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# Classificational and Theoretical Execution Misconceptions: Classification of Misconceptions Based on students Concepts in Plane Geometry

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**Abstract:** *Misconception is a mismatch of students' conceptions with concepts agreed upon by experts. Misconception is a problem that often occurs in the world of education, especially in mathematics in the matter of plane geometry. This type of research is a descriptive qualitative research that aims to describe the types of misconceptions and causes of misconceptions experienced by students on the subject of plane geometry. The results showed that there were two types of misconceptions experienced by students, namely classificational execution misconceptions, and theoretical execution misconceptions. Misconception of classificational execution is the mismatch of students' conceptions when classifying a plane geometry with a concept agreed upon by experts; and the theoretical execution misconception is a mismatch between students' conceptions of definition, properties and elements of planes geometry. The causes of misconception are students' preconceptions, students' abilities, textbooks, and teacher teaching methods.*

**Keyword:** *Misconceptions, Classification of Misconceptions, Execution Misconceptions, Classificational Execution Misconceptions, and Theoretical Execution Misconceptions*

## PRELIMINARY

Misconception is a conception of students that is not in accordance with the ideas or ideas recognized by experts. This is consistent with what was conveyed by Brown (1992), and Suparno (2013) that misconception is a concept that is not in accordance with the acknowledgment of experts, besides misconception is a naive view and an idea that is not in accordance with acceptance in scientific terms. Misconceptions are divided into two namely conceptual misconceptions and theoretical misconceptions (Ojose, 2015). Conceptual misconceptions are misconceptions caused by students' lack of understanding of a concept. Meanwhile, the execution misconception is a misconception caused by students failing to manipulate the procedure. Before detecting misconceptions experienced by students it is important to know in advance understanding students' concepts, conceptions and preconceptions.

The concept is a design, ideas that are extracted from the results of their own thoughts that can be used as a reference or guide (Dahar, 2011). The concept according to the researcher can be interpreted as an abstract idea obtained from a book that is used as a reference and agreed upon by experts. Based on the form, the concept can be divided into 3, namely classificational, correlational, and theoretical concepts (Amien, 1979). The classificational concepts is an idea that can help someone to be able to distinguish or classify between examples and not examples. The correlational concept is the relationship between one concept and another. While theoretical concepts are ideas or ideas that serve as theories written in a book and used as guidelines.

Conception is defined as opinions, understandings, views, meanings, ideals that cross the mind (KBBI, 2007). In contrast to this opinion, the conception can be defined as an interpretation of every one of the scientific concepts that have come to mind that are sometimes obtained from the environment or formal education (Dahar, 2011). From these

two definitions, conception is everyone's thoughts about a concept gained from his experience. Before conception, students already have an initial concept derived from experience, friends and parents called preconceptions.

Preconception is an initial concept that a person has after doing construction and before they get formal lessons about certain materials (Dahar, 2011; Suparno, 2013). So, preconception can be interpreted as an initial concept that someone has and the concept is obtained before they receive formal learning at school.

Based on the concept theory presented by Amien (1979) and the theory of misconception presented by Ojose (2015), types and indicators of misconception can be found as follows:

**Table 1. Types and Indicators of Misconception**

Types of Misconception		Indicators of Misconception
Classificational Conceptual Misconceptions		Discrepancy in students' conceptions when classifying a plane geometry build with concepts agreed upon by experts
Correlational Misconceptions	Conceptual	Mismatch of students' conceptions when connecting between plane geometry with concepts agreed upon by experts
Theoretical Misconceptions	Conceptual	The discrepancy between students' conceptions of definition, properties and elements of plane geometry
Classificational Execution Misconceptions		Discrepancy students distribute what is known in the problem to the formula used
Correlational Misconceptions	Execution	Discrepancy of students in executing the questions into the answer sheet
Theoretical Execution Misconceptions		Discrepancy in the formula used when solving problems

Education is the need of all people, because education has an important role for every individual who will take the development of a nation (Lestari, 2019). In the world of education, misconception is no longer a problem that has just happened because misconceptions often occur in mathematics, especially in the material of planes. Plane build is one of geometry material. Geometry is one of the fields of mathematics that develops students' spatial abilities (Fuat, 2013). Geometry is a branch of mathematics that has concepts that need to be understood by students, but many students still experience difficulties in understanding the concept of a plane (Fuat, Nusantara, T., and Parta, IN, 2015; Fuat, F., Nusantara, T., Irawan, EB, & Irawati, S. 2017; 2018; and Fuat, Nusantara, T., Irawan, EB, & Irawati, S., 2019). The plane structure learned by eighth grade students is about rectangular and triangular shapes. However, in this study only discusses the area (L) and circumference (K) of two plane structures namely trapezoid and rhombus. Trapezoid is a quadrilateral that has only one pair of parallel sides whose length is not the same (Ariawan, 2014). The following formula is the circumference (K) and area (L) of the trapezoid:

$$K_{\text{trapezoid}} = \text{The length of the sides of the trapezoid}$$

$$L_{\text{trapezoid}} = \frac{1}{2} \times \text{number of sides parallel} \times \text{trapezoid height}$$

