The factors that influence students’ solution related to inverse proportion problems

A F P Alam1*, Suhendra1 and S Prabawanto1

1Departemen Pendidikan Matematika, Universitas Pendidikan Indonesia, Jl. Dr. Setiabudhi No. 229, Bandung 40154, Indonesia

*Corresponding author: alfarisputraalam@upi.edu

Abstract. This study aims to explain how factors that influence students that their answer was correct mathematically and plausible on the problem of the inverse proportion concept. The subjects of this study were four students of grade 7th, a junior high school in Bandung. This research used the qualitative method with the triangulation for collecting data in the forms of written test, interview, and documentation. The result of this study analyzed by using relevant theories. This implies the need for analysis of written tests and students interview as evaluation to improve learning. During the study, we found factors that influence students in to find their answers correct mathematically and plausible. These factors include students' understanding related to inverse proportion concept, understanding of students related to calculating operations, understanding of students related to reading and forming tables, understanding of students in terms of graphs, and understanding of mathematics equation. Based on the results of this study concluded that students could understand the questions with plausible. However, these factors affect students in problem-solving of the inverse proportion concept so that students' difficulties in finding the right answers mathematically.

1. Introduction
Mathematics is a science that has an important role in the development of other knowledge and the development of modern technology. This important role makes mathematics as a science that is learned from kindergarten level to several majors in higher education. Learning mathematics itself has several concepts that are interrelated with other concepts [1-3].

One concept in mathematics is the concept of proportion. The concept of proportion on is one of the prerequisite skills of some material, such as geometry, trigonometry, social arithmetic, etc. The concept of proportion has an important role in developing students' mathematical abilities [4]. The concept of proportion divided into two concepts, one of inverse proportion concept. A reverse of inverse proportion concept that gives a relation between 2 quantities, if one magnitude is enlarged, the other magnitude will be reduced, and vice versa [5]. One example of the problem of inverse proportion concept in everyday life is that when a cattle farm has enough stock of cow feed for 20 cows for 15 days. If the number of cows is added to 10, the stock of cattle feed will run out within 12 days. The example explains that the more number of cows, the longer the adequacy of cattle feed will decrease.

It is this understanding of inverse proportion that students expect students to have. Students are not only required to solve the concept of proportion problems correctly mathematically, but also in a reasonable manner so that students can solve various problems on the concept of inverse proportion.
This shows that the concept of inverse proportion takes an important role in developing students' mathematical abilities [4].

In some studies it was found that learning obstacle on the concept of inverse proportion which would certainly affect students in solving [6, 7]. This study aims to explain the factors that influence students in searching for mathematically correct and plausible answers related to the problem on the concept of inverse proportion, so that from these factors can be used as material for evaluation in learning the concept of comparative reversal. The specific questions to be answered by this study was "how are the factors that influence students in searching for mathematically and sensibly correct answers related to the problem of the concept of a reverse value?"

2. Methods
This study uses descriptive design with qualitative methods. Data collection techniques used were triangulation in the form of written tests, interviews, and documentation. The subjects of this study were four seventh grade students in one of the junior high schools in Bandung. The research procedure is to review the literature on the concept of inverse proportion and making instruments, choosing subjects and research sites, giving written tests, interviewing students and teachers based on written test results, analysing learning documents, analysing all data, and concluding research results [8-10].

3. Result and Discussion
3.1. Results of Data Collection
In this section, explain the results and discussion of the data obtained from data collection techniques in the form of written test results, interview results and documentation results.

