

MATHEMATIC REASONING ABILITY OF JUNIOR HIGH SCHOOL STUDENTS IN SOLVING STORY QUESTIONS

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Abstract

This study aims to see the mathematical reasoning abilities of junior high school students in solving problems. The method used in this research is quantitative descriptive method. This research was conducted at SMP Negeri 1 Lemembu Jaya. The research sample was class IX.1. Subjects taken in this study were 21 students. The data research technique in research is a test. The data analysis technique used in this study was descriptive statistical analysis. The results of this study were categorized low in the mathematical reasoning ability of junior high school students in solving story questions

Keywords: mathematical reasoning skills, story problems.

INTRODUCTION

Mathematics is a science with abstract objects that is developed through deductive reasoning and is able to develop models that apply examples to solve problems in everyday life (Fajriani & Masni, 2017). According to Basuki (2015) mathematics can change a person's mindset into a mathematical, systematic, logical, critical and careful mindset. Therefore mathematics is one of the main subjects that must be followed and studied by students in the context of every level of education (Fitri & Yani, 2017).

Based on the learning objectives of mathematics in the Minister of Education and Culture (2014) one of the abilities that must be possessed by students is the ability to reason mathematically. Mathematical reasoning ability is defined as the ability to connect problems into an idea or main idea so that it can solve a mathematical problem (Salmina & Nisa, 2018). According to Yenni & Aji (2016) reasoning abilities make students able to solve problems in everyday life and as a process or activity of thinking in drawing conclusions based on statements that have been proven true. There are several indicators of mathematical reasoning ability, including:

According to Yenni & Aji (2016) indicators of mathematical reasoning ability are:., Make a conjecture, Give reasons or evidence of some solutions, Draw conclusions from a statement., Checks the validity of an argument, Finding patterns or properties of a phenomenon to make mathematical generalists, Perform mathematical manipulation. According to Sumarno (Lestari & Yudhanegara, 2017: 82) there are several indicators explained by him, namely:

- 1) Draw logical conclusions.
- 2) Provide explanations with models, facts and properties and relationships.
- 3) Estimating the existence of an answer and a solution process.
- 4) Using patterns and relationships to analyze a mathematical situation.

- 5) Studying and compiling a conjecture.
- 6) Create a counter example (counter example).
- 7) Follows a reference and checks arguments with validation.
- 8) Arguments must be made valid.
- 9) Using direct and indirect evidence .

From some of the indicators above, the researchers took indicators according to Yenni and Aji (2016), because these indicators are suitable to be used in solving problems in the story of the two-variable linear equation system (SPLDV) material. To train and familiarize students in using their reasoning abilities, students are given problems in the form of story questions related to everyday life (Yuniawati, 2017). Math story problems are a form of math problems that involve aspects of the ability to read, reason, and analyze, therefore the aspects that exist in math story problems play an important role in students' daily lives in solving a problem (Wahyuddin & Muhammad, 2016). Math story problems are more about providing problems related to everyday life, so that they can train students in using their mathematical reasoning abilities when solving problems in the form of stories.

Solving math problems is an activity in learning mathematics, one of which is math story problems, where math story problems relate to life and are part of applied math material (Gunawan, 2016). So math story problems are a form of math problems that train students to measure an ability they have and as an aspect of the ability to think logically in solving math problems in everyday life. The following are the steps in solving story problems according to experts as follows: According to Wahyuddin and Ihsan (2016) there are abilities that students must have in solving story problems as follows:

1. Students are able to write down the known aspects of the problem and then these aspects are expressed in mathematical form.
2. Able to make mathematical models.
3. Able to complete known mathematical models.
4. Able to answer questions from existing problems.

Here are the steps for solving story problems on SPLD material according to (Wijaya & Masriyah, 2012) as follows:

1. Understand the problem by determining what is known and what is stated.
2. Creating mathematical models.
3. Solve a known mathematical model.
4. Determine the final answer.

From the several steps in solving the story problems above, the researcher took the steps according to Wijaya and Masriyah (2012), because these steps were suitable in solving the story problems in this study. Based on this description, the formulation of the problem in this study is "How is the mathematical reasoning ability of junior high school students in solving story problems".