Rhombus is a level ladder whose four sides are the same length (Ariawan, 2014). Following the circumferential formula (K) and area (L) rhombus:

$$K_{\text{rhombus}} = \text{The length of the sides of the rhombus}$$

$$L_{\text{rhombus}} = \frac{1}{2} \times \text{horizontal diagonal side} \times \text{vertical diagonal side}$$

In learning mathematics, teachers need to develop five mathematical competencies, namely: (1) understanding concepts, (2) procedural skills, (3) strategic competencies, (4)

adaptive reasoning, (5) productive attitudes (Killpatrick, 2011; Lestari, 2019). As for one of the causes of misconceptions is the lack of understanding of students' concepts of area (L) and circumference (K) plane. In addition, students' skills in manipulating procedures also become one of the causes of misconceptions. To find out more can be seen from the results of the initial tests and interviews conducted by researchers.

Based on the results of preliminary tests conducted by researchers on SMP Negeri 2 Bangil students, there are problems that occur in the vast material and the circumference of a plane. This is shown by the fact that there are still many students who cannot complete, as well as the students' discrepancies in applying the formula of area and circumference to the following story problem: Mr. Pur wants to provide a wire fence for his garden. Mr. Pur garden is shaped like a rhombus with diagonals of 10m and 24m in length. Determine the costs incurred by Mr. Pur to give his garden wire fence, if the price of 1m wire is Rp 10,000. Most students answer the following:

Diketahui = Diagonal 1 = 10m  
 Diagonal 2 = 24m  
 Jawab =  $\frac{1}{2} \times d_1 \times d_2$   
 $= \frac{1}{2} \times 10 \times 24$   
 $= 1 \times 5 \times 24$   
 $= 120 \text{ m}$   
 $120 \text{ m} \times 10.000 = \text{Rp. } 1.200.000$

**Figure 1. Student Test Results**

Based on Figure 1 shows that the area multiplied by the price of the wire per meter used by students is not appropriate to be applied to solve the problem, and the unit area written is also not appropriate. To find out more whether students experience misconceptions can be seen from the following interview excerpt:

- P : From the problem, what is known in the problem?  
 S :  $d_1 = 10m$  and  $d_2 = 24m$   
 P : How do you move to solve the problem?  
 S : Determine the area of the garden using the formula for rhombic area, then multiply the area of the garden with the price of a wire per meter  
 P : Are you sure about your work?  
 S : Sure sis

Based on the results of the interview it can be shown that the signs of misconception occur in junior high school students 2 Bangil because students' conception of students about the area and circumference of flat shape are not in accordance with the concept of area and circumference agreed by experts, the area unit written is also not in accordance with the unit area agreed upon by experts namely  $m^2$ .

Based on the description above, researchers are interested in finding out more about the misconceptions experienced by students of SMP Negeri 2 Bangil. This study aims to describe the types and causes of misconceptions experienced by students on the subject of plane.

## METHOD

This type of research is descriptive qualitative research. This misconception can be revealed from the results of written tests and the results of researchers' interviews with students. The validity of the data used in this study is the triangulation of techniques, by comparing students' preconception data, students' written test results, and interview results.

This research was carried out in VIID class at SMP Negeri 2 Bangil, Pasuruan Regency for two weeks. In the first week, researchers conducted a written test to obtain data about students' preconceptions and misconceptions. The written test was attended by 32 students who had received a flat flat material lesson before. The type of test questions used in this study are diagnostic test items consisting of 3 breakdown questions. From the test results were then analyzed and from the results of the analysis obtained 6 students who were detected experiencing misconceptions on the material to get up plane geometry. Based on the results of the analysis and the results of discussions with mathematics subject teachers, the 6 students were determined by researchers as subjects in this study. In the second week, researchers conducted interviews with the study subjects to find out more about the types and causes of misconceptions experienced by the 6 subjects.

