Analysis of Students’ Incorrect Answers at Scale Materials in The Fifth-Grade of Primary School

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Abstract. This research aims to analyze a comparison between predictions made by authors and the reality that occurs in the real classroom situation, and to analyze students’ responses toward questions given by teachers on the topic of scale materials. This research used the descriptive-qualitative method, and involved 50 fifth-grade students from a primary school in the city of Bandung. The results of this research showed that there are some influences between learning methods and students’ responses shown by the way students answer questions. In reality, there are many students’ responses produced beyond the predictions of authors. Based on the results, we conclude: 1) incorrect answers made by students are not only influenced by the learning methods used by teachers, but also influenced by other complex factors, such as the lack of student understanding and reasoning; (2) teachers need to understand that every student has different perspectives in answering questions, so teachers should be more careful in assessing their students’ answers.

1. Introduction
Mathematics is a tool to develop a way of thinking, is a deductive science that promote student thinking in a formal and abstract manner, but must be given to children from an elementary school that their way of thinking is still at the stage of concrete operations [1]. Therefore, a teacher will surely prepare the best strategy and methods of teaching mathematics to fit the students’ thinking stage [4]. Strategies and methods which is chosen by teacher will greatly affect the way students in mathematical thinking.

According to Piaget [2], ‘studying the cognitive structure of a person occurs because the process of assimilation and accommodation’. The assimilation is the process of acquiring new information that directly integrates with the information we already have, whereas the accommodation is the process of re-structuring the information that we already have with new information. So, learning is not only the process of delivering and collecting knowledge, but also the process of accommodating the old knowledge to new knowledge.

According to cognitive development, elementary students are at the stage of concrete operations, in which children will learn by manipulating concrete objects. Elementary students will have difficulty if they are asked to think abstractly [6], including when it is connected in the material about seeking scale. The teacher can provide concrete examples that commonly using the scale, for example on a map or drawing.
In addition to referring the theory of Piaget, this study uses the theory of Ausubel. The core learning theory of Ausubel [2] is meaningful learning. Meaningful learning is a process that links between new knowledge on relevant concepts contained in a person's cognitive structure. According to this theory, learning can be classified into two dimensions, namely a reception and discovery, where it gives students an emphasis on memorizing the material. By the reception dimension, we mean that the teacher directly communicates the material to students in its final form, then students are asked to memorize the material. By the invention dimension, we mean that the teacher initially provides learning at which the material must be found by the student, then the students memorize the material.

In responding problems, every student has definitely different ways, and mistakes that students may do would vary according to their respective capabilities [5]. Therefore, to analyze students’ mistake in answering problems, the research questions of this study included: What are the results of the comparison between the predictions of researchers regarding the strategies which are used by the teacher in the learning process and the reality which occur in the learning process? What are the comparison between researchers predictions on students' responses in answering problems and actual reality that occur? How can we interpret students’ mistakes from the perspective of the theories described earlier?

2. Experimental Method
To address the research question, we conducted a qualitative study through administering an individual written test on the topic of Scales [3]. Data were collected through exploration ability of primary students on scales materials. The subjects of the research were 50 fifth-grade students from one of primary school in the city of Bandung.

First of all, before learning process was happened, we made some predictions about learning strategies which would be used by teacher and predictions about strategies which would be used by students to answer questions from the teacher. In the analysis, we compared our predictions and the reality occurred in the learning and teaching process.

3. Result and Discussion
3.1 Analysis of Strategy
After making observations, we tried to compare the prediction of teaching method and the reality that occurs in the classroom. The comparison between predictions and the reality is presented in the Table 1.

| Learning Model | Prediction   | Fact        |
|----------------|--------------|-------------|
| Model          | Classical    | Classical   |
| Approach       | Expository   | Expository  |
| Method         | Lecture, Questions & Answers, Practice | Lecture, Questions & Answers, Practice |
| Technique      | Expository   | Expository  |
| Strategy       | Pictures and Map | x |

Based on the observation, the learning model which is used by teacher is the classical model. This is similar to the prediction. The teacher used this model because this model is easier to use considering the number of students in a class, with 50 students. Because of that many students, the teacher is required to submit items as good and as comfortable as possible. Classical learning will make it easier for the teacher to organize the subject matter, because generally classical learning lesson material will be uniformly absorbed by students both the sequence and scope.

