

## Research Article

# Learning Obstacles in the Concept of Quadrilateral Constructed Areas

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**ORCID**Vidya Soneta: <https://orcid.org/0000-0003-2872-6535>**Abstract.**

This study aims to describe the learning obstacle in the concept of quadrilateral constructed areas based on the meaning obtained by students. The research method used is a qualitative method with a case study design. The participants in the research were 26 students of grade VII from one of the Bungo State Junior High Schools. The data collection was carried out by testing the respondents' abilities, interviewing them, and then conducting an in-depth analysis of the obstacles experienced by students. Based on the research conducted, it was revealed that epistemological obstacles arise because students understanding about the given problem is different from the usual context. Epistemological obstacle arise in the form of students' limited knowledge in solving problems related to the concept of the area of a rectangular dataset. Ontogenic obstacles are related to students' lack of concentration and readiness in the teaching and learning process.

**Keywords:** junior high schools, learning obstacles, quadrilateral constructed areas.

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## 1. INTRODUCTION

Mathematics as part of education has a very important role in the life and development of science and technology. Mathematics is a subject that is taught at every level of education. The material in mathematics can train students to think logically, systematically and critically. One of the materials studied in mathematics is geometry [1]. The topic of geometry studied by junior high school students is the area of a rectangular shape which is one of the materials that becomes the basis when students learn about building materials at a higher level. From the results of observations made at one of the SMPN in Bungo Regency, it was found that there were still many students having difficulty solving problems related to the area of a rectangular shape if the context given was slightly different from the example given by the teacher. This is because students do not understand the concept. So that when students are faced with different problem situations students are not able to answer them.

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This statement is supported by research that has been done by previous colleagues. Based on the results of the study, it can be concluded that the problems experienced by students in solving the problems given are learning barriers, both from the aspect of student knowledge, student readiness and the orderliness of the material provided. [2]. There are three types of learning obstacle is ontogenical obstacle, didactical obstacle, and epistemological obstacle [3]. Ontogenic obstacle occur because of the lack of mental readiness to learn children. This can be caused by the insufficient age of the child in learning a certain level of learning. Didactical obstacle occur because of a shortage in the ability to teach a teacher or it can also occur because of a teacher's mistake in designing the learning process. This is due to the lack of teaching competence of a teacher or the lack of teacher preparation in preparing for learning. Epistemological obstacle are obstacle related to the limited knowledge of students in a particular context. These obstacle make it difficult for students to solve non-routine problems.

This epistemological barrier is seen during observations where students have difficulty solving problems due to lack of knowledge [4]. Based on the problems that have been described, it is important to conduct further research on learning obstacle. The purpose of this study is to describe the description of learning obstacle in the concept of a rectangular flat shape based on the meaning obtained by students. Based on the research background that has been described previously, the research questions can be formulated as follows. (1) What is the meaning of the concept of a rectangular flat shape according to Junior High School students; (2) How is the meaning of the concept of a rectangular flat shape obtained by junior high school students; and (3) Based on the meaning and experience of the identified students, what are the learning obstacle contained in the broad concept of a rectangular flat shape?

## 2. RESEARCH METHOD

The method used in this research is a qualitative research with a case study research design. The qualitative method is a research method based on the philosophy of postpositivism and is suitable for researching natural objects [5]. The focus of this research is to explore the broad meaning of rectangular shapes in students' thinking, students' experiences in the learning process and the implications of learning obstacle in learning the concept of rectangular flat shapes. The subjects in this study were 26 students in one of the junior high schools in Bungo Regency.

Data collection was carried out by giving the respondent's ability test regarding the area of the rectangular shape and interviews. The test given is in the form of questions

related to the area of a rectangular shape with four questions with a processing time of 45 minutes. Next, document the results of student work to be analyzed based on the emerging learning obstacle. Interviews were conducted after seeing the results of the tests given. Interviews were conducted with the aim of clarifying the obstacle that arise based on the test answers. Interview questions were made based on four ways of justifying which consisted of students' explanations about the obstacle they faced from a perceptual, memorial, introspective, and a prioribelive point of view [6].