**RESULTS AND DISCUSSION**

From the research that has been done, two data are obtained, namely data regarding students' preconceptions and misconceptions. The following is a detailed discussion,

1. Students' Preconceptions

Following are presented about the preconceptions of each research subject, this data is obtained from solving question number 1.

a. FS Subject

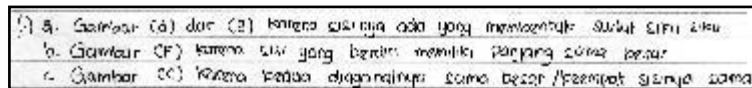


Figure 2. FS Test Results Problem Number 1

The following are excerpts from the FS interview with researchers

- P : From question number 1 (a), which is a right trapezoid?
- FS : Picture (d) and picture (g), while pointing to the picture on the problem
- P : Can you explain the definition or mention its properties?
- FS : because one corner is forming  $\angle 90^\circ$
- P : Which shows one of the forming angles  $\angle 90^\circ$ ?
- FS : The angle E ( $\angle E$ ) and the angle J ( $\angle J$ ), while pointing to the angle in picture (d) and picture (g)
- P : Can you show trapezoidal isosceles and rhombus? Why?
- FS : Picture (f) is an isosceles trapezoid because the sides that stand are the same length and picture (c) is rhombus because the two diagonals are equal and the four sides are the same

Based on Figure 2 and the interview excerpt above shows that the preconception (initial concept) of the FS subject regarding the definition, properties, types of trapezoidal and rhombus is still lacking. The FS subject should write on the answer sheet the characteristics of the trapezoid and rhombus precisely and completely. However, FS subjects can classify a flat shape precisely this is known from the results of the interview. The cause of the lack of initial knowledge of the FS subject is due to the lack of references the subject has.

b. MH Subject

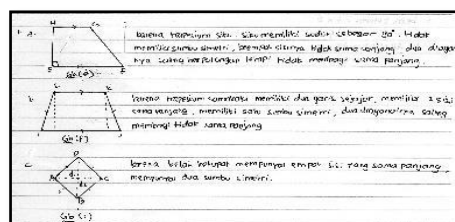


Figure 3. MH Test Result Problem Number 1

The following excerpts MH interview with researchers:

- P : From question number 1 (a), which is a right trapezoid? Why?  
 MH: Picture (d) because the four sides are not the same. While pointing at the picture problem  
 P : From question number 1 (b), which one includes the isosceles trapezoid? Why?  
 MH: Picture (f) because it has 2 equal sides, the two diagonals divide equally  
 P : Do you think the picture (c) is rhombus? Why?  
 MH: Yes, the picture (c) is rhombus because it has four sides of the same length, has two symmetry axes.

Based on Figure 3 and the interview excerpt above shows that the preconception (initial concept) of the MH subject regarding the definition, properties, types of trapezoidal and rhombus are still lacking. Supposedly, MH subjects mentioned pictures (d) and pictures (g) to answer question number 1 (a). The cause of the lack of initial knowledge of MH subjects is because of the lack of references the subject has. As a result, MH subjects are not sure if the pictures shown are different from those in the book.

c. MI Subject

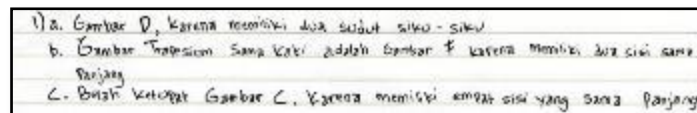


Figure 4. MI Test Result Problem Number 1

The following excerpts MI interview with researchers:

- P : From question number 1 (a), which is a right trapezoid? Why?  
 MI : Picture (d) and picture (g) because they have two sides of equal length  
 P : Please show which two sides are the same length?  
 MI : HG side and EF side, (pointing to the picture)  
 P : In your opinion, which shows the isosceles and rhombus trapezoid? Why?  
 MI : Picture (f) is an isosceles trapezoid because it has two equal sides and picture (c) because it has all four sides of the same length

Based on Figure 4 and the interview excerpt above shows that the preconception (initial concept) of MI subjects regarding the definition, properties, types of trapezoidal flat structure and rhombus are still lacking. Supposedly, MI subjects mentioned pictures (d) and pictures (g) to answer question number 1 (a) and mentioned the characteristics completely. However, MI subjects can classify a plane correctly. The cause of the lack of initial knowledge of MI subjects is due to the lack of references the subject has.

d. PA Subject

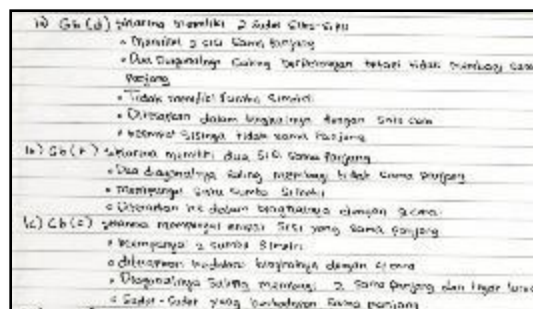


Figure 5. PA Test Results Problem Number 1

The following are excerpts of the PA interview with researchers:

- P : From question number 1 (a), which is a right trapezoid? Why?  
 PA : Picture (d) because it has two right angles  
 P : Please show which of the two angles you mean?  
 PA : The angle of EF and HG, (pointing to the picture)  
 P : From question number 1 (b), which one shows an isosceles trapezoid? Why?  
 PA : Picture (f), not to mention the reason  
 P : In your opinion, which picture shows the rhombus? Why?  
 PA : Picture (c) because it has four sides that are the same length  
 P : What do you mean by rhombus?  
 PA : Rhombus is getting up plane

Based on Figure 5 and the interview excerpt above shows that the preconception (initial concept) of the PA subject regarding the definition, properties, types of trapezoidal and rhombus is still lacking. Supposedly, the PA subject mentions pictures (d) and pictures (g) to answer question number 1 (a). However, PA subjects can define rhombus as a plane. The cause of the lack of initial knowledge of the subject PA is due to the lack of references the subject has.

e. SA Subject

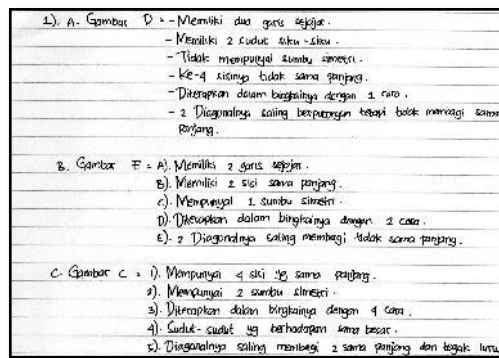


Figure 6. SA Test Results Problem Number 1

The following are excerpts from the SA interview with researchers:

- P : From question number 1 (a), which is a right trapezoid? Why?  
 SA : Picture (d) because it has two right angles"  
 P : From question number 1 (b), which one shows an isosceles trapezoid?  
 SA : Picture (f)  
 P : Why do you think the picture (c) is rhombus?  
 SA : Having four sides of equal length

Based on Figure 6 and the interview excerpt above shows that the preconception (initial concept) of the SA subject regarding the definition, properties, types of trapezoidal and rhombus is still lacking. Supposedly, the SA subject mentioned pictures (d) and pictures (g) to answer question number 1 (a). The cause of the lack of initial knowledge of the subject of the SA is because of the lack of references the subject has.

f. WF Subject



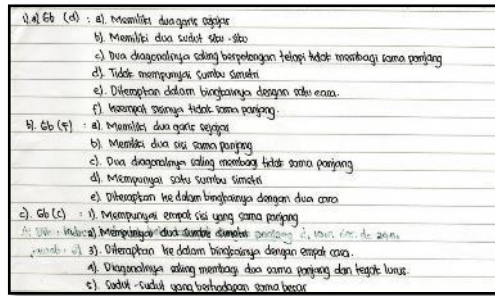


Figure 7. WF Test Result Problem Number 1

The following are excerpts of the WF interview with researchers:

- P : From question number 1 (a), which is a right trapezoid? Why?  
 WF : Picture (d) because it has two right angles  
 P : From question number 1 (b), which one shows an isosceles trapezoid? Why?  
 WF : Picture (f) because it has two parallel lines, has two equal sides  
 P : In your opinion, which is rhombus? Why?  
 WF : Picture (c) because of the rhombus picture like that

Based on Figure 7 and the interview excerpt above shows that the preconception (initial concept) of the WF subject regarding the definition, properties, types of trapezoidal and rhombic is still lacking. The WF subject should have answered picture (d) and picture (g) to answer question number 1 (a). However, on the answer sheet the subject WF can mention the properties of a plane precisely. The cause of the lack of initial knowledge of WF subjects is due to the lack of references that the subjects have.

2. Students' Misconceptions

Following are presented regarding the misconceptions of each research subject, this data was obtained from solving questions number 2 and 3.

a. FS Subject

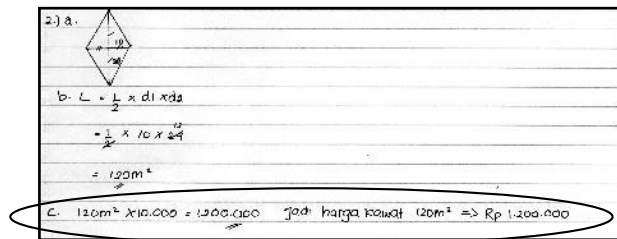


Figure 8. FS Test Results Problem Number 2

The following are excerpts from the FS interview with researchers:

- P : Can you name anything you know from question number 2?  
 FS : What is known is  $d_1 = 10m$ ,  $d_2 = 24m$   
 P : In your opinion, is it true that if you want to give a fence to the garden in all parts of the garden or only the edge of the garden is given a wire fence?  
 FS : Not true, only the edge of the garden is given a wire fence  
 P : If only the edges of the garden are given a wire fence, is it true that the formula used is the broad formula?  
 FS : Right



Based on Figure 8 and the interview excerpt shows that the FS subject experienced a misconception of theoretical execution because the formula used by the FS subject to solve problem number 2 (c) is not quite right. The FS subject should calculate the circumference of the rhombus first, then multiply the circumference by the price of the perimeter wire. The cause of misconceptions experienced by FS subjects is because FS subjects have not yet fully understood the concept of area and circumference of the rhombus, the subject's thinking is not appropriate because the FS subject considers that the application of the formula of area and circumference is the same.

Figure 9. FS Test Results Problem Number 3

The following are excerpts from the FS interview with researchers:

- P : From the picture in the question, what is the height of the trapezoid?  
 FS : 6 cm  
 P : How do you go about solving problem number 3 (a)?  
 FS : First I calculate the area of the trapezoid, then calculate the area of the rhombus. (While showing pictures on the questions)  
 P : From the picture in the question, what are the sizes  $d_1$  and  $d_2$ ?  
 FS :  $d_1 = 6$  cm,  $d_2 = 8$  cm  
 P : What is the length of the DC, CB, AF, ED sides?  
 FS : DC = CB = AF = ED = 6 cm

Based on Figure 9 and interview excerpts show that misconceptions experienced by FS subjects are misconceptions of classificational execution because when FS subjects distribute trapezoidal and diagonal-diagonal height dimensions and the rhombic sides do not match. So the calculation result of FS subject is wrong. Supposedly, the FS subject uses the formula 2 times OD to calculate length  $d_1$ , formula 2 times OC to calculate length  $d_2$ . The cause is the lack of experience of FS subjects because FS subjects assume that the size stated in the problem is the length of the diagonal

b. MH Subject

Figure 10. MH Test Result Problem Number 2

The following excerpts MH interview with researchers:

- P : Can you name anything you know from question number 2?  
 MH:  $d_1 = 10\text{m}$ ,  $d_2 = 24\text{m}$   
 P : Which do you think is said as  $d_1$ , please show?  
 MH: From the base point to the point of intersection between diagonals (vertical lines) called  $d_1$  (while pointing at the picture he drew)  
 P : Are you sure you use the formula  $\text{Costs} = L \times 10,000$  for solving problem number 2 (c)?  
 MH: Yes, I'm sure  
 P : Try to imagine to give a wire fence, for Mr. Pur about only giving the edges or all parts of the garden?  
 MH: Just the edge of the garden

Based on Figure 10 and the interview excerpts show that the MH subject understands the known and questions in question for number 2. However, the MH subject still experiences a misconception of theoretical execution because the MH subject applies an inappropriate formula. This happens because of the lack of understanding of MH subjects regarding the concept of area and the circumference of a flat shape, but students understand that for the provision of a wire fence only on the edge.

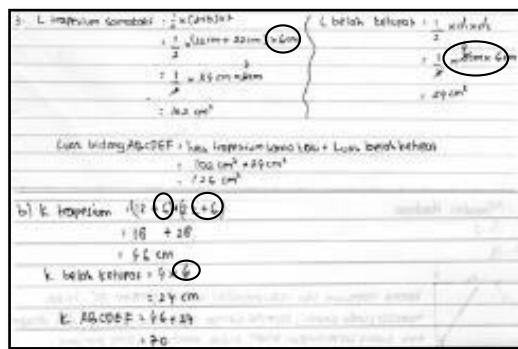


Figure 11. MH Test Result Problem Number 3

The following excerpts MH interview with researchers:

- P : What are the steps to solving problem number 3 (a)?  
 MH: The first step is to calculate the area of the trapezoid, then calculate the area of the rhombus and the final step is to add the area of the trapezoid and the area of the rhombic  
 P : From the picture in the problem, what is the height of the trapezoid?  
 MH: 6 cm  
 P : From the picture in the question, what are the sizes  $d_1$  and  $d_2$ ?  
 MH:  $OB = d_2 = 6\text{cm}$ ,  $EO = DO = d_1 = 8\text{cm}$   
 P : What are the steps to solving problem number 3 (b)?  
 MH: Calculate the area around the trapezoid, then calculate the circumference of the rhombus using the formula  $4 \times s$ , then add the circumference of the trapezoid with the circumference of the rhombus  
 P : What is the length of the rhombus?  
 MH: 6