The learning approach used by the teacher was expository approach. This is consistent with the prediction. The reason of the teacher for using this approach is that because there are so many students...
but limited time to learn, so it is expected that using this approach can overcome these problems. This teaching approach is quite common in Indonesia [3].

The learning method which is used is the method of lecturer, discussion and exercises. This is consistent with the prediction. The reason of the teacher for using this method is that because the lecturer method is the application and narrative orally by the teacher to the class, using teaching aids to clarify the description given to the students. The lecturer method is often encountered in the processes of learning in schools starting from a low level to the college level, so that this method has been regarded as the practical method for teacher to make teaching and learning interactions. The use of this method can help the teacher to maximize her time and learning objectives.

Learning techniques which is used by teacher is the technique of expository. This is consistent with the predictions that have been made previously. The teacher using this technique because the number of students in the classroom quite a lot but limited time to learn, so that the use of this expository technique is suitable. Teacher did not use learning strategies. This is not consistent with the predictions that have been made.

### 3.2 Analysis Students Response to Questions by Teacher

After doing predictions about students’ responses to questions which is provided by the teacher, the researcher analyzed the students’ response which is accordance with the results of observations that have been made. Beside of that, the researcher explained about the possible reasons why the students answer the question, how many students answered precisely and less precise, as well as the comparison between predictions and reality. Problems which is given by the teacher are 5 questions but the researcher analyzed at question number 1. The elaboration of predictions and reality is presented in the Table 2.

| Problems                                                                 | Prediction(s)                                      | Students’ actual strategies          | n/N |
|-------------------------------------------------------------------------|----------------------------------------------------|-------------------------------------|-----|
| 1. The distance from A to B on map is 5 cm. The actual distance of this is 60 km. What is the scale on the map? | a. Scale = 60 km = 6,000,000 cm = 5 : 6,000,000 = 1 : 1,200,000 | - Response a exist                   | 39/50 |
|                                                                         | b. Scale = 60 km = 600,000 cm = 5 : 600,000 = 1 : 120,000 | - Response i exist                   | 2/50  |
|                                                                         | c. Scale = 60 km = 60,000 cm = 5 : 60,000 = 1 : 12,000  | - Response j exist                   | 3/50  |
|                                                                         | d. Scale = 60 km = 6,000 cm = 5 : 6,000 = 1 : 1,200      | - Response k exist                   | 2/50  |
|                                                                         | e. Scale = 60 km = 600 cm = 5 : 60 = 1 : 12             | - No student answers on the predictions. | 4/50  |
|                                                                         | f. Scale = 60 km = 60 cm = 5 : 60 = 1 : 12              | - Response b, c, d, e, f, g, h don’t exist |       |
|                                                                         | g. Scale = 60 km = 6,000,000 cm = 5 : 600,000 = 1 : 120,000 |                                    |       |
3.2.1 Analysis Question Number 1

Based on observations of the student responses on problem 1, provided by the teacher, we found that almost all students answered correctly. The right answer is in accordance with the prediction of a response, which in fact as many as 39 students right in doing the calculation method or the answers. Students were able to change the unit of distance from kilometers to centimeters. Then, after changing the distance unit, students were able to compare the distance on the map with the actual distance. After that, the students were also able to simplify these comparisons in a simpler form. As in the ratio of 5:6,000,000, students were able to simplify the comparison form. So the answer is 1:1,200,000.

