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ANALYSIS OF STUDENTS MATHEMATICAL REASONING ABILITY IN SOLVING STORY PROBLEMS ON THE TOPIC OF CUBOID AND CUBE REVIEWED FROM LEARNING STYLES

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Abstract

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Mathematical reasoning ability is an important skill that students must have in the process of learning mathematics. This skill allows students to develop logical, analytical, systematic, critical, and creative thinking patterns. Based on this, the researcher examined the mathematical reasoning ability of grade VII students at SMP Negeri 2 Pakisaji in solving story problems about blocks and cubes. This study is entitled "Analysis of Students' Mathematical Reasoning Ability in Solving Cuboid and Cube Story Problems Reviewed from Learning Styles" and uses a descriptive qualitative approach. This study involved 30 students, of which 6 students would be selected for analysis, with 2 students from each category of high and low learning styles. Data collection methods include learning style tests, written tests, interview guidelines, and documentation. The results of the study showed that students with visual learning styles and high mathematical reasoning abilities can present, ask questions, make guesses, perform mathematical manipulations, draw conclusions, and check the correctness of answers. In contrast, students with low mathematical reasoning abilities have not been able to do these things. The same thing is also seen in students with auditory and kinesthetic learning styles who have high mathematical reasoning abilities, where they can do similar activities, while students with low mathematical reasoning abilities still face difficulties.

Keywords: Mathematical Reasoning Ability, Story Problems, Learning Styles.

INTRODUCTION

Mathematics is a subject that needs to be learned from elementary to secondary levels. The goal of learning mathematics is to help students develop their ability to understand problems, create mathematical models, solve them, and interpret the results obtained (Farida et al., 2021). Mathematics teaching in schools aims to improve students' thinking skills in solving mathematical problems. This aligns with the goals of mathematics education as outlined in Permendikbud No. 58 of 2014, which include communicating ideas and thoughts and constructing mathematical proofs using complete sentences, symbols, tables, diagrams, or other media to clarify issues (Alfionita & Hidayati, 2019).

Mathematical reasoning ability is one of the important skills that students must have in learning mathematics. With this ability, students can develop logical, analytical, systematic, critical, and creative thinking patterns (Linola et al., 2017). Students' mathematical reasoning ability needs to be developed so that they do not just follow procedures and imitate examples without really understanding the material being taught. This is also in line with the opinion (Sumartini & Utami, 2023) that reasoning skills are important to develop because through reasoning students can think and explore mathematical ideas.

Considering the importance of mathematical reasoning, according to (Ario, 2016) A thorough examination of students' mathematical reasoning skills is necessary. This involves evaluating their mastery of mathematical reasoning after instruction and identifying the different mistakes they make when responding to mathematical reasoning questions. The results of this analysis will be used to design learning strategies or methods that can overcome these errors. Thus, it is hoped that students' mathematical reasoning abilities can improve in the future and as conveyed by (Rohmah et al., 2020) students can understand the concept by developing solutions to a problem with the answers and abilities they have. On. Before conducting the analysis, the learning provided must be the type that encourages students to be more actively involved. Learning should position students as the primary participants in the educational process, rather than merely passive recipients of information from the teacher. Failing to do so can significantly contribute to students' weak reasoning abilities.

Students' weak mathematical reasoning abilities are undoubtedly affected by various factors, one of which is their individual learning style. According to (Kurniawati, 2021), Each student has a unique learning style, and these differences in learning styles affect how students understand problem solving. Therefore, students' learning styles will produce various characteristics in solving problems. At the Junior High School level, students will face abstract problems and require mathematical reasoning to solve them, especially in the material on cuboid and cubes.

Initial observations at SMP Negeri 2 Pakisaji revealed that students' mathematical reasoning skills in solving story problems involving blocks and cubes did not meet the anticipated indicators. The student's learning style factor was one of the causes. According to (Saputri et al., 2017), There are indicators used to assess students' mathematical reasoning abilities, these indicators include presenting information, asking questions, making guesses, carrying out mathematical manipulations, drawing conclusions, checking the correctness of answers and finding patterns or properties to make generalizations.

