ANALYSIS OF STUDENTS' MISCONCEPTIONS IN SOLVING MATHEMATICS PROBLEMS ON FLAT CONSTRUCTION MATERIALS

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ARTICLE INFO	ABSTRACT
Received: Ferbuary, 26th 2022 **Revised:** March, 15th 2022 **Approved:** March, 16th 2022	*This study aims to find out the misconceptions experienced by students in solving mathematical problems in the material of quadrilaterals in the fourth grade of SD Negeri 2 Biwinapada. This type of research is qualitative research. The subjects in this study were 3 fourth-grade students at SD Negeri 2 Biwinapada. Data collection techniques using tests and interviews. The data analysis techniques used are data reduction, data presentation, and drawing conclusions. The results showed that the misconceptions experienced by students include: 1) classificational misconceptions, namely a) not writing down what is known and asked or other elements needed to answer questions and b) errors in determining examples of rectangular shapes which are square or square long. 2) Correlational misconceptions, namely a) errors in representing the problem in the form of pictures, b) errors in applying the area value in the formula and c) making mistakes in applying the relationship between the formula used and the problems contained in the problem. 3) Theoretical misconceptions, namely errors in writing quadrilateral units, namely area (cm) and circumference (cm2).*
KEYWORDS	Bagasse, Briquettes, Energy, Orange Peel

INTRODUCTION

Mathematics is a subject that has an important role in education. Based on the Regulation of the Minister of National Education No. 22 of 2006 concerning Content Standards for primary and secondary education units, mathematics needs to be taught to students starting from elementary school to equip students with logical, analytical, systematic, critical, and creative thinking skills as well as the ability to work together (Siswono, 2018). In addition, mathematics is also the basis of science and technology. Hence why it is necessary to be understood, taught, and mastered to make it applicable in everyday life. Therefore, mathematics must be taught starting from basic education.

The Ministry of Education and Culture (2014) explains that there are various abilities that must be mastered by students, one of which is problem-solving skills. Problem-solving is one of the goals of learning mathematics (Amaliah, Fitri, Sutirna & Rafiq, 2021). NCTM (2000) in Amaliah, Sutirna, & Zulkarnaen (2021), stated that problem-solving means engaging in a task where the solution method is not known beforehand. To find solutions, students must draw on their knowledge, and through this process, they will develop new mathematical understandings. There are several steps that can be taken to solve mathematical problems, Polya (1973) in Amaliah, Sutirna, & Zulkarnaen (2021), namely (1) understanding the problem Please delete these words (2) planning a solution (devising a plan), (3) implementing the plan and (4) checking back.

Students can be said to have good problem-solving skills if they are able to go through all stages of problem-solving. However, there are still find students who have misconceptions about solving mathematical problems. Abraham explained that students are said to have understood a concept if they have met a criterion, namely understanding, misconception, and not understanding. Meanwhile, misconceptions are things that are often experienced by students. Therefore, it is important for teachers to know the misconceptions experienced by students.

A teacher should teaching subjects from the ideas that the students already has as a benchmark for preparing learning that can reduce misconceptions and increase the concept of new ideas. That way, the teacher can help students not to experience misconceptions about the lesson, especially the mathematics lesson on the geometry of quadrilaterals, namely squares and rectangles. Suparno (2013) defines misconceptions as understanding concepts that are not in accordance with scientific understanding or the agreement of experts in the field (Ainiyah, 2015).

In this study, the researchers analyzed the types of misconceptions based on the types proposed by Moh. Amien (Ainiyah, 2015), namely: 1) classificational misconceptions, which are forms of misconceptions based on misclassification of facts into organized charts, 2) correlational misconceptions, which are forms of misconceptions based on errors regarding special events. interconnected, or observations consisting of assumptions, especially in the form of the formulation of general principles, and 3) theoretical misconceptions, which are forms of misconceptions based on errors in studying facts or events in an organized system.