In this research, perceptual questions are asked in the form of asking students to describe the area of the rectangle itself. Questions for the memorial aspect are questions that ask students to explain everything related to the area of a rectangular shape whether it is a square, rectangle, trapezoid, kite, rhombus and others. The point of view of the introspective aspect is a question that shows the efforts made by students in finding the truth that supports their own opinion. Meanwhile, from an a prioribelive point of view, questions ask students to explain the conclusions obtained and their impact on learning outcomes.

### 3. RESULT AND DISCUSSION

The data obtained is based on the respondent's ability test regarding the area of the rectangular shape to identify learning obstacle that arise. The questions tested consist of 4 questions while the questions tested include the concept of a rectangular flat shape in the form of a square, trapezoid, rhombus and rectangle.

#### *Question Number 1*

*The floor of a rectangular room has an area of  $4 \text{ m}^2$ . The floor of the room will be tiled with a ceramic size of  $20 \text{ cm} \times 20 \text{ cm}$ . If the price of one tile is Rp. 1.500.00.*

In question number 1 students can answer using the concept of the area of a square. Where students can solve problems by calculating the area of the tiles and then dividing the floor area by the area of the tiles. However, based on the results of the answers, there were 15 people who still could not solve the questions correctly. The following are student responses (S1) regarding the concept of a square;

*R : What is the first idea that comes to your mind when you see a given problem?*

*S1 : Ceramics and the room are both square in shape*

*R : Tell me about the answer you made?*

*S1 : First, I made what is known in the problem, then I compared the area of the room with the area of the ceramics.*

Students should find the area of the tile first and then equate the unit between the area of the tile and the floor area. Then to find the number of tiles needed by comparing the floor area with the ceramic area. Based on the interview script, the students did not understand how to relate the concept of square area to each other. Students know that the room and the tiles are square. However, it has not been able to link the concept between the area of the room and the area of the ceramics. Perceptually, students have not been able to describe the area of a rectangular shape. This is indicated by the statement of the second student.

*Question Number 2*

*Mr. Gani has a garden in the form of an isosceles trapezoid with the lengths of the parallel sides 30 m and 25 m. And the length of the hypotenuse is 15 m. If Mr. Gani installs a fence with a distance of 50 cm from each fence post, then determine the area of Mr. Gani's garden and the number of fence posts needed.*

The solution to problem number 2 is to calculate the perimeter of the trapezoid. Judging from the students' answers, there were 18 people who still could not answer the questions correctly. Examples of student responses (S2) that are not correct regarding the concept of area of a trapezoid.

*R : What concept is used to solve this problem?*

*S2 : In solving the given problem using the concept of a trapezoidal area by dividing the number of two parallel sides then multiplied by the height of the trapezoid*

*R : Are there other concepts used?*

*S2 : No, that's the only concept for question a but for question b I divide the area of the trapezoid by the distance of each pole.*

Students find the area of the trapezoid just by looking at the known numbers and directly dividing the area of the trapezoid by the distance fence. Step 1 should have been done using the Pythagorean concept in finding the height of the trapezoid and then finding the area of the trapezoid used. Next to find many fence posts using the concept of a trapezoidal circumference. Judging from the interview script, the students did not understand how to relate the Pythagorean concept to determining the height of the trapezium. Introspectively students have not been able to relate the concept of the previous material to the material being studied at this time. This means that the provision of previous concepts is not enough to apply mathematical concepts. This can be seen from the statement of the first student (S2).

*Question Number 3*

*It is known that the rhombuses ABCD and BFDE with  $BD = 50$  cm and  $AE = 25$  cm, and  $EF = 2AE$  The area of the shaded area is*

To solve problem number 3 students can determine the area of each side and then look for the difference. The answers made by students were 20 people who were still wrong in answering the questions. The students' responses (S3) are still wrong about the concept of a rhombus.