As for previous research, for example the first was conducted by (Salaswati & Adirakasiwi, 2022), The study found that students' mathematical reasoning abilities are categorized into three levels: high, medium, and low. Students with high mathematical reasoning skills almost meet all the established indicators. Students with medium mathematical reasoning ability only meet some of the indicators, while students with low ability generally do not meet the existing indicators. The second study was conducted by (Kusumaningtyas et al., 2021), The study's results indicated that students with high mathematical ability tend to also exhibit high mathematical reasoning skills. In contrast, students with moderate mathematical ability generally show moderate mathematical reasoning, and those with low mathematical ability tend to have low mathematical reasoning skills. Students with high mathematical reasoning are capable of offering multiple solutions when solving problems.

The main difference between this study and previous studies lies in the focus and indicators used. This study focuses on students' mathematical reasoning abilities in solving story problems about blocks and cubes, taking into account students' learning styles. Meanwhile, previous studies did not take into account students' learning styles. In addition, the completion indicators in previous studies only included drawing conclusions, while this study also includes additional indicators such as checking predetermined answer estimates and finding patterns or characteristics of mathematical phenomena to make generalizations. This

study will be conducted at SMP Negeri 2 Pakisaji with grade VII students in semester 2, using material about cuboid and cubes. In contrast, previous studies covered different materials, namely relations and functions in the first study, and quadrilaterals in the second study.

Based on observations at SMP Negeri 2 Pakisaji and interviews with grade VII mathematics teachers, it is evident that students' learning styles influence their mathematical reasoning abilities in solving story problems related to blocks and cubes. Therefore, the researcher intends to conduct a study to better understand the mathematical reasoning abilities of grade VII students at SMP Negeri 2 Pakisaji. This study is entitled "Analysis of Students' Mathematical Reasoning Abilities in Solving Cuboid and Cube Story Problems Reviewed from Learning Styles."

RESEARCH METHODS

The approach used in this study is a qualitative approach. A qualitative approach provides detailed explanations and discussions of problems that are not yet fully known and understood. This approach makes it easier to understand all aspects discussed in the study (Shidiq & Choiri, 2019). This research will be conducted at SMP Negeri 2 Pakisaji, located on Jl. Darungan, Gelanggang Village, Pakisaji District, Malang Regency. The subjects of the research are grade VII students of the 2023/2024 academic year, and this research will be conducted in the even semester. SMP Negeri 2 Pakisaji was selected as the research site because observations and interviews with grade VII mathematics teachers revealed that students' learning styles impact their mathematical reasoning abilities, particularly in solving story problems involving blocks and cubes. The study aims to explore the mathematical reasoning abilities of grade VII students at this school.

This research is qualitative, so the research subjects are selected selectively according to the research objectives, namely to determine the mathematical reasoning ability of grade VII students at SMP Negeri 2 Pakisaji in solving story problems about blocks and cubes, viewed from learning styles. A total of 30 students will be involved in this study.

In the process of collecting information and analyzing students' mathematical reasoning abilities, several students will be selected as representatives of each learning style and to represent various answers to the questions given. The selected students will be interview sources to further explore their abilities in solving story problems about blocks and cubes.

RESULTS AND DISCUSSION

In this study, the indicators used to assess students' mathematical reasoning abilities include presenting information, asking questions, making guesses, carrying out mathematical manipulations, drawing conclusions, checking the correctness of answers, and finding patterns or properties to make generalizations (Adamura & Susanti, 2018).

The analysis of the written test on mathematical reasoning abilities for class VIIC students at SMPN 02 Pakisaji reveals that the average score is below 55, indicating a low level of mathematical reasoning ability. Specifically, the average scores are 38.8 for visual learners, 40.9 for auditory learners, and 47.75 for kinesthetic learners. These findings are consistent with Ardi Gustiadi's research, which also shows that the average score for students' mathematical reasoning ability is below 55, specifically 42.08, reflecting a low level of mathematical reasoning skills (Gustiadi et al., 2021). This shows the need for a learning process that is specifically designed to train students' mathematical reasoning abilities, with the aim of improving learning outcomes, especially in the material on blocks and cubes.