Based on the results of the initial test for fourth graders at SD Negeri 2 Biwinapada, there are some students who still have misconceptions in determining formulas and performing operations to calculate the area and perimeter of a combined square and rectangular shape. Furthermore, after interviewing the teacher, sometimes he does not provide reinforcement for students if there is a misunderstanding in the explanation. Therefore, misconceptions are a condition that must be handled because they can hinder students' knowledge of mathematics, one of which is geometry material, especially in rectangular flat shapes, namely squares and rectangles. Thus, it is necessary

to analyze the misconceptions experienced by students. Hence, the researchers were interested in conducting research with the title analysis of student misconceptions in solving mathematical problems on the material of quadrilaterals (squares and rectangles) in grade IV SD Negeri 2 Biwinapada.

RESEARCH METHOD

This research applied qualitative approach. According Bodgan & Taylor qualitative research is one of the studies using descriptive data in the form of words or verbal and observed behavior of each subject (Sujarweni, 2014). Thus, the data obtained from this study were analyzed descriptively to determine the types of misconceptions experienced by students in solving mathematical problems in rectangular shapes, namely squares and rectangles. The subjects of this research were selected 3 fourth grade students of SD Negeri 2 Biwinapada who represented each category of ability, namely high, medium, and low, as well as students with good communication skills. This is done by researchers because they want students to be able to give or convey ideas, ideas, or reasons. So that researchers can identify more deeply the research subject. The instruments used in this research were 1) a description test of 6 numbers consisting of rectangular shape material, namely square and rectangular and 2) interviews. The data obtained were then analyzed using qualitative data analysis, proposed by Miles and Huberman, namely data reduction, data presentation and conclusion drawing (Rahimah, 2019). To compare the results of students' work with interviews, researchers used triangulation techniques to analyze students' misconceptions in solving mathematical problems on rectangular flat shapes, namely squares and rectangles.

RESULT AND DISCUSSION

After the mathematical problem solving test on the rectangular flat shape material, it can be seen that the results of the categorization of students' abilities are as follows.

Table 1. Results of Students' Mathematical Problem Solving Ability Tests on Quadrilateral Flat Shapes

Category	Student Value	Number of Students
Tall	51-100	8
Currently	33-50	7
Low	0-32	5

In order to describe students' misconceptions in solving students' mathematical problems in each category, 1 student in the high category will be selected with the subject code S-01, medium, subject code S-02, and low, subject code S-03.

Based on the test results, it can be seen that students with high abilities (S-01) are able to solve questions well. Likewise, students with moderate abilities (S-02) are quite good at answering test questions. Meanwhile, students with low abilities have not been able to solve problems well. The types of misconceptions experienced by students are described in the following table:

Table 2. Results of the Misconception Analysis of High Ability Students (S-01)

No. Problem	Types of Misconception			Statements
	Classification	Correlational	Theoretical	
1.	No misconceptions			
2	Error in assuming area value as length value	Error in applying the formula for area and perimeter of rectangle	No theoretical misconceptions	There are no other numbers that can be used as length values
3	No misconceptions			
4	No classificational misconceptions	Error in applying the formula for the perimeter of a rectangle	Error in determining the unit for the perimeter of a rectangle	Writing the formula K = 2 × x (p × l), because the lamp distance is 3 meters
5	No misconceptions			
6	Errors in determining the value of the side length of a square	Error in applying formulas & representing problems in the form of pictures	No theoretical misconceptions	There are lengths and lengths of sides, so write the formula L = 2 (p × l)

Table 3. Results of the Misconception Analysis of Medium Ability Students (S-02)

