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Mathematical Reasoning Ability for Class IV Students on Polygon Materials

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Abstract. The background of this research is the low ability of mathematical reasoning in students, such as a lack of understanding of concepts in solving mathematical problems. This qualitative descriptive study aims to analyze the mathematical reasoning abilities of fourth-grade students on polygon material at SDN Kedungmulyo Pati Regency. The subjects in this study were 22 students from fourth-grade students at SDN Kedungmulyo. The data in this study were obtained from tests and interviews. The results showed that the mathematical reasoning ability of students in the polygon material for the very high category was 9.09% (two students), the high category was 36.36% (eight students), the medium category was 40% (nine students), the low category was 13.63% (three students), and none from the very low category. The findings indicate that the average value of students' mathematical reasoning abilities on polygon material is in the medium category.

INTRODUCTION

Education is a conscious and planned effort to create a learning atmosphere and learning process. So students actively develop their potential to have religious spiritual strength, self-control, intelligence personality, noble character, and skills needed by themselves, society, nation, and state. In obtaining an education, a person must go through a learning process [1].

Learning is a series of activities between educators and students in a learning environment. The form of the learning environment in primary education in elementary school. Mathematics is one of the compulsory subjects taught at every level of education, including primary education. As stated in Law no. 20 of 2003 Chapter X Article 37, paragraph (1) states that the primary and secondary education curriculum must contain: religious education, civic education, language, mathematics, natural sciences, social sciences, arts and culture, physical education and sports, skills / vocational education, and local content [2].

According to Soedjadi in Rismen *et al*. [3], mathematics is a science based on reason and has a relationship with objects in the abstract mind, or mathematics examines abstract objects. In line with the opinion of Hudojo [4], mathematics is an abstract thought in the form of symbols arranged hierarchically, and reasoning is deductive. Therefore learning mathematics is included in activities that require higher thinking order. For that, it can be interpreted that mathematics is the science of abstract thought that examines numbers, shapes, general symbols, and a concept. The result is a truth that can be accepted by deductive logic. So, it can be applied in other fields.

As the basis of all sciences, mathematics has an essential role in everyday human life, especially in developing science and technology. The Ministry of National Education Number 22 of 2006 concerning content standards for

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primary and secondary education units states that the purpose of mathematics lessons for students is that students are expected to have the following abilities. (1) Understand mathematical concepts, explain the interrelationships between concepts and apply concepts or algorithms, flexibly, accurately, efficiently, and precisely in problem-solving. (2) Using reasoning on patterns and characteristics, performing mathematical manipulations in loading generalizations, compiling evidence, or explaining mathematical ideas and statements. (3) Solving problems, including the ability to understand problems, mathematical design models, complete models, and interpret the solutions obtained. (4) Communicating ideas in symbols, tables, diagrams, or other media to clarify the situation or problem. (5) Having an attitude of appreciating the usefulness of mathematics in life, namely having curiosity, attention, and interest in learning mathematics, as well as a tenacious and confident attitude in problem-solving [5][6].

The National Council of Teachers of Mathematics (NCTM) states that when learning mathematics, students are required to have the following abilities: (1) mathematical communication, (2) mathematical reasoning, (3) mathematical problem-solving, (4) mathematical connections, and (5) mathematical representations [7]. There are five essential abilities in the learning objectives of mathematics that have been described above, one of which is the ability to reason systematically.

Nababan argues mathematical reasoning is a person's ability to draw conclusions or make new statements, following a collection of previously known ideas in a way that can be accepted by reason deductively and inductively [8]. Meanwhile, according to Fajri, mathematical reasoning ability is one indication of some of the development of abilities that exist in mathematical thinking in the mathematics learning process [9]. Based on the understanding that has been put forward, it can be concluded that mathematical reasoning ability is one of the abilities that indicate the development of mathematical thinking concepts where the ability connects problems that occur to reasoning so that students are expected to be able to solve mathematical problems.

Mathematical material and mathematical reasoning are two things that cannot be separated. Namely, mathematical material is understood through reasoning, and reasoning is understood and trained through learning mathematical material. Through reasoning, students are expected to be able to think that mathematics includes knowledge that can be accepted by reason or logic [10].