The learning process can assist students in addressing problems related to reasoning, particularly in enhancing their mathematical reasoning abilities. Based on the results of written tests and interviews concerning students' mathematical reasoning skills, as analyzed through the lens of learning styles, it is evident that different learning styles impact students' performance in this area, the problems faced are as follows:

1. Visual learning style students with high mathematical reasoning ability show that the students can carry out the Mathematical reasoning process including presenting known and asked information, making assumptions, carrying out mathematical manipulations, drawing conclusions, and checking the truth and accuracy of the answers. as seen in the following picture.

$$\text{Jawab: } (51 + 52 + 5) \times 2 = (104 + 5) \times 2$$

$$= 17 \times 2$$

$$= 34$$

Jadi, kubus kecil yang terkena satu sisinya adalah 34 sisi kubus kecil

Figure 1. Student Work Results JJ Question Number 1

$$\text{Jawab: } V_k = s \times s \times s$$

$$= 30 \times 30 \times 30$$

$$= 27000 \text{ cm}^3$$

$$V_{La} = \frac{1}{3} \times (\frac{1}{2} \times a \times a) \times t$$

$$= \frac{1}{3} \times (\frac{1}{2} \times 50 \times 30) \times 30$$

$$= \frac{1}{3} \times (\frac{1}{2} \times 1500) \times 30$$

$$= \frac{1}{3} \times 22500$$

$$= \frac{1}{3} \times 4500 \times 30$$

$$= \frac{1}{3} \times 13500$$

$$= 4500$$

$$V_k - V_{La} = 27000$$

$$\frac{4500}{2250}$$

Jadi volume bangun tersebut adalah 22500

Figure 2. Student Work Results JJ Question Number 2

The shortcomings of the students are that the students do not write the trait pattern to make generalizations on the answer sheet, but the students can provide answers during the interview process. Visual learning style students with low mathematical reasoning skills show that the students have not been able to carry out the mathematical reasoning process well. This can be seen in the students' answers in writing what is known and asked, there are errors that cause the next resolution process which includes submitting conjectures, carrying out mathematical manipulations, drawing conclusions, and checking the truth, accuracy of answers and writing trait patterns to make generalizations wrong.

Diketahui pada gambar 1 terdapat
 Panjang balok = 10 cm
 Menentukan volume kubus / balok

$$S^3 = s \times s \times s$$

$$S^3 = 10^3$$

$$= 1000 \text{ cm}^3$$
 Jadi, volume nya adalah 1000 cm³

Figure 3. Student Work Results AD Question Number 1

Diketahui panjang rusuk = 30 cm
 Menentukan volume bangun panjang rusuk limas segi tiga

$$\text{Volume} = s^3 / 3 \times s \times s \times s$$

$$s^3 = 30^3$$

$$= 30 \times 30 \times 30$$

$$= 27.000 \text{ cm}^3$$
 Jadi volume nya adalah 27.000 cm³

Figure 4. Student Work Results AD Question Number 2

This is in line with research conducted by (Irianti, 2020) that students with visual learning styles and high reasoning abilities are able to understand problems, plan problem solving, solve problems accurately, and recheck the answers obtained. In contrast, students with low reasoning abilities often have difficulty in understanding problems and planning solutions. The results of problem solving from students with low reasoning abilities are often inaccurate, and they usually do not recheck the answers that have been given. Therefore, it is important to strengthen conceptual understanding in the problem solving process, because it is in accordance with what was conveyed by (Annisa, 2022) that students' ability to understand mathematical concepts is influenced by mathematical reasoning factors, while the rest is influenced by other factors such as learning styles.

- Students with an auditory learning style with high mathematical reasoning abilities show that these students can carry out mathematical reasoning processes including presenting what is known and asked, making assumptions, carrying out mathematical manipulations, drawing conclusions, and checking the truth and accuracy of answers as seen in the following image.