No. Problem	Types of Misconception			Statements
	Classification	Correlational	Theoretical	
1	Error in determining the example of a rectangular shape which is either a square or a rectangle	Error representing the problem in the form of a picture	No theoretical misconceptions	The selected image has been seen in a book
2	No misconceptions			
3	Not experiencing classificational misconceptions	Error applying the formula for the area of a square & rectangle	Error determining the unit area of a square &	Writing the formula L = p × l, because the area of the shaded area

			rectangle	is in the rectangle
4	No misconceptions			
5	Error in determining the value of the side length of a square	Error in applying the formula for the perimeter of a square	Error writing the unit for the perimeter of a square	Writing the formula K= 4 (side + side), because there are two length values, namely tape & side
6	Does not experience classification misconceptions	Errors in representing questions in the form of pictures	Makes mistakes in writing the unit area of squares & rectangles	writing the unit area of squares & rectangles Writes the formula for the area of the garden, L = s×l×p, because the pond is made in a garden

Table 4. Results of Low Ability Students' Conception Analysis (S-03)

No. Problem	Types of Misconception			Statement
	Classification	Correlational	Theoretical	
1	Error determining the example of a quadrilateral which is a square or a rectangle	Error representing the problem in the form of a picture	Make a mistake in identifying the shape of a square or rectangle based on its properties	I don't understand, just just answering
2	Made an error in specifying the length value as the area value of the rectangle	Error applying the relationship between the area formula and the perimeter of a rectangle	Error in determining the unit perimeter of a rectangle	Write the formula K=p + l, because the perimeter is the sum of all sides of the shape
3	Made an error in determining the value of the length, width of a rectangle and the value of the side of a square	Error applying the formula for the area of a square & rectangle	Error determining unit area of square & rectangle	Do not understand how to work on the problem so that it is answered arbitrarily with 12+4+8+32=56

4	Not experiencing classificational misconceptions	Error in applying the formula for the perimeter of a rectangle	Error writing unit of perimeter a rectangle	Write the formula K= p + l, because the perimeter is the sum of all the outer sides of the plane
5	No misconceptions			
6	Not experiencing classification misconceptions	Errors in applying the formula for the area of squares and rectangles and representing the problem in the form of pictures	Made a mistake in writing the unit area of a square & rectangle	Write down the answer 10+8+6=24, because it's just an answer

Discussion

There are several types of misconceptions experienced by groups with high, medium, and low abilities in class IV SD Negeri 2 Biwinapada in solving problems solving mathematical problems with rectangular flat material, namely:

1. Description of Classificational Misconceptions

Based on the analysis of the results of the tests and interviews, it showed that students experienced classificational misconceptions in several indicators of misconceptions on the material of rectangular flat shapes.

In the description question number 1, it relates to restating the concept of quadrilaterals (squares and rectangles). There are several answers that have misconceptions, namely S-16 and S-08 on the indicator making an error in determining the example of a rectangular flat shape which is either a square or a rectangle. This is in line with the opinion of Dedy & Sumiaty in (Fajari, 2020) states that students become poor in context because they always imitate existing examples and do not understand the construction of concepts from the results of their own thinking. This is supported by the opinion of Gita et al (2018) which states that the misconceptions that occur can be caused by the way of teaching and presenting pictures (Fajari, 2020).

In the description questions number 2, 3, 4, 5, and 6 related to the concept of area and perimeter of quadrilaterals (square and rectangle). The three subjects experienced the same misconception in answering, namely not writing down what was known and asked in the question. This is, in line with the opinion (Darmila, 2015) which states that based on the results of research conducted, students' conceptual errors are caused by several things, namely students are wrong or even unable to write down known objects clearly and completely and have difficulty interpreting the sentence questions into known objects one by one. This is also supported by the opinion of Polya (2004) in (Rofi'ah, Ansori, & Mawaddah, 2019) states that in understanding the problem, it begins with understanding the language and terms in the problem and formulating what is known, then ensuring that what is known is sufficient to determine what you want to get in the question.