3.1.1 Results and analysis writing test. In this study, the questions tested on the written test are a matter of the story of the concept of inverse proportion. The questions tested contain aspects studied in the concept of inverse proportion. The question contains aspects of tables, graphs, and similarities from the concept of inverse proportion. The following is an example of the problem.

| The Problem |
|-------------|
| Wulan drove a car from Jember to Malang City for 180 km. Specify the length of travel time if speed Wulan driving a car is 40, 50, 60 and 70 km/hour! |
| (a) Make a table that shows the relationship between the length of the trip and the speed of Wulan driving a car! |
| (b) Make a graph that shows the relationship between the length of the trip and the speed of Wulan driving a car! |
| (c) What can you conclude from the tables and graphs that you have made? |
| (d) At what speed did Wulan travel to less than 7 hours? Give your reasons! |

In the question (a), students are asked to make a table of information obtained. Students are asked to create a table that shows the relationship between travel time and speed. The results of this test show that there are students who can work on the problem, and students are wrong in working on the problem. The following is an overview of the results of students' work in the question (a).
Figure 1. Representative of the results of students' work in the question (a).

In the question (b), students are asked to graph the information obtained from tables and questions. The results of this test show that there are students who can make a graph, make a wrong graph, and not answer the question. The following is an overview of the results of students' work on the question (b).
In the question (c), students are asked to deduce the form of tables and graphics that students have made. This question can show the extent to which students understand the concept of inverse proportion. The results of this test show that there are students who conclude the concept of speed, students conclude the concept of inverse proportion that is associated with the concept of speed, and students conclude the use of graphics in general. The following is an overview of the work results of students in question (c).

Representative answers students (1)

Representative answers students (2)

Representative answers students (3)

Representative answers students (4)

Figure 2. Representative of the results of students' work in the question (b).

In the question (d), students are asked to do calculations using logic thinking to solve simple problems to more complex problems. Students are asked to calculate at what speed the driver can travel back and forth in less than 7 hours. Then students are asked to give reasons for the answers they have set. The results of this test show that there are students who can determine by using logic. That the driver can travel back and forth in less than 7 hours at a speed of 60 km/h and 70 km/h. There are students who use solutions in a general way, there are students who have not can determine the resolution of the problem and there are students who do not answer the question. The following is an illustration of the results of students’ work in question (d).

Representative answers students (1)

Representative answers students (2)

Figure 3. Representative of the results of students' work in the question (c).
3.1.2 Results and analysis of interviews. The topic of student interviews, which is to contain students' responses to the questions that have been done, includes the reasons for students, students' mind-sets, students' answers viewed from the students' logic, and factors that influence students' answers. The four students have diverse views on how students answer question, some students have similar mind-set and logic, and some identic factors that influence students' answers. The following is an overview of student interviews.

Based on the results of the interview, students (1) work on the problem (a) by creating a table that is based on time. Based on the length of time, students determine the distance travelled. The table does not describe the relationship between speed, distance, and time. In the question (b) the student graphs the value due to an error in the form of a question table (a) that students make. Students assume that charts are made based on the length of time and distance at each speed. In question (c), students conclude tables and graphs using the speed formula. Students assume from making tables and graphs, students become aware of the formula for calculating distances using the speed formula. This is in sharp contrast to the tables and graphs students make because they do not describe the velocity formula. The next interview reveals the fact that students can determine travel time but have difficulty making tables and graphs that are in accordance with the concept. In the question (d), students feel that they have no difficulty in working on the problem. However, students are lacking in determining the speed at which motorists can travel back and forth in less than 7 hours. Students only think if the driver can travel less than 7 hours only at a speed of 60 km / hour. The student logic has not reached the point where besides 60 km / h there is a speed of 70 km / h, which is faster so the travel time is definitely less than 7 hours.

The results of student interviews (2) explained that students made mistakes in calculating the division operation because of the students' negligence. Students do not understand how to create a table that describes the relationship between speed, distance, and time. Students also find it difficult to graph according to the concept. Students graph in several parts at each predetermined speed. This is because students answer the graph in origin. Students do not understand in making a graph in accordance with the concept of inverse proportion. In question (c), students conclude with conclusions that do not lead to the concept of inverse proportion. Students answer that the graph can make it easier to know the proportion. Based on the interview, it is known that the mind-set of students has not led to the concept of inverse proportion. In question (d), students answer all prescribed speeds of less than 7 hours. Based on the results of the interview, students did not understand the question (d) properly. The mind-set of students has not been able to capture the intent of the question (d).