Reasoning ability is one of the crucial aspects of the mathematics learning process. Through reasoning abilities, it is easier for students to develop and build a thought or idea, help solve problems in mathematics, and conclude. According to Baroody there are four reasons why mathematical reasoning skills are needed in everyday life, namely: (1) The reasoning needed to do mathematics. That is, reasoning is involved and has an essential meaning for the development and application of mathematics. (2) The need for reasoning in school mathematics reasoning is needed in mathematics lessons at school. The reasoning is needed in learning to learn mathematical concepts correctly. (3) Reasoning involved in other content areas, having intentions in other disciplines, and reasoning skills can also be implemented. This makes the reason that reasoning ability can support the progress of other scientific fields. (4) Reasoning needed for everyday life means that reasoning ability is needed. This means that reasoning has a role in problem-solving in everyday life [11].

According to Irianti [12], students who were given problem-based learning had better mathematical reasoning abilities and were classified as having sufficient qualifications than students who were given ordinary learning, classified as having mathematical reasoning abilities with fewer qualifications. This is also similar to that expressed by Aulya and Purwaningrum [13] in their research that the Problem-Based Learning (PBL) learning model in collaboration with learning media can improve students' reasoning abilities so that the expected learning objectives can be achieved.

Based on the problems described, the researchers conducted unstructured interviews with resource persons, namely fourth-grade teachers at SDN Kedungmulyo. Information obtained from interviews with the informants revealed that the difficulties in learning mathematics usually lie in understanding concepts. For example, students find determining the formula used when working on math problems challenging. In addition, students have not memorized multiplication or formulas in mathematics lessons, and students' memory is weak. The problem is related to the low mathematical reasoning ability of students. The narrative expressed by the teacher is that in learning, the teacher still uses conventional learning methods.

The conventional learning method is the teacher's effort to deliver the material orally or through lectures. Students are obliged to pay attention and listen to the teacher's explanation, write the material explained by the teacher, ask the teacher if they do not understand, and be evaluated. So conventional learning teachers are more potent in learning when transferring knowledge than students. Students tend to be passive in receiving information provided by the teacher [14].

Some of the problems mentioned by the teacher show that the teacher teaches memorizing mathematical concepts rather than directing students to use reasoning in learning mathematics. This is contrary to Wati and Sary [15], students

are not only taught to memorize many mathematical formulas when learning mathematics but also be able to apply mathematics to their daily lives, which will later solve problems that arise related to mathematics.

Based on the description that the researcher has described above, it can be seen that mathematical reasoning ability is crucial for students and needs to be considered in learning mathematics. With that, the researchers tried to research "How is the Mathematical Reasoning Ability of Class IV Students on Polygon Materials at SD Negeri Kedungmulyo, Pati Regency" to analyze the mathematical reasoning abilities of fourth-grade students on polygon material at SDN Kedungmulyo, Pati Regency.

METHOD

The approach in this study is a qualitative approach with descriptive research methods. The place used to conduct research is SD Negeri Kedungulyo in Pati Regency. This study's data sources are fourth-grade students of SD Negeri Kedungmulyo, with 22 students in one class. The data obtained are in the form of mathematical reasoning ability test results and interview results.

This study's subjects were nine of 22 fourth-grade students at SD Negeri Kedungmulyo. Students were selected based on information obtained from the classroom teacher, namely three students from each category ability with high, moderate, and low. Data collection techniques used are written tests and interviews. The written test is carried out by giving students ten polygonal material description questions. Each item contains ten indicators of reasoning, namely: (1) understanding meaning, (2) logical thinking, (3) understanding negative examples, (4) deductive thinking, (5) systematic thinking, (6) consistent thinking, (7) draw conclusions, (8) determine methods, (9) make reasons, and (10) determine strategies. The test time is 120 minutes. Three validators have validated the questions: one lecturer and two teachers. The results of the validation show that the first and second validators got a score of 88% with a description suitable for use without revision. The third validator's assessment obtained a score of 80% with a statement that it was suitable for use without revision.