Continues on other responses, it was found that there are two students in accordance with the predictions i which is created by the researcher:

\[ \text{Scale} = 60 \text{ km} = 6,000,000 \text{ cm} = 5 : 600,000 = 1 : 120,000 \]

Actually, the students have been able to change the unit of distance from kilometers to centimeters but when students compare the distance on the map with the actual distance, the student less scrupulous in rewriting the actual distance that should 6,000,000 to 600,000. In addition, students may feel confused by the large number of 0. However when simplifying this comparison is correct, students' answers are 1:1,200,000. Some teachers may not consider this problem as a big problem, but if this problem is allowed to continue, the students will continue to have a misconception of matter on an ongoing basis. Therefore, early treatment is needed to help students reducing this type of mistakes. Furthermore, response prediction j answers appear by three students, as follows:

\[ \text{Scale} = 60 \text{ km} = 60,000,000 \text{ cm} = 5 : 60,000,000 = 1 : 1,200,000 \]

If it is analyzed, it can be seen that students do not really understand how to change the unit of distance from kilometers to centimeters which has been described by teachers, by multiplying to 100,000. But in fact students take to 1,000,000. After that students write a comparison between distance on the map and the actual distance is 5:60,000,000. Then, when simplify the comparison students answer is correct, it is 1:1,200,000.

Furthermore, response prediction k answers appear by two students, is as follows:

\[ \text{Scale} = 60 \text{ km} = 6.000,000 \text{ cm} = 5 : 600,000 = 1 : 120,000 \]

If it is analyzed, it can be seen that the students have learned how to change the unit of distance from kilometers to centimeters, but when students compare the distance on the map with the actual
distance the student less scrupulous in rewriting the actual distance that should 6.000.000 to 600.000. So that it causes some students write the wrong answer.

From the analysis of students' answers on problem 1, there are four students who answered beyond predictions. The examples of students’ responses are as follows:

- **Scale = 60 km = 60.000.000 cm**
  
  \[ = \frac{5}{12.000.000} \]

- **Scale = 60 km = 6.000.000 cm**
  
  \[ = \frac{5}{6.000.000} \]

- **Scale = 60 km = 60.000.000 cm**
  
  \[ = \frac{8}{48.000.000} \]

- **Scale = 60 km = 6.000.000 cm**
  
  \[ = \frac{5}{6.000.000} \]

In the first answer, students were not yet understand how to change the unit of distance kilometers to centimeters so that the final answer becomes wrong. In the second answer, the students already know how to change the unit of distance from kilometers to centimeters. Students also have to do a comparison between the distance on the map with the actual distance, but the students are less scrupulous to simplify it so that the students' answer was wrong.

Later in the third answer, the students do not understand how to change the unit of distance kilometers to centimeters. In addition, students were careless in writing the distance on the map. Students write down the distance on a map that is 8 cm, while the matter is 5 cm. So the final answer becomes wrong.

In the last answer, finally, the students already know how to change the unit of distance from kilometers to centimeters. Students also have to do a comparison between the distance on the map with the actual distance, but the students are careless simplify it so that the students' answer was wrong.

Based on the predictions, made by the results of the students 'answers, there are seven predictions: b, c, d, e, f, g, h on question number 1 does not appear in the students' answers. Thus, of the 10 answers predictions that have been made, there are three predictions according to the prediction of the results of the students' answers.

In general, factors of students incorrect answers include because students do not understand how to change the unit of distance and students also are felt difficult in simplifying the comparison. Research has demonstrated that teacher instruction has a major impact on student learning [7]. In this study, the teacher gave problems to students, next the teacher told them the way to answer the problems. After that, the teacher gave students instruction to answer some similar problems. So that some students just duplicate the way from the teacher explanations without understanding why the answer like that. Indirectly it may influence students to do incorrect responses.

4. Conclusion
Based on the analysis of the predictions and observations that have been made, conclusions that can be drawn are as follows. Each method certainly has its advantages and disadvantages, it can be taken into consideration by the teacher in determining which method is most appropriate for use in learning. In addition to preparing methods, teachers are also expected to use the media as well as props to support the learning process so that students are more interested and more understand the material which is presented so that students are involved actively in the learning process.

Based on the results, the following are some recommendations: (1) The error responses of the students are not only influenced by the teaching methods used by the teacher, but also influenced by other complex factors; so we recommend for further research to assess students' mistakes by
considering other factors; (2) Teachers need to understand that every student has a different way in answering a problem, so that teachers can be more prudent in assessing the students' answers.

5. References
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Acknowledgements
We thank students and teacher who participated actively in this research.