2. Description of the Correlational Misconception

Based on the analysis of test results and interviews, it was found that there were correlational misconceptions in some of the description questions. From the results of the analysis, it shows that the subjects of S-14 have correlational misconceptions which are located in questions number 1, 2, 4, and 6. S-16 have correlational misconceptions which are located in the description questions numbered 1, 3, 5 and 6. Meanwhile, S-03 experienced a correlational misconception which lies in the description questions number 1, 2, 3, 4, and 6

In the description problem number 1, it relates to the concept of quadrilaterals (squares and rectangles). Subjects S-16 and S-08 experienced a misconception, namely an error in representing the problem in the form of an image. This can be seen from the answers of students who made mistakes in determining the shapes which are types of squares and rectangles based on the existing images. This is in line with the results of Fajari's research (2020), including that students are accustomed to getting up in a flat position or building a horizontal space.

In the description problem number 2 is related to the concept of the relationship between the area and the perimeter of a rectangle. Subject S-14 applies the formula $K = 2$ (area + width) and S-08 applies the formula $K = p + l$. So that S-14 and S-08 have misconceptions, namely: students' mistakes in applying the area value in the formula and applying the perimeter formula of a rectangle that is not in accordance with the concept of the perimeter of a rectangle. This is in line with the opinion of Putra Jaeng & Sukyasa in Hanifaturrocmah, Sary, and Azizah stating that they are said to have made a conceptual error if they do not use the formula correctly and students are also unable to operate multiplication, division and subtraction.

In the description problem number 3 it is related to the concept of the area of the shaded flat shape. Subjects S-16 applied the formula $L = $ length x area and S-8 applied the formula $12 + 4 + 8 + 32$. So they experienced misconceptions, namely students' mistakes in applying the formula to solve problems. In the description problem number 4 is related to the concept of the perimeter of a rectangle. Subject S-14 applies the formula $K = 2 \times x (p + l)$ and S-08 applies the formula $K = p + l$. So that they experience misconceptions, namely students' mistakes in applying the formula for the perimeter of a rectangle, namely $K = 2 \times x (p + l)$ and $K (p + s)$. In question number 5 it is related to the concept of the perimeter of a square. Subject S-16 applies the formula $K = 4$ (side + side). So that there is a misconception, namely an error in applying the formula to solve the problem. This is in line with the opinion of Putra Jaeng & Sukyasa which states that they are said to have made a conceptual error if they do not use the formula correctly and students are also unable to operate multiplication, division and subtraction. (Faturrochmah, Sary, & Azizah, 2021).

In the description problem number 6, related to the relationship between the formula for the area of a square and a rectangle, the three subjects experienced misconceptions in applying the formula and illustrating the shape of the land which was then made a fish pond in it. Students apply the formula for the area of the garden as $L = 2$ $(p \times l)$, $L = p \times l \times s$, and $L = p + l + s$. This is in line with the results of research by Rahayu and Arfiansyah (2021) stating that the correlational misconceptions experienced by students include students making mistakes in applying the relationship between the formulas used and the problems contained in the questions, which include errors in applying the perimeter formula of a rectangle, errors in applying the perimeter formula.

the same as the formula for the area of a rectangle and errors in applying the formula for the perimeter of a square. In addition, errors in representing the problem in the form of images (Rahayu and Arfiansyah, 2021).

3. Description of Theoretical Misconceptions

Based on the results of data analysis, it was found that there were theoretical misconceptions in some of the description questions. From the results of the data analysis, it shows that the three subjects experienced theoretical misconceptions about the error indicator in writing the perimeter unit of a rectangular shape. This is in line with the opinion, Ningsih, (2016), understanding the concept is very important to be mastered by students in dealing with variations in the form of problems in mathematics that are being faced, the importance of understanding concepts is the basis in obtaining the expected learning outcomes, while the use of concepts in mathematics is related to understand and distinguish words, symbols and signs (Fauzi & Arisetyawan, 2020). This is also supported by the results of research, Putra, Jaeng, & Sukyasa (2016) which states that one of the mistakes is not writing down the unit area and perimeter of a flat shape (Faturrochmah, Sary, & Azizah, 2021).