Based on Figure 11 and the interview passage above shows that the subject understands the steps to solve problem number 3. However, when the subject distributes what is known from the problem to the formula used is not appropriate. So the misconception experienced by MH subjects is the misconception of classificational execution. This happens because the MH subjects were convinced that the length of the rhombus diagonal was 6 cm instead of 2 times OD to calculate length  $d_1$ , not 2 times OC to calculate length  $d_2$ . In addition, MH subjects assume that everything that is known in the problem can all be used directly to solve the problem there is no need for another process.

c. MI Subject

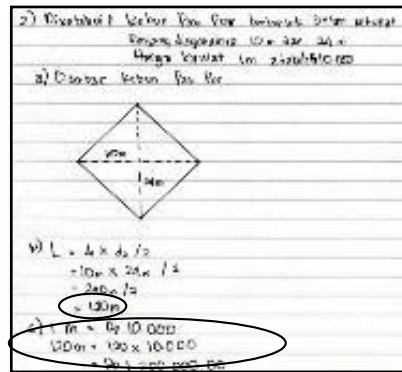


Figure 12. MI Test Result Problem Number 2

The following excerpts MI interview with researchers:

- P : What is known from question number 2, please specify?  
 MI : Rhombus-shaped garden with diagonals of 10m and 24m  
 P : To solve problem number 2 (c) what formula did you use?  
 MI : Cost incurred =  $L \times$  wire price  
 P : Are you sure?  
 MI : Sure  
 P : Have you ever solved a problem like this?  
 MI : Never before, sis

Based on Figure 12 and the interview excerpt shows that MI subjects have not been able to show the length of each diagonal. In addition, MI subjects believe that to solve problem number 2 (c) is to use the cost formula =  $L \times$  wire price. So the MI subject misconceptions of theoretical execution because MI subjects do not understand what is said to be diagonal 1 and diagonal 2, the unit area written by MI subject in solving problem number 2 (b) is not appropriate, and the formula applied to solve problem number 2 (c) is also not appropriate. This can occur because of the lack of student understanding of the concept of unit area, as well as the subject's lack of experience to solve broad problems and the circumference of a plane so that the subject lacks understanding of the characteristics of the problem that should use the broad formula. The MI subjects should first calculate the circumference of the garden and then use the cost formula =  $K \times$  wire price.

d. PA Subject

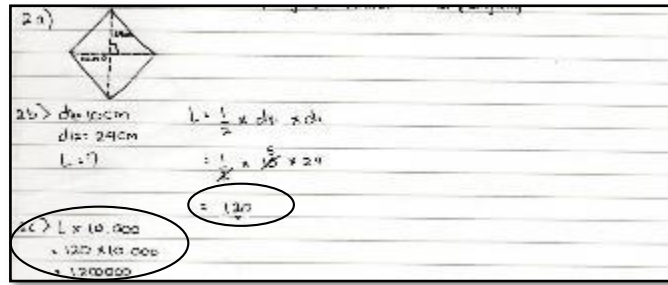


Figure 13. PA Test Results Problem Number 2

The following are excerpts of the PA interview with researchers:

- P : Please state what is known from question number 2?  
 PA : Rhombic,  $d_1 = 10$ ,  $d_2 = 24$   
 P : What formula do you think is used to solve problem number 2 (c)?  
 PA : Cost incurred =  $L \times$  wire price  
 P : Are you sure?  
 PA : Sure

Based on Figure 13 and the interview excerpt, the PA subject can mention what is known in the matter. However, the PA subject unit does not write the unit area in solving problem number 2 (b), the PA subject should write the unit m at each completion step and the m<sup>2</sup> unit in the final result. In addition, the subject of PA when applying the formula used to solve problem number 2 (c) is not appropriate because the subject PA should have used the formula  $K \times$  wire price to calculate the costs incurred by Mr. Pur when giving fences. Thus, the misconception experienced by PA subjects is the misconception of theoretical execution. This can occur because of the lack of knowledge and experience of PA subjects in solving broad and rounded plane problems.

e. SA Subject

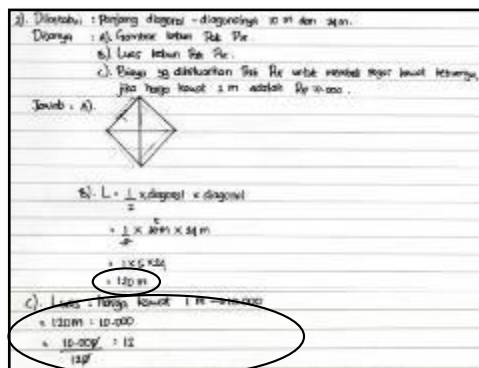


Figure 14. SA Test Results Problem Number

The following are excerpts from the SA interview with researchers:

- P : Please state what is known from question number 2?  
 SA : What is known is  $d_1 = 10\text{m}$ ,  $d_2 = 24\text{m}$   
 P : What formula do you think is used to solve problem number 2 (c)?  
 SA : Cost incurred =  $L \div$  wire price  
 P : Are you sure?  
 SA : Sure

P : Have you ever solved the same problem with question number 2?