RESEARCH METHODS

This research uses *quantitative descriptive research method* . In describing quantitative data, the purpose of this study is to determine the mathematical reasoning ability of junior high school students in solving story problems with the results of the tests taken. The subjects in this study were students of SMP Negeri 1 Lemembu Jaya class IX.I totaling 21 students. Before conducting research, first the test instrument was validated to 2 validators who were experts in the field of mathematics. The test instrument that was validated by the two validators aims to determine whether the items on the instrument have met the standard indicators of mathematical reasoning ability so that they can be used in research.

This study uses 3 description questions, which have previously been validated with two validators, the questions will be used as test questions. The data collection technique in this research is test data. The instrument used to collect the data is a test of students' mathematical reasoning abilities using 3 questions. The timing of this research is seen from the schedule of mathematics lessons and the state of school time. After the student's mathematical reasoning ability test has been carried out, we continue to score each answer that has been obtained. Following are the scoring guidelines based on indicators:

Table 1. Indicator of Mathematical Reasoning Ability Test Score

Indicator	Student response	Score
1. Submit conjecture	a Not making allegations	0
	Wrong in making allegations	1
	Answered almost all correct	2
	Propose the allegation correctly and clearly	3
2. Provide reasons or evidence for some solutions.	No answer / none correct	0
	Only partially correct answers	1
	Answered almost all correct	2
	Answering by following logical arguments, and drawing logical conclusions and being answered completely, clearly and correctly.	3
3. Draw conclusions from statement.	There is no answer / none is correct / does not match the statement	0
	a Only partially correct answers	1
	Answered almost everything right	2
	Answer by following logical arguments, and draw logical conclusions and answer completely, clearly and correctly.	3
4. Checks the validity of an argument.	No answer / none is true / not in accordance with the statement.	0
	Only partially correct answers	1
	Answer almost right	2
	Answer by following logical arguments, and draw logical conclusions and answer completely, clearly and correctly	3
5. Finding patterns or properties of a phenomenon to make mathematical generalists.	No answer / none is true / not in accordance with the statement.	0
	Only partially correct answers	1
	Answer almost right	2
	Answer by following logical arguments, and draw logical conclusions and answer completely, clearly and correctly	3
6. Perform manipulation.	No answer / none is true / not in accordance with the statement.	0
	Only partially correct answers	1
	Answer almost right	2
	Answer by following logical arguments, and draw logical conclusions and answer completely, clearly and correctly	3

Source (Yenni & Aji, 2016)

If the scoring has been done, the next step is to give a score to determine the students' mathematical reasoning ability by using the following formula:

$$P = \frac{\sum \text{Skor yang diperoleh setiap pernyataan}}{\text{skor maksimal}} \times 100$$

(Alifin, Kodirun, & Ikman, 2018)

P = Final Value.

The range of values obtained by students is 0 – 100, these values are described statistically by using the mean (*mean*), median, mode, maximum value, minimum value, range (*range*), standard deviation (*standard deviation*), and data variance. To see the criteria for mathematical reasoning abilities that exist in students, then the test scores that have been done by students will be categorized. The category criteria for classifying test scores from mathematical reasoning abilities can be seen in the following table:

Table 2. Criteria for the Category of Mathematical Reasoning Ability

Category	Mathematical Reasoning Ability Achievement
Tall	>70%
Currently	55%= 70%
Low	≤55%

Source Maya (in Suprihatin, Maya, & Senjayawati, 2018)

RESULTS AND DISCUSSION

The results of students' mathematical reasoning abilities can be described statistically in the following table.

Table 3. Statistics of students' mathematical reasoning abilities

Statistic	N	Amount	mean	median	mode	Standard Deviation	Maximum	Minimum
Score	21	514.60	24.50	15.60	7.80	20.96	70.5	0

From table 3 , it can be seen that the students' mathematical reasoning ability in solving problems of a two-variable linear equation system got an average of 24.50 in the low category. Students' mathematical reasoning abilities can be presented according to the high, medium, low categories which can be seen in the following table.

Table 4 Percentage of Students' Mathematical Reasoning Ability

Achievement percentage	>70%	55% -70%	≤55%	
Category of mathematical reasoning ability	Tall	Currently	Low	Amount
Number of students (person)	1	2	18	21
Percentage	4.76%	9.52%	85.72%	100%

After obtaining the results of the mathematical reasoning ability test and the results of the mathematical reasoning ability test on the material of a two-variable linear equation system based on the ability indicators obtained in table 5.

Table 5. Overall Results of Students' Mathematical Reasoning Ability Indicators

Indicator of mathematical reasoning ability	Percentage of student answers(%)	Category
Submit a conjecture	52.38	