times 10^{-2})^3 = 6 \times 10^{-6}$ |
| 5    | They did the wrong interpretation the problem to become mathematics notational.                                                                                                                        | They did the wrong interpretation the problem to become mathematics notational.                                                               | They did the wrong interpretation the problem to become mathematics notational.                                                                                        |

In number 2a, the students with high, medium, and low mathematical ability, had misconception because they couldn't simplify an exponential expression of integer exponential concept correctly, but they had high confidence (CRI 3-5) to solve that problem. They said  $-2^2 = 4$ .

In number 2b, the students with high, medium, and low mathematical ability, had misconception because they was ignored a rule of fraction exponential concept, but they had high confidence (CRI 3-5) to solve that problem. They could determine the simplification result of exponential expression  $(-4)^{3/2}$ .

In number 2c, only the students with low mathematical ability who had the misconception, because they couldn't applied the fraction exponential concept correctly, but they had high confidence (CRI 3-5) to solve that problem. They said that an exponential expression  $8^{(-1/3)}$  can't simplified.

In number 3, only the students with medium and low mathematical ability who had the misconception, because they couldn't solve the problem which is consist of integer exponential concept correctly, but they had high confidence (CRI 3-5) to solve that problem. They said the wrong result of the value of that number.

In number 5, the students with high, medium, and low mathematical ability who had the misconception, because they couldn't solve the problem which is consist of zero exponential concept correctly, but they had high confidence (CRI 3-5) to solve that problem. They did the wrong interpretation from the problem to become the mathematics notational.

### Discussion

In this study, there are the weaknesses that will be discussed, as follows:

1. In item number 4, all students include students with high, medium, and low mathematical ability can solve correctly and confidence (high CRI 3-5). It looks that number 4 is easy to solve and nothing students who had misconception on that number. Therefore, number 4 includes the bad problem to be used to identify the misconceptions of students.
2. Researcher couldn't find out and analyze the students misconception in zero exponential concept. This is because students with high, medium, and low mathematical ability did wrong in first step when solve number 5, that is interpreted the problem to become mathematics notational. So, zero exponential number that have to appear in number 5, it doesn't appear. Therefore, number 5 includes the bad problem to be used to identify the misconceptions of students, because can't covering zero exponential concept.



## CONCLUSION AND SUGGESTION

### Conclusion

The students with high, medium, and low mathematical ability had misconceptions in the integer exponential concept and the fraction exponential concept. Whereas in the zero exponential concept, the research couldn't find out and identify misconception of students. The students with high, medium, and low mathematical ability had misconceptions when determined the even power result of negative integers and misconceptions when applied a rule as a requirement of the fraction exponential concept. The students with medium mathematical ability also had misconceptions when converted the decimal expression to become the exponential expression. The students with low mathematical ability also had misconceptions when determined the power result of the multiplication of two numbers in the bracket.

### Suggestion

Based on the result and discussion of this research, the researcher suggests that teachers should give various examples for each exponential concept when introduce the properties and the concept of exponential. Teachers also should emphasize the rules that apply to the properties or the concept of exponential and give the reason about the existence of that rules.

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