SA : Never before

Based on Figure 14 and the interview excerpt shows that the SA subject understands what is known in the question and what is asked from question number 2. However, the unit area written by the SA subject in solving problem number 2 (b) is not appropriate, the formula used by the SA subject to solving problem number 2 (c) is not appropriate. This shows that the SA subject experienced a misconception of theoretical execution because the SA subject was convinced that the formula used to solve problem number 2 (c) was correct. In addition, SA subjects may experience such misconceptions due to the lack of understanding of the concept of broad unit concepts, as well as the lack of experience of SA subjects in equating typical questions such as questions number 2 (c).

f. WF Subject

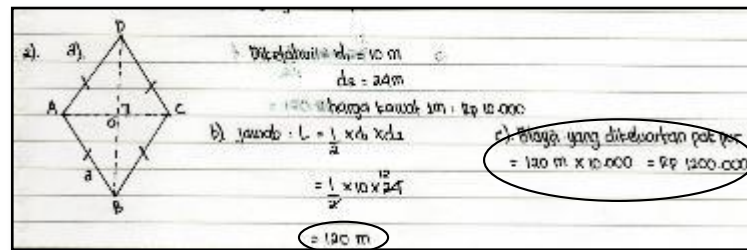


Figure 15. Results of the WF Test Question Number 2

The following are excerpts of the WF interview with researchers:

P : Please state what is known from question number 2?

WF : What is known is  $d_1 = 10\text{m}$ ,  $d_2 = 24\text{m}$ , wire price of  $1\text{m} = 10,000$

P : What formula do you think is used to solve problem number 2 (c)?

WF : Cost incurred =  $L \times$  wire price

P : Are you sure?

WF : Sure

Based on Figure 15 and the interview excerpt WF subjects can mention what is known in the questions. However, the unit area written by the WF subject when solving problem number 2 (b) is not appropriate because the WF subject writes the unit area m not  $\text{m}^2$ . In addition, the subject of WF when applying the formula used to solve problem number 2 (c) is not appropriate because the WF subject should use the formula  $K \times$  wire price to calculate the costs incurred by Mr. Pur when giving fences. Thus, the misconception experienced by WF subjects is the misconception of theoretical execution. This can occur because of the lack of knowledge and experience of the WF subject in solving wide-ranging and plane problems.

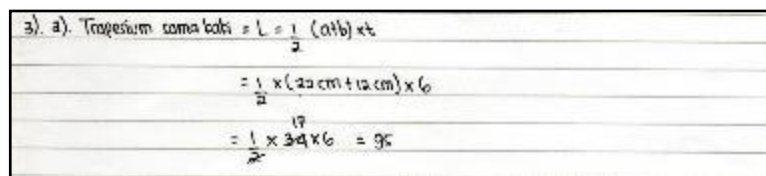


Figure 16. WF Test Result Problem Number 3

The following are excerpts of the WF interview with researchers:

P : What steps did you take to solve problem number 3 (a)?

WF : First determine the area of the trapezoid, then determine the area of the rhombus and the final step is to add the two areas together

P : From the picture in the problem, what is the height of the trapezoid?  
WF : 6 cm  
P : Are you sure?  
WF : Sure

From Figure 16 and interview excerpts show that the subject of WF experienced a misconception of classificational execution because the subject has not been able to determine the height of the trapezoid, so the size of the trapezoid height distributed by the WF subject is not appropriate. This is due to the lack of subject knowledge regarding the height of the trapezoid, the subject believes that the height measurements substituted into the formula are appropriate. Supposedly, the WF subject distributes the size of a trapezoid height equal to an OD length of 8 cm.

Based on the results of the research that has been described previously, the types of misconceptions experienced by students of SMP Negeri 2 Bangil there are two types of misconceptions namely classificational execution misconceptions and theoretical execution misconceptions.