Then after the students worked on the test questions, interviews were conducted with nine students who had been selected with different levels of ability. Interviews were conducted to confirm the answers that had been written by the students so that the researcher could know the students' reasoning abilities more deeply. The result of the interview shows the reasoning ability of the students as follows:

MNH : "kalau segi banyak beraturan panjang sisinya sama dan tidak punya garis melengkung, kalau segi banyak tidak beraturan panjang sisinya tidak sama" "a regular polygon has the same side lengths and has no curved lines, an irregular polygon the side lengths are not the same"

From the results of the interviews above, it can be seen that MNH students can understand the meaning and differences between regular and irregular polygons. This is proven when students can explain the meaning and characteristics of regular and irregular polygons. It can be said that **reasoning abilities in understanding** are good.

AJP : "yang gambar a itu bu panjangnya tidak sama, dan yang gambar b panjangnya sama" "picture a isn't the same length, and picture b is the same length"

Based on the results of the interviews, when the writer asked how to find the similarities and differences between the two shapes, the students answered, judging from the side lengths of the two shapes. So, it can be concluded that students can **think logically**.

AJP : "karena yang dicentang panjangnya sama itu segi banyak beraturan, yang disilang ada garis melengkungnya itu bukan segi banyak" "Because what is checked is the same length as a regular polygon, what is crossed by a curved line is not a polygon"

From the results of the interviews, the students explained clearly the reasons for choosing figures a, c, d, f, and g **as non-polygonal figures** because they have curved lines. In addition, the figure is called a regular polygon because it has the same side lengths.

P : "Jelaskan bagaimana cara kamu mengerjakan soal 4a sampai 4c!" "Explain how you do questions 4a to 4c!"

MAP : "(students are silent)"

P : "kok bisa menuliskan jawaban ini di soal 4a dan 4b langkahnya bagaimana?" "How come you can write this answer in questions 4a and 4b what are the steps?"

MAP : "tadi melihat teman bu" "i copy my friend ma'am"

In terms of **deductive thinking**, students could not answer the questions posed by the author. Students admit to writing down some of the answers in number 4 to see their friends' responses. It can be concluded that students have not been able to think deductively.

Q: "Bagaimana langkah kamu dalam menyelesaikan soal tersebut? Coba jelaskan secara urut" "How did you solve the problem? Please explain in order"

LMP : "Menulis diketahui dan ditanyakan habis itu mencari panjangnya terus luasnya persegi panjang" "Write down what is known and what is being asked, after that find the length and then the area of the rectangle"

In **thinking systematically**, students could answer or explain in detail the steps that must be used to find the breadth. It can be seen that students understand the intent of the questions, but students are not careful in doing so the comparison is reversed.

Q : "Apa alasan kamu menggambarkan kedua bangun tersebut sebagai bangun segi banyak tidak beraturan?" "What is your reason for describing the two figures as an irregular polygon?"

LMP: "karena sama-sama memiliki panjang yang tidak sama bu" "because they both have the different length ma'am"

From the results of the interviews, students describe the two figures because they have unequal side lengths. Students can already **think consistently.**

Q : "Bagaimana cara kamu mengerjakan soal nomor 7?" "How do you do question number 7?"

MA : "mencari dengan rumus luas persegi, persegi panjang, dan segitiga bu" "find the formula for the area of a square, rectangle, and triangle bu"

Q: "Apa yang dapat kamu simpulkan dari jawaban soal tersebut?" "What can you conclude from the answer to the question?"

MA : "(students are silent)"

From the results of the interviews, it seemed that students did not understand the meaning of the questions because when asked about how to do question number 7, they only explained until they found the area of all the shapes. Students cannot yet **draw conclusions.**

Q : "Bagaimana langkah kamu dalam mencari luas bangun gabungan pada nomor 8?" "What are your steps in finding the area of the compound shape in number 8?"

MNH: "luas perseginya dihitung dulu bu terus menghitung luas segitiganya dikali dua habis itu dijumlah $100 + 60 = 160$ *cm^2" "First calculate the area of the square, ma'am, then calculate the area of the triangle multiplied by two and then add up to* $100 + 60 = 160$ *cm^2"*

From the results of the interviews, students explained the method used to solve question number 6 correctly. Students solve the problem by finding the area one by one, then adding it and getting the final result. It can be said that students can already **determine the method.**

Q: "di soal nomor 9 bangun apa saja yang termasuk bangun segi banyak beraturan dan tidak beraturan?" "In question number 9, what shapes are included in regular and irregular polygons?"