CONCLUSION

Based on the description and analysis of the data on the misconceptions of fourth graders of SD Negeri 2 Biwinapada on the material of quadrilaterals (square and rectangle) the results are obtained, namely students with high mathematical abilities experience the least level of misconceptions when compared to students with moderate and low mathematical abilities; students with moderate math abilities experienced the most misconceptions from students with high math abilities, and students with low math abilities experienced the most misconceptions compared to students with high and moderate math abilities.

The misconceptions experienced by fourth grade students of SD Negeri 2 Biwinapada include: 1) Classificational misconceptions, namely: 1) not writing down known and asked elements or other elements needed to answer questions and making mistakes in determining examples of rectangular shapes. which is a square or a rectangle 2) Correlational misconceptions, namely errors in representing the problem in the form of images, errors in applying the area value in the formula and making mistakes in applying the relationship between the formula used and the problems contained in the problem. 3) Theoretical misconceptions on the error indicator in writing the perimeter unit of a rectangular flat shape, which is cm2 and the unit area of a rectangle, which is cm.

REFERENCES

Ainiyah, Lutfia Afifatul. (2015). Identifikasi Miskonsepsi Siswa Dalam Materi Geometri Pada Pembelajaran Matematika Siswa Kelas VIII SMP Negeri 1 Punggelan. *Journal Student UNY*, *3*.

Amaliah, Fitri, Sutirna, &., & Rafiq, Zulkarnaen. (2021). Analisis Kemampuan Pemecahan Masalah Matematis Siswa Pada Materi Segiempat dan Segitiga. *AKSIOMA: Jurnal Matematika Dan Pendidikan Matematika*, *12*(1), 10–20.

Darmila. (2015). *Analisis Kesalahan Konsep Matematika Siswa dalam Penyelesaian Soal Pemecahan Masalah Matematika di SD Negeri 30 Kendari*. Universitas Halu Oleo.

Fajari, Urip Nurul. (2020). Analisis Miskonsepsi Siswa pada Materi Bangun Datar dan

Bangun Ruang. *Jurnal Kiprah*, *8*(2), 113–122.
https://doi.org/10.31629/kiprah.v8i2.2071

Faturrochmah, H., Sary, R. M., & Azizah, M. (2021). Kesalahan Siswa dalam Mengerjakan Soal Materi Bangun Datar Berdasarkan Teori Nolting pada Siswa Kelas IV Sekolah Dasar. *Elementary School: Jurnal Pendidikan Dan Pembelajaran Ke-SD-An*, *8*(2), 310–321.

Fauzi, Irfan, &., & Arisetyawan, Andika. (2020). *Analisis Kesulitan Belajar Siswa pada Materi Geometri di Sekolah Dasar*. *11*(1), 27–35.

Rahimah, Nonong. (2019). Pemecahan Masalah Matematika Siswa Pada Materi Bangun Datar Segi Empat Berdasarkan Kemampuan Matematik (Students ' Mathematics Problem Solving Ability On Rectangular). *THETA: Jurnal Pendidikan Matematika*, *1*(2).

Rofi'ah, N., Ansori, H., & Mawaddah, S. (2019). Analisis Kesalahan Siswa dalam Menyelesaikan Soal Cerita Matematika Berdasarkan Langkah Penyelesaian Polya. *EDU-MAT: Jurnal Pendidikan Matematika*, *7*(2).

Siswono, Tatag Yuli Eko. (2018). *Pembelajaran Matematika Berbasis Pengajuan dan Pemcahan Masalah Fokus Pada Berpikir Kritis dan Kreatif*. Bandung: PT Remaja Rosdakarya.

Sujarweni, V. Wiratna. (2014). *Metodologi Penelitian Lengkap, Praktis, dan Mudah Dipahami*. Yogyakarta: Pustaka Baru Press.