Identification and Exploration of Elementary School Teacher Misconception in Mathematical Learning

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Abstract. Mathematics is one of the compulsory subjects that must be taught to students at all levels of education. It creates students not only to have the ability to think logically, critically, analytically, creatively, accurately, thoroughly but also carefully develop the ability to use mathematics in problem solving. Therefore, mathematics teachers are required to convey mathematical concepts correctly. Unfortunately, there are some elementary school teachers whose understanding of the concepts in mathematics learning is incorrect. The aim of this study was to identify the misconception of elementary school teachers in mathematics learning. This type of research was descriptive-qualitative research, where data had been analysed qualitatively. The research data were in the form of interviews and observations of the subjects, namely elementary school teachers in Sidoarjo district. Regarding to the data, there were several misconceptions in elementary school teachers, consisting of 1) Defining the apex point of the cone as the angle formed by the curved side; 2) Defining a cone surface as a side; 3) Defining a cylinder surface as a side, and 4) Defining the cone as a pyramid.

1. Introduction

Mathematics is one of the compulsory subjects that must be taught to students at all levels of education. It prepares students not only to have the ability to think logically, critically, analytically, creatively, accurately, thoroughly but also carefully develop the ability to use mathematics in problem solving [1]. Given the importance of the objectives of this learning, every mathematics teacher is required to be able to convey mathematical concepts correctly. Unfortunately, we still can find some of elementary school teachers who have misconceptions in mathematics. It can be caused by several things, including poor understanding, lack of depth about a concept in mathematics. It can happen not only when the elementary school teachers have undergone their professions as a teacher but also when the teachers take formal education. The understanding of concepts is very crucial for everyone [2]. A person's understanding of a particular concept is one of the indicators of that person's achievement in learning a material. Gagne, Briggs, and Wagner stated that mastery of concepts as well, broadly, and deeply as those possessed by experts in certain fields of study, enables one to apply them in various purposes including for teaching purposes [2].

A person's understanding develops since preschool and changes as a consequence of acquiring new experiences [3]. This allows one to have a different understanding of a concept in the end. For example, suppose someone understanding of the concept of saving money in a bank. Since primary education age, a student has to be taught with the concept of saving money in a bank. However, the difference in one's life experience, there is a shift in understanding of the concept of the bank itself. Similarly, when students learn the concept of area in mathematics. At the beginning, elementary students explore the area by using the number of small squares to calculate the area of a figure drawn in the book. Along with increasing school
age that gives new experiences to students, junior high school students no longer need a small square to calculate an area, but enough to use the formulas that apply to each rectangular. While in high school students, the concept of area develops again with the new concept of integrals for an irregular shape.

In the case of introducing concepts in school, Bell states that conceptions in a person need to be clear and identified before they carry out the learning process in school [4]. This applies not only for students but also for teachers. The reasons for the importance of understanding and identifying conceptions are: (a) the conceptions of teachers or students are often not in line with scientific conceptions or conceptions of experts or often called misconceptions. (b) The conception of the teacher or student can influence, help or possibly hinder the understanding of other concepts or can even cause difficulties in learning.

The task of a teacher in the class is not only to teach where the teachers simply transfer information or knowledge to students, but also as a process of changing students’ existing conceptions and which may not be in accordance with the opinions of experts [5]. It is believed that the conception owned by a teacher is correct first. If the initial concepts are wrong and those are taught to students; it will contribute to produce new concepts which are irrelevant. It becomes very important then to identify misconceptions among teachers, especially in elementary school teachers. Given their task to teach basic concepts to embed new concepts in higher classes.

The initial conception possessed by elementary school teachers before teaching needs to be known, so that new concepts to be taught by them can be accepted correctly, can be understood, make sense and be useful for students. Teachers who do not understand the basic concepts will not succeed in instilling the concepts in subsequent learning. This will result in reducing the achievement of student learning outcomes in school and in everyday life.

In accordance with the background, the formulation of research question in this study is: “How to identify and explore of elementary school teachers' misconceptions in mathematics learning?".

2. Misconception in Mathematics Learning

It is well-known that in mathematics learning there are many concepts that must not only be understood by students but also be used to learn new concepts. Every mathematical concept learned by students since elementary school will continue to develop until the higher education level. For example, the concept of rectangles; this concept has been introduced to elementary school-age students; and when the students continue their studies at higher institutions with major related to calculation, this rectangular concept will be re-used by these students. Such that, if someone has experienced a misconception in understanding a concept, then it can be ascertained that the person will have difficulty learning new concepts in higher classes.