The results of student interviews (3) explain that students can work on the questions (a) the form of the table. Student answers are very detailed, mentioning the length of time to unit minutes. Students use logic very well so they round up units of minutes. In question (c) students can conclude well the data in the table. Students have linked these conclusions to the concept of inverse proportion. Students do not answer questions (b) and (d). Students are still having difficulty answering questions related to graphical forms for questions (b) and students forget to answer questions (d).

The results of student interviews (4) explain that students can work on the problem (a) by making a table and determining the length of the trip correctly. Students say if there are no difficulties in making a table. In the question (b), students find it difficult to graph the concept of inverse proportion. This is inversely proportional to the correct student answer. Students answer questions (b) correctly and illustrate the graph of the concept of a reverse value ratio. Students (4) are the only students who
can graph correctly. In the question (c) students can give conclusions by linking the problem with the concept of inverse proportion. In the question (d) students do not experience difficulties and answer correctly. Unique things happen to the answer to the question (d) students, where students make sense that the speed above 60 km / h takes under two hours.

The teacher interview aims to see whether the question is worthy of being tested to students and to reinforce the conclusions of student factors that influence students in finding mathematically correct and plausible answers to the problem of the concept of inverse proportion. The results of the teacher interview indicate that the questions are feasible and illustrate the understanding of the concept of inverse proportion. The teacher also explained that the factors that influence students' answers are students' understanding of the concept of inverse proportion, students' understanding of calculating operations, understanding of students related to reading and forming tables, understanding of students in terms of graphs and understanding of the mathematical equations.

3.1.3 Results and analysis of documentation study. Documentation studies carried out are in the form of documentation of records and documents that are used as witnesses of certain events or as material for accountability. The document review will focus on the concept of inverse proportion. These records and documents are in the form of journals, student records, mathematics books for class VII SMP / MTs, as well as other relevant sources. The results of this study indicate that students have not been taught the concept of inverse proportion of form tables, graphs, and comparisons. Learning that is carried out in the form of an exercise in the concept of the concept of inverse proportion.

3.2. Discussion
In the question (a), it was found that students answer incorrectly. Student errors occur in determining the length of time required by the driver and the form of a table that describes the relationship between speed, distance, and time. Based on the results of student answers, teacher interviews, student interviews, and documentation studies, the factors that influence the students' answers are students' understanding of the concept of inverse proportion, understanding of students regarding counting operations, understanding of students related to reading and forming tables.

In the question (b), it was found that students answer with wrong answers and do not answer. Based on the results of student answers, teacher interviews, student interviews, and documentation studies, the factors that influence the students' answers are students' understanding of the graphic form.

In the question (c), students were found to answer with answers that do not describe the concept of inverse proportion. Based on the results of student answers, teacher interviews, student interviews, and documentation studies, the factors that influence the students' answers are students' understanding of the concept of inverse proportion, students' understanding of reading and forming tables, and students' understanding of graphic forms.

In the question (d), it was found that students answered incorrectly and did not answer. Student errors occur in determining at what speed the driver can take less than two hours on the trip. Based on the results of student answers, teacher interviews, student interviews, and documentation studies, the factors that influence the students' answers are students' understanding of students regarding counting operations.

Based on the results of interviews and documentation studies it was found that these factors occur because the learning process is not optimal. The less optimal form of learning is not teaching the concept of inverse proportion in the form of tables, not teaching the concept of inverse proportion in the form of graphics, lack of variations in questions, and learning in the form of practice (students were not taught to construct concepts).

4. Conclusion
Based on the results of the study it can be concluded that students try to find a solution to the problem of the concept of inverse proportion correctly mathematically and make sense. Students can understand the form of the problem in the problem, but students have limitations to answer or solve
the problem, this is caused by several factors. Factors that influence students in finding the right and reasonable answers are students' understanding related to the concept of inverse proportion, understanding of students related to calculating operations, understanding of students related to reading and forming tables, understanding of students regarding graphic forms and understanding of students in the form of mathematical equations.

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