1. Classificational Execution Misconceptions

The following characteristics and causes of students experiencing these misconceptions, namely:

- a. Student discrepancies in distributing what is known on the problem into the answer sheet, such as distributing the size of the height of the trapezoid when calculating the area of the trapezoid and distributing the sizes of the rhombic diagonals when calculating the area of the rhombus. This is in accordance with the theory conveyed by Ojose (2015) regarding the execution misconception, namely the misconception caused by students failing to manipulate the procedure and in accordance with the theory of classificational concepts, namely students still cannot distinguish the height of the trapezoidal, diagonally rhombic. Thus found a new type of misconception that is misconception of classificational execution and in accordance with the indicators of misconceptions presented in Table 1. In addition, students 'thinking about rhombic diagonals is still inaccurate, this can be seen from students' knowledge of diagonal definitions. Students define a diagonal on the rhombus is a line formed from the base to the intersection.
- b. The cause of students experiencing this misconception is the lack of students' understanding of the concepts of trapezoidal and rhombic flat shapes. This can occur because of the lack of reference students have and there is an incorrect explanation about the properties of the trapezoidal and rhombic flat structure.

2. Theoretical Execution Misconceptions

The following characteristics and causes of students experiencing these misconceptions, namely:

- a. Discrepancy of students when applying the formula of area and circumference of trapezoidal and rhombic flat shapes. so the student answers are wrong. As students should use the rhombus circumference formula to solve the problem, but students use the rhombic area formula to solve it. This is in accordance with the theory conveyed by Ojose (2015) regarding the misconception of execution, namely the misconception caused by students failing to manipulate procedures and in accordance with theories about theoretical concepts, namely students still do not understand the broad concept and the circumference of a plane. So that found a new type of misconception is the theoretical execution misconception. In addition, the criteria for students experiencing this type of misconception are also in accordance with the indicators of misconception that can be seen in Table 1.

- b. The cause of students experiencing these misconceptions is students' preconceptions because students assume that the broad and round shape of the trapezoidal and rhombic plane are just like those in the worksheets and their notebooks and the lack of student knowledge regarding the application of the broad and circular shape formula. This can happen because students only know the formula for the area and circumference of the trapezoid and rhombus that is written in general.

## CONCLUSION

There are two types of misconceptions experienced by students, namely classificational execution misconceptions and theoretical execution misconceptions. The theoretical execution misconception is more dominant than the classificational execution misconception. The causes of misconceptions experienced by students are from the students themselves because of the lack of student understanding of the concepts of area and circumference of plane, lack of student experience in solving broad problems and circumference of plane, lack of references used by students. In addition, the book is one of the causes of misconceptions because there is an incorrect explanation in the book and the book does not provide a complete explanation.

This research is still limited to the types and misconceptions experienced by students on broad subject areas and the circumference of a plane. In addition, the instruments used in research can only detect two types of misconceptions. So it is recommended for further researchers to develop this research in different materials and levels, using research instruments that can detect all types and causes of misconceptions.

## REFERENCES

- Ariawan, I. P. W. (2014). *Geometri Bidang*. Yogyakarta: Graha Ilmu.
- Dahar, R. W. (2011). *Teori-teori Belajar dan Pembelajaran*. Jakarta: Erlangga.
- Fuat. (2013). Melukis Segmen Garis  $a\sqrt{b}$  Dengan  $a, b \in Q^+$ . *Jurnal Ilmiah Edukasi & Sosial*. (Online). (<http://www.jiesjournal.com>, diakses 09 September 2019).
- Fuat, Nusantara, T., dan Parta, I. N. (2015). *Pengembangan Buku Ajar Geometri yang Membangun Kemampuan Membuktikan*. Tesis. Pascasarjana Universitas Negeri Malang.
- Fuat, F., Nusantara, T., Irawan, E. B., & Irawati, S. (2017). A Study on Students' Proof Construction by Using  $(H \rightarrow H1) \wedge (\neg C \rightarrow \neg H1) \rightarrow C$  Against The Proof Form. *International Conference on Language and Education*, 187-194.
- Fuat, F., Nusantara, T., Irawan, E. B., & Irawati, S. (2018). Psychological View on Students' Conviction in Mathematical Proof. *International Conference on Mathematics and Science Education of Universitas Pendidikan Indonesia*, 3, 704-709. Dari <http://science.conference.upi.edu/proceeding/index.php/ICMScE/article/view/105>
- Fuat, Nusantara, T., Irawan, E. B., & Irawati, S. (2019). Students' Mathematical Conviction in Mathematics Proof. *IOP Conf. Series: Earth and Environmental Science* 243: 012133. DOI: 10.1088/1755-1315/243/1/012133
- Lestari, A. S. B. (2019). Comognitive Matematis Siswa SMP Tentang Luas Daerah. *Jurnal Ilmiah Edukasi & Sosial*.(Online). (<http://www.jiesjournal.com>, diakses 09 September 2019).
- Ojose, B. (2015). *Common Misconceptions in Mathematics*. Lanham: University Press Of America
- Suparno, P. (2013). *Miskonsepsi & Perubahan Konsep Dalam Pendidikan Fisika*. Jakarta: PT Gramedia Widiasarana Indonesia.