Dit = Berapa banyak kubus kecil yang terkena cat hanya satu sisi
 Jawab = Memjumlahkan setiap kubus yang terkena cat hanya satu sisi
 Dik = Terdapat 17 kubus kecil yang terkena cat pada sisinya saja
 yang ada pada sisi balok yang terlihat
 seluruhnya = $17 \times 2 = 34$

Figure 5. NR Student Work Results for Question Number 1

Jawab = $K = s^3$
 $= 30 \times 30 \times 30$
 $= 27.000 \text{ cm}^3$
 $LA = 6 \times s \times s \times t$
 $= 6 \times 30 \times 30 \times 30$
 $= 6 \times 27.000$
 $= 162.000$
 $= 162.000 \text{ cm}^2$
 $Volume = 27.000 - 162.000$
 $= -135.000$
 Jadi Volume bangun tersebut adalah 135.000 cm³

Figure 6. NR Student Work Results for Question Number 2

The shortcomings of the students are that the students do not write the trait pattern to make generalizations on the answer sheet, but the students can provide answers during the interview process. Students with an auditory learning style with low mathematical reasoning skills show that the students have not been able to carry out the mathematical reasoning process well. This can be seen in the students' answers in writing what is known and asked, there are errors that cause the next resolution process which includes submitting

conjectures, mathematical manipulation, drawing conclusions, and checking the truth and accuracy of the answers and writing the trait pattern to make generalizations wrong.

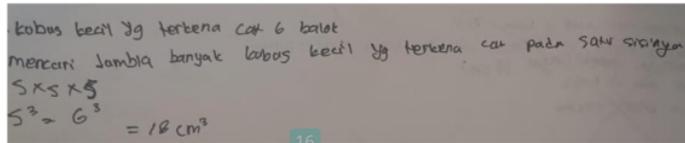


Figure 7. MN Student Work Results Question Number 1

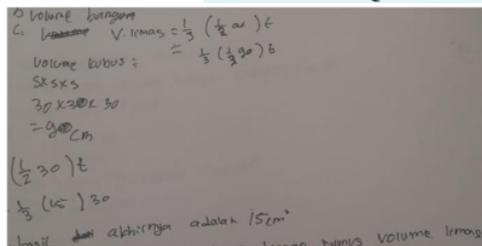


Figure 8. MN Student Work Results for Question Number 2

This is in line with research conducted by (Sayuri et al., 2020) Students with an auditory learning style have the ability to present mathematical statements in writing, using pictures or diagrams, and draw conclusions. However, these students are not yet fully able to compile evidence or provide appropriate reasons, draw conclusions from statements, and determine the correct pattern regarding the truth of the solution provided. Thus, in accordance with what has been conveyed by (Rahmatina et al., 2023) It is important to conduct interviews to obtain in-depth information about students' mathematical reasoning abilities, especially to explore information about students' conceptual understanding and the problem-solving processes they use.

- Students with a kinesthetic learning style with high mathematical reasoning abilities show that these students can carry out mathematical reasoning processes including presenting what is known and asked, making assumptions, carrying out mathematical manipulations, and drawing conclusions as seen in the following image.