Misconception itself occurs because of confusion or lack of knowledge about the initial concept which is a prerequisite for learning new concepts. Knowledge is formed by students in contact with the environment, challenges, and material learned [6]. It means, if in constructing knowledge, students experience a mismatch with the concept according to the experts, then the student will experience misconceptions. Misconceptions are deviations or misconceptions that are difficult to change and will take over a long period of time. According to Osborne & Wittrock states that when the conception is considered contrary to the accepted meaning in mathematics, then misconception has occurred [7]. Misconception refers to a concept that is not in accordance with scientific understanding or understanding received by experts in that field [6]. If it relates to learning mathematics, misconception can also be interpreted as a misunderstanding in understanding the material and occurs when students answer math questions.

3. Research Method

This research had been categorized as a descriptive-qualitative research. This study aimed to identify and explore elementary teacher misconceptions in learning mathematics. This is as revealed by Marsigit that descriptive research aims to describe situations and events [8]. Meanwhile, the data obtained were obtained from interviews and observations of the learning process carried out by research subjects. The research subjects were elementary school teachers in Sidoarjo. The elementary school teachers have been grouped according to their employment status and school accreditation. The research instrument used was an elementary mathematical concept mastery test and interview guidelines. This instrument was used to find out whether or not there was a misconception in elementary school teachers, what material in elementary
mathematics learning that often occurs misconceptions and what causes these misconceptions. The concept mastery test sheet was used as a justification for misconceptions of elementary school teachers. Interview guidelines were used to determine the causes of misconceptions in learning mathematics. Data collection was carried out directly through tests, interviews and observation sheets of the implementation of learning in class.

4. Results and Discussion

Regarding to the data, several misconceptions were found made by the research subject as follows:

| No  | Material                                         | Number of teacher | Percentage (%) | Note                                                                 |
|-----|--------------------------------------------------|-------------------|----------------|----------------------------------------------------------------------|
| 1.  | Integer Operation                                | 8                 | 15,4           | Teachers did not pay attention to the numbers operations, they only see the sequence of operations that lies in the problem. |
| 2.  | Application of Integer Operation (story problem) | 15                | 28,8           | Teachers were lack of distance concept.                                |
| 3.  | The using of learning media for integer operation| 12                | 23,1           | Teachers did something wrong with the procedure.                      |
| 4.  | Determine rational number between two rational numbers | 4            | 7,7            | Teachers were lack of information about the problem.                  |
| 5.  | Converting decimal number to rational number     | 18                | 34,6           | Teachers made a mistake to multiply between some decimal numbers      |
| 6.  | The application of perimeter and area (story problem) | 7            | 13,5           | Teachers made something wrong with the concept of perimeter and area of the plane. |
| 7.  | The square root operation                        | 24                | 46,1           | Teachers had problem to convert square root number to decimal number  |
| 8.  | Cube net                                         | 23                | 44,2           | Teachers only knew a cube net 4 out of 11                             |
| 9.  | The element of geometry shape                    | 36                | 69,2           | Teachers made a mistake to decide how many edges, vertex in cube and cylinder? |
| 10. | The relationship between surface area and volume in Polyhedron | 15            | 28,8           | Teachers made a mistake to find the cube root                        |
| 11. | The relationship between surface area and volume in 3D curved space | 30            | 57,7           | Teachers made a mistake to find an area of cone surface              |
| 12. | The relationship between surface area and volume in polyhedron (story problems) | 25            | 48,1           | Teachers made a mistake to find an area of polyhedron which have trapezium base |

From the table above, it can be identified that there are still many elementary school teachers in Sidoarjo who have misconception of the material in mathematics learning. The most misconceptions are determining how many edges, vertex in cone and cylinder. In addition, the teacher also made many mistakes
in determining the surface area of the cone. The teacher made a mistake in determining the area of a polyhedron that has a base in the form of a trapezoid.

Here are some examples of the results of the work of elementary school teachers in Sidoarjo.

![Figure 1. Misconceptions in the Element of Geometry Shape](image1)

Regard to the figure 1, it can be seen that teacher could not answer about how many edges and vertex in the element of geometry shape, specifically in cone and cylinder. It was about 36 teacher who made a mistake in this problem.

![Figure 2. Misconceptions in the area of cone surface](image2)

Regard to the figure 2, it can be seen that teacher could not answer about the area of cone surface. Most of the teacher have misconception between the area of cone surface and the area of cone surface without its base. It was about 30 teachers whom made a mistake in this problem.

5. Conclusion

From the data obtained and the results of data analysis, it could be concluded that misconceptions of mathematical materials are still found in elementary school teachers in Sidoarjo district. This material is spread not only on algebraic material but also on geometry. In particular, the teachers had difficulty in determining the elements of geometry shape. Based on the results of this study, further research is needed to address the problems of misconceptions that occur in elementary school teachers in Sidoarjo district. This is considering the role of these teachers in introducing the basic concepts of mathematics to elementary school students.

6. References

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