LMP : "yang persegi segi, segitiga sama sisi banyak beraturan, yang segi banyak tidak beraturan segitiga siku-siku, segitiga sama sama kaki, jajargrnjang, dan segitiga lancip" "a square and a equilateral triangle are regular polygon, irregular polygon are a right triangle, an isosceles triangle, a parallelogram, and an acute triangle"

From the interview results, the students correctly answered the grouping of regular and irregular polygonal shapes. However, students **could not provide a clear explanation** of the shapes that had been grouped. It can be said that students cannot yet make reasons for solving math problems.

Q: "Apa strategi atau cara yang kamu lakukan untuk menyelesaikan soal nomor 10*?" "What strategy or method did you use to solve question number* 10*?"*

CNS: "menggunakan keliling segitiga dan ditambah semua" "using the perimeter of the triangle and adding all"

Q: "Alasan apa yang mendasari kamu menggunakan rumus tersebut?" "What is the reason that underlies you to use the formula?"

CNS: "karena panjang sisi-sisinya segitiga 14 cm*" "because the length of the sides of the triangle is* 14 cm*."*

From the interview results, the researcher asked about the **strategy used** to solve problem number 10 by using the perimeter of the triangle. Students use the formula for the perimeter of a triangle because students assume all the sides of the triangle have the same size, 14 cm.

RESULT AND DISCUSSION

The study began with students doing a mathematical reasoning ability test in the form of ten description questions with polygonal material, where each question had different reasoning indicators. Next, they interviewed fourth-grade

students at SDN Kedungmulyo, Pati Regency. The reasoning ability category from the test results of 22 fourth-grade students can be described as follows:

TABLE 1. Category of mathematical reasoning ability.

Category	Percentage	Number of Students
Very high	13,63%	2
High	31,81%	8
Moderate	40,90%	9
Low	13,63%	3
Very low	0%	0
Total		22

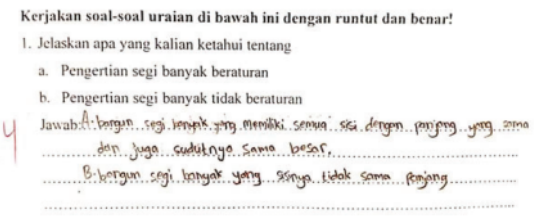
The distribution of students' responses (n=22) is shown in Table 1. Overall, the student gave a positive reaction to Mathematical reasoning ability. Table 1 indicates that students retained highly positive responses (9.09%), while eight students (36.36%) were at the level of high-level agreement, and 40% gave moderate reactions to the statement. Only three students (13.63%) showed negative replies to the same idea. However, when we viewed it collectively, the data indicate that more than three-quarters of the respondents delivered positive responses to the statement on Mathematical reasoning ability. This is in line with the results of previous research, which also found that students' reasoning abilities at the elementary school level were in the moderate category [16][17][18].

TABLE 2. Description of the polygon material questions.

Questions Item	Description of Indicator	Answer	
		Frequency & Percentages Correct	Frequency & Percentages Wrong
1	understanding the meaning of the question	18 (81.8%)	4 (18.2%)
2	logical thinking	16 (79.5%)	6 (20.5%)
3	understanding negative examples	19 (88.2%)	3 (11.8%)
4	deductive thinking	8 (36, 4%)	14 (63, 6%)
5	systematic thinking	10 (47.0%)	12 (53.0%)
6	consistent thinking	16 (68.2%)	7 (31.8%)
7	the indicator drawing conclusions	9 (39.0%)	13 (61.0 %)
8	determines the method	10 (47.0%)	12 (53.0%)
9	making excuses	12 (53.0%)	10 (47.0%)
10	determines the strategy	7 (31.8%)	15 (68.2%)