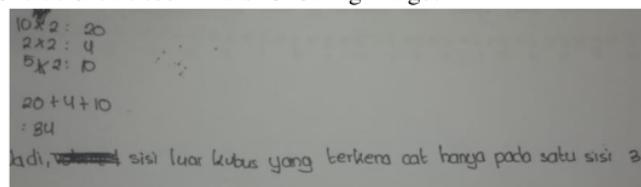


Figure 9. Student Work Results for RAP Question Number 1

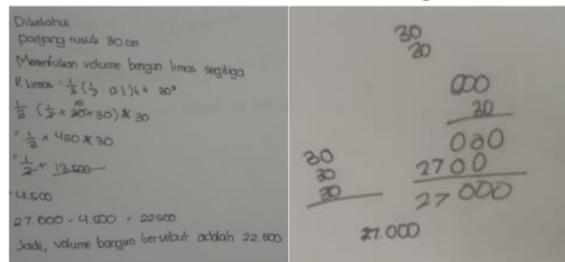


Figure 10. Student Work Results for RAP Question Number 2

The shortcomings of the students are that the students do not check the truth and accuracy of the answers and write down the nature patterns to make generalizations on the answer sheet, but the students can provide answers during the interview process. Students with a kinesthetic learning style with low mathematical reasoning skills show that the students have not been able to carry out the mathematical reasoning process well. This can be seen in the students' answers in writing down what is known and asked, there are errors that cause the next resolution process which includes submitting conjectures, mathematical manipulation, drawing conclusions, and checking the truth and accuracy of the answers and writing down nature patterns to make generalizations wrong.

Figure 11. Results of IR Student Work on Question Number 1

Figure 12. Results of IR Student Work on Question Number 2

This is in line with research conducted by (Safitri et al., 2023) The mathematical reasoning ability of students with kinesthetic learning styles only includes four indicators, namely submitting conjectures, presenting ideas, carrying out mathematical manipulations, and determining solution strategies. However, students with kinesthetic learning styles have not been able to fulfill the indicators of drawing conclusions and checking the truth or validity of a statement. Therefore, as conveyed by (Araiku et al., 2019) There is a need to provide a conceptual understanding of solving mathematical reasoning problems continuously and with structured problem solving starting from determining what is known and asked, submitting conjectures, mathematical manipulation, drawing conclusions, rechecking and generalization so that students' mathematical reasoning abilities can improve.

CONCLUSION

The research results and discussion show that students with:

1. Visual learning style

- a. Visual learning style students with high mathematical reasoning ability can solve problems well according to the mathematical reasoning indicators. These students can carry out the mathematical reasoning process including presenting what is known and asked, submitting conjectures, carrying out mathematical manipulations, drawing conclusions, and checking the truth and accuracy of the answers. The shortcomings of these students are that students do not write down the trait patterns to make generalizations on the answer sheet, but students can provide answers during the interview process.
- b. Visual learning style students with low mathematical reasoning ability show that the students have not been able to carry out the mathematical reasoning process well. This can be seen in the students' answers in writing what is known and asked, there are errors that cause the next resolution process which includes submitting conjectures, mathematical manipulation, drawing conclusions, and checking the truth and accuracy

of answers and writing down patterns of traits to make generalizations wrong. The shortcomings of these students are that students do not write patterns of traits to make generalizations on the answer sheet, but students can provide answers during the interview process.

2. Auditory learning style

- a. Students with auditory learning styles with high mathematical reasoning abilities show that these students can carry out mathematical reasoning processes including presenting what is known and asked, submitting conjectures, carrying out mathematical manipulations, drawing conclusions, and checking the truth and accuracy of answers. The shortcomings of these students are that students do not write down the pattern of traits to make generalizations on the answer sheet, but students can provide answers during the interview process.
- b. Students with an auditory learning style with low mathematical reasoning ability ¹show that the students have not been able to carry out the mathematical reasoning process well. This can be seen in the students' answers in writing what is known and asked, there are errors that cause the next resolution process which includes submitting guesses, mathematical manipulation, drawing conclusions, and checking the truth and accuracy of answers and writing down patterns of properties to make generalizations wrong.

¹²3. Kinesthetic learning style

- a. Students with a kinesthetic learning style with high mathematical reasoning abilities show that these students can carry out mathematical reasoning processes including presenting what is known and asked, making assumptions, carrying out mathematical manipulations, and drawing conclusions. The shortcomings of these students are that students do not check the truth and accuracy of the answers and write down patterns of traits to make generalizations on the answer sheet, but students can provide answers during the interview process.
- b. Students with a kinesthetic learning style with low mathematical reasoning ability show that the students have not been able to carry out the mathematical reasoning process well. This can be seen in the students' answers in writing what is known and asked, there are errors that cause the next resolution process which includes submitting conjectures, mathematical manipulation, drawing conclusions, and checking the truth and accuracy of answers and writing down patterns of properties to make generalizations wrong.

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