*R : What is known in the question?*

*S3 : The diagonal of one of the rhombuses and one of the lines in the diagonal are lines AE and EF*

*R : What is the formula for finding the area of a rhombus and its properties?*

*S3 : The formula is that the two diagonals are multiplied and then divided by two. One of the properties of a rhombus is that its diagonals are the same length*

*R : Have you ever read other sources other than those given by the teacher at school?*

*S3 : No, ma'am, I only understand the example given by the teacher, in the example only the diagonal is known and then it is immediately multiplied*

*R : How are you sure about your answer that you get?*

*S3 : Waiting for discussion from the teacher or friend whose answer is correct.*

Supposedly to find one of the other diagonals on the rhombus can use the number of lines AE, EF and CF. Then find the difference between rhombus ABCD and BEDF. Judging from the interview script, students did not understand how to relate the properties of a rhombus in determining the diagonal of a BDEF rhombus. In memory, students have not been able to relate one concept to another. In this case, the learning experience that he has gone through is not sufficient to equip him to apply the mathematical concepts he has learned, causing low a priori belief. This can be seen from the third S3 question.

#### *Question Number 4*

*The length of the path that surrounds grandfather's rectangular garden is 450 m. If the width of the garden is 75 meters. How much*

*a. Grandpa's garden length*

*b. Grandpa's garden area*

Students can answer question number 4 by using the concept of the area of a rectangle. Of the 26 students' answers collected, there were 12 students who still could not answer the questions correctly. The following are student responses (S4) that are not correct.

*R : What is the formula for finding the area of a rectangle and the perimeter of a rectangle?*

*S4 : The formula for finding the area of a square length is the length times the width, then the formula for the perimeter of a rectangle is the sum of all the sides of the rectangle*

*R : Have you looked in various sources for examples of questions that use the concept of a rectangle?*

*S4 : I only study and imitate the example given by the teacher, in the example there is only if the length is known and the width is known, determine the area of the rectangle.*

Students only find the length of the rectangle by finding the difference between the length of the road and the width of the garden. Then find the area of the rectangle, if the question a is wrong, then b is also wrong. Students should use the concept of the perimeter of a rectangle to determine the length of the garden. Then use the concept of the area of a rectangle to determine the area of the garden. When viewed from the results of the interviews, students did not understand in relating the concept of circumference to the area of a rectangle. In memorial terms, students could not relate one concept to another. In this case, the learning experience he has gone through is not enough to equip him to apply the mathematical concepts he has learned [7].

The data obtained shows the limited knowledge of students regarding the concepts of the area of a rectangular shape. Students do not understand the concept of the material but students only understand the procedure in solving problems based on the examples given by the teacher usually. This shows an indication that students experience learning epistemological obstacle, namely student knowledge that has a limited context. If people are faced with different contexts, knowledge becomes unusable or he has difficulty using it [8,9]. Another learning barrier encountered in this study is the ontogenic barrier. Ontogenic obstacle is learning difficulties caused by the lack of readiness of the learning process and the lack of concentration of students in the teaching and learning process. Some children sometimes lack the skills needed for age-related cognitive purposes [10]. Ontogenic obstacle that arise due to the lack of students' understanding of the concept of quadrilaterals and understanding of the prerequisite material. This results in students experiencing obstacle in the next material. This shows a lack of student concentration in the teaching and learning process.

## 4. CONCLUSION

Based on the research that has been done, it can be concluded that the learning obstacle that arise during learning about the concept of the area of the quadrilateral are epistemological and ontogenic obstacle. There were no didactic obstacle due to the pandemic situation so that the learning process could not be seen. This was revealed through analysis of student answers and interviews with several students. Epistemological obstacle in the form of limited knowledge of students in solving problems related to the concept of the area of a rectangular data set. Ontogenic obstacle related to the lack of concentration and readiness of students in the teaching and learning process. This was revealed through analysis of the results of student answers and interviews with several students.

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