The reasoning ability test that has been carried out on each question indicator obtains different results (Table 2). 1) The percentage of 81.8% is owned by the indicator understanding the meaning of question number 1, there are 18 correct answers. 2) The logical thinking indicator owns 79.5%, meaning that in question number 2, there are 16 correct answers. 3) 88.2% is owned by the indicator of understanding negative examples, meaning that in question number 3, there are 19 correct answers. 4) The percentage is 36, and the deductive thinking indicator owns 4%, meaning that in question number 4, there are eight correct answers. 5) The percentage of 47.0% is owned by the systematic thinking indicator, meaning that in question number 5, there are ten correct answers. 6) The consistent thinking indicator owns 68.2%, meaning that in question number 6, there are 16 correct answers. 7) The percentage of 39.0% is owned by the indicator drawing conclusions meaning that in question number 7, there are nine correct answers. 8) The percentage of 47.0 % owned by the indicator determines the method meaning that in question number 8, there are ten correct answers. 9) The percentage of 53.0% is owned by the indicator making excuses, meaning that in question number 9, there are 12 correct answers. 10) The indicator owns the percentage of 31.8% determines the strategy. This means that in question number 10, there are seven correct answers. Overall, the average mathematical reasoning ability of fourth-grade students at SDN Kedungmulyo Pati Regency is 57.5%, or it can be interpreted that students' reasoning abilities are classified as moderate.

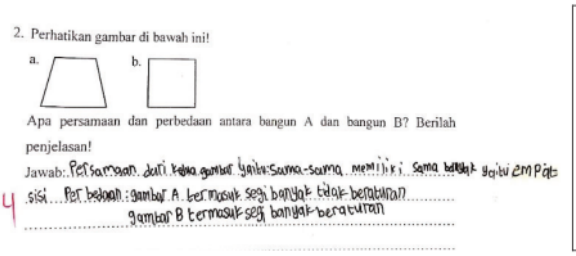
From the interview responses, ninth students gave different feedback on each indicator. The respondent showed intensity in the agreement or disagreement. Most students can write and explain the meaning of regular and irregular polygons orally thoroughly. Some students are less able to present orally and write the meaning of regular and irregular polygons.



Answer this question orderly and correctly! 1. Explain about a. Definition of the regular polygon b. Definition of an irregular polygon Answer: a. A polygon that has the same length on all sides and also the same angles b. A polygon that has different lengths on its sides

FIGURE 1. Student work results on the first indicator.

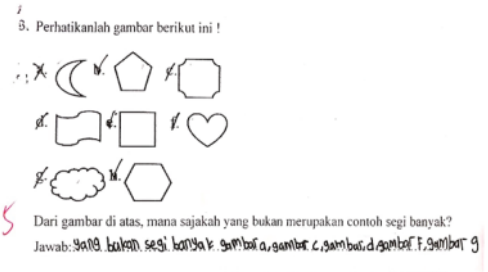
On the indicator of understanding (Fig. 1), the researcher gave questions regarding understanding regular polygons and the meaning of irregular polygons in one question, namely questions 1a and 1b. From the results of research conducted by the authors, the indicator of understanding is included in the very high category. On this indicator, most students have a good knowledge of writing the meaning of regular and irregular polygons in completely using sentences that are easy to understand. Although most of the students answered correctly, there were some errors in responding to this indicator. Students only answered one meaning or were incomplete in explaining, then reversed in writing between the meanings of regular and irregular polygons. In line with the research, which found that the student's ability to understand is very high, but there are still a few students who are wrong in giving answers. These errors arise because students are incomplete in writing understanding [19].



2. Observe these pictures What are the difference and similarities between pictures a and b? Explain! Answer: similarity is that both pictures have four sides. The difference is that picture a is an irregular polygon, and picture b is a regular polygon

FIGURE 2. Student work results on the second indicator.

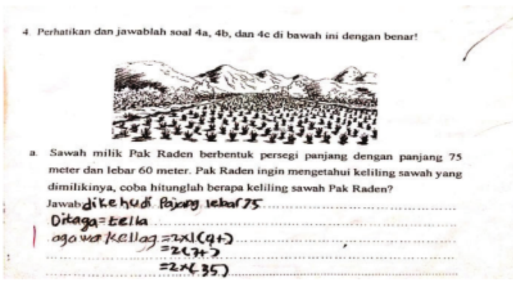
In the logical thinking indicator (Fig. 2), the researcher gave questions by presenting two polygonal images. Then students were asked to look for similarities and differences in shapes in one problem, namely in question number 2. From the author's research results, the indicators of logical thinking were included in the very high category. Most students could explain and show the similarities and differences between the figures in written and spoken form using their language. To display the difference in the pictures, students look at the side lengths of the pictures to determine whether they are a regular or irregular polygon type. Then for student equations, look at the number of sides. If interpreted in logical thinking, students form understanding and opinions and then draw conclusions. In line with Akuba *et al*. [20], her research obtained very high results on logical thinking indicators. In her study, she stated that aspects of logical thinking were good because students could describe answers and write down known and asked aspects, problem formulation, and operating results and conclusions.



3. Observe these pictures From the pictures above, which ones are not a polygon? Answer: not polygon: a c d f g

FIGURE 3. Student work results on the third indicator.

In the indicator of understanding negative examples (Fig. 3), the researcher gives questions by presenting some polygonal and non-polygonal figures to look for shapes that are not polygonal. The indicator problem for understanding negative examples is in number 3. From the results of the research conducted by the researchers, the indicator for understanding negative examples is in the very high category. Most students can apply their understanding of the definition of the concept of polygons and not polygons to problem number 3. So that the problem only requires knowledge and accuracy in determining images. In line with Ariati and Juandi [21], his study found excellent criteria for understanding negative examples. In his research, he argues that the indicator of understanding negative examples is used to test students' ability to know which are examples of a concept and which are not.

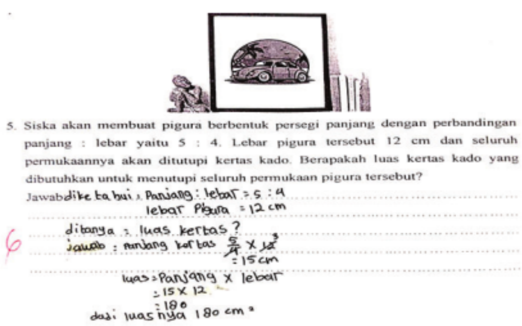


4. Observe the picture and correctly answer the questions
   a. Mr. Raden's ricefield is rectangular, with a length 75 m and a width 60 m. Mr. Raden wants to know the circumference of his property. Can you help him?

Answer:
Known: length: … Width: 75
Asked: circumference
Answer: circumference $= 2 \times 1(4+)$
$= 2(3+)$
$= 2 \times (35)$

FIGURE 4. Student work results on fourth indicator.

The researcher gives story questions related to everyday life on the indicator of deductive thinking (Fig. 4), The problem of deductive thinking indicators is at number 4. From the results of the research conducted, the indicators of deductive thinking are included in the low category. Most students make mistakes in writing what is known and what is being asked. Some do not have what is known and what is being asked first in answering. If it is understood more profoundly, deductive thinking is a process of thinking from general to specific. Then, using what is known and what is being asked will be more straightforward and not wrong in deducing statements. Then some students do not memorize the formula, so in working on it, students have difficulty determining how. This study's results align with the results of a study conducted by Nashihah *et al*. [22], who obtained a shallow category on deductive thinking indicators. Where students have not been able to think about specific problems, but in his research, some students answered correctly and got the maximum score.



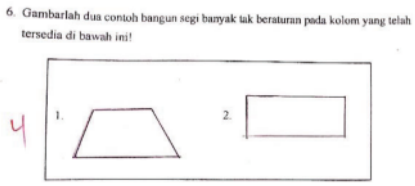
5. Siska will make a rectangular frame with a ratio of 5:4. The width is 12cm, and all surfaces will be covered with gift wrappers. How much is the area of the gift wrapper needed to cover all frame's surface?

Answer:
Known:
Length : width = 5 : 4
Width = 12cm
Asked : area

Answer : length $= \frac{5}{4} \times 12 = 15$ cm
Area = length × width
= 15 × 12
= 180
so the area is 180 cm^2

FIGURE 5. Student work results on the fifth indicator.

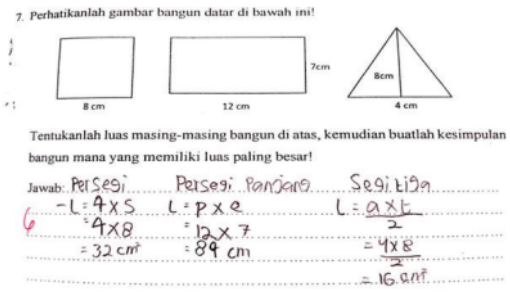
On the systematic thinking indicator (Fig. 5), the author provides word problems related to everyday life to calculate the area of a rectangle. The problem of indicators of systematic thinking is at number 5. From the author's research results, indicators of systematic thinking are included in the medium category. In this indicator, half of the students are correct in doing the work, the results of the work are done coherently and entirely on the question sheet, both are known, asked, and the way of solving it is not written down randomly. Thus, the final result obtained is also correct. On that, some students answer in an unsystematic manner. For example, when they should find the length first and then find the area, these students answer in reverse; that is, they find the area first and then the length. That means students do not fully understand the intent of the questions, so students are careless in answering. This is in line with the results of Meirisa *et al*. [23] that the systematic thinking indicator in his research is in the medium category. In his study, this indicator has the least number of correct answers. Some students answered not including what was known and were asked or immediately wrote down their calculations but did not proceed to get the final result. According to Meirisa, this was because students did not read and understand exactly what was meant by the questions. So that students are mistaken in determining the final results and conclusions.



6. Draw two examples of an irregular polygon in this box!

FIGURE 6. Student work results on the sixth indicator.

To measure students' consistency in thinking (Fig. 6), the researcher gave questions on the consistent thinking indicator that asked students to describe two irregular polygons. The problem of indicators of systematic thinking is at number 6. From the results of the research conducted by researchers, indicators of consistent thinking are included in the high category. Most students describe irregular polygons correctly according to the theoretical concepts or definitions taught. In line with [19], indicators of consistent thinking were included in the high category, where most students answered steadily or fixed three different questions according to the question instructions given. Gofur [19] also says that consistency is a way of thinking focused on one field and does not move to another area as long as the first field is completed.



7. Observe these two-dimensional figures

Determine the area of each figure, then conclude which figure has the largest area

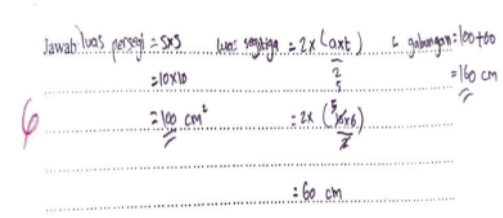
Answer:

Square	Rectangular	Triangle
$L = 4 \times s$	$L = p \times l$	$L = \frac{a \times t}{2}$
$= 4 \times 8$	$= 12 \times 7$	$= \frac{4 \times 8}{2}$
$= 32\ cm^2$	$= 84 cm^2$	$= 16 cm^2$

FIGURE 7. Student work results on the seventh indicator.

To determine students' ability to draw conclusions (Fig. 7), on the indicator of drawing conclusions, the researcher gave questions with the command to find the area of the largest shape among the three figures presented in the problem. The problem of indicators of systematic thinking is at number 7. Based on the author's research, indicators of consistent thinking are included in the medium category. In this indicator, some students answered by looking for each area from the existing shapes and then sorted from the smallest to the largest. Then the final results found by students can be precise. However, some students only looked for the area of each shape without giving a conclusion, and some were wrong in using the area formula. Just as with the research which obtained intermediate category results on indicators, it drew conclusions [19]. Student mistakes in answering this indicator, namely students who were less

specific in answering, ignored what was known and asked, and made mistakes in calculating the formula, including no conclusions from the answers students wrote. As Hariyani [24] said, conclusions were drawn after confirming that the previous questions were correct or in the form of facts so that the conclusions drawn were ultimately proven right.

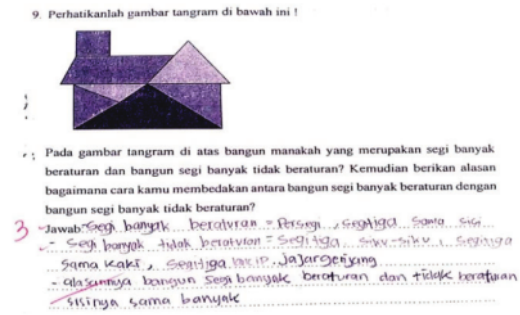


Answer

Rectangular	Triangle	Combination
$= s \times s$ $= 10 \times 10$ $= 100\ cm^2$	$= 2 \times \frac{(a \times t)}{2}$ $= 2 \times \frac{(10 \times 6)}{2}$ $= 60\ cm$	$= 100 + 60$ $= 160cm$

FIGURE 8. Student work results on the eighth indicator.

In the indicator determining the method (Fig. 8), the researcher asked students to find the area of a compound figure consisting of one square shape and two triangles. The question of indicators determining methods is in number 8. From the research results that researchers have conducted, indicators determining methods fall into the medium category. Some students answered with the correct formula and method, first finding each shape's area and then adding up the resulting area of a square with the area of two triangles. Some other students already understand the concept, but students are not careful when working on it, such as only finding the area of one triangle even though there are two triangles in the picture. In addition, students answer randomly by adding up the already known numbers, so the final results are also wrong. Determining the method is a way of solving a problem that is done regularly or systematically. Riyanto and Siroj [25] said that deciding the strategy to solve a problem must follow the type of problem that exists. Each type of problem has a different solution method.



9. Observe this tangram

In the above tangram, which is a regular polygon and an irregular polygon? Give a reason for how you differentiate the regular and irregular polygon!

Answer:

Regular polygon: square, equilateral triangle

Irregular polygon: right triangle, isosceles triangle, acute triangle, parallelogram

Reason: regular and irregular polygons have sides of the same number

FIGURE 9. Student work results on the ninth indicator.

In the indicator for making reasons (Fig. 9), the author gives questions where students are asked to provide reasons for the shapes that have been selected and then group them according to the type of polygon. The problem of indicators of making excuses is in number 9. From the author's research results, indicators of making excuses fall into the medium category. In this indicator, some students group shapes according to the type of polygon and give the right reasons. In the process of grouping shapes into types of polygons, that must be considered. Students must be mature in existing theoretical concepts or definitions so that when giving reasons, those reasons are acceptable to logic. Following Abidin's opinion, which states that in making reasons, one goes through a reasoning process because reasons are proof of the truth of a statement, so before conveying reasons, one must understand and grasp the concepts being discussed that the reasons given make sense [26].

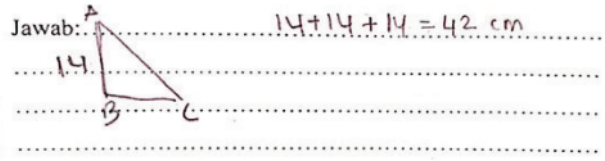


FIGURE 10. Student work results on tenth indicator.

On the indicator determining the strategy (Fig. 10), the author gives a statement about finding the length of the base of a triangle. The question of indicators determining strategy is number 10. From the author's research results, indicators determining strategy fall into the low category. Only a few students answered using the correct strategy and method on this indicator. The first strategy carried out by students is to translate the statement or what is in the problem into an image. After that, students use the formula for the area of a triangle to find the base size. As stated by Polya there are several strategies for solving problems, one of which is making pictures [27]. The results of research [12] obtained almost the same results on this indicator, the indicators determining the strategy and the study results were in the shallow category. Many students cannot answer with the correct strategy, so the final results obtained are also wrong, and many students leave the answer sheets blank.

CONCLUSION

The research results found that the highest result was in the moderate/medium category, with a percentage of 40.90% (9 students). It was also found that no students belonged to the shallow category (0%). This means that the reasoning ability of fourth-grade elementary school students for polygon material is in the moderate/medium category. Determination of this intermediate category is obtained from the measurement results of ten indicators, which, if translated or sorted from the most significant indicators to the minor influential indicators, are as follows: understanding negative examples, understanding the meaning of the question' logical thinking, consistent thinking, making excuses, systematic thinking, determines the method, the indicator drawing conclusions, deductive thinking, and determines the strategy. And as a recommendation for teachers in the learning process, they should be able to focus on indicators to assess the method because this study found that students' weaknesses were in these indicators. At the same time, the recommendation for further researchers is that it is hoped that they can find solutions to overcome students' weaknesses in reasoning abilities, especially in the indicator that determines the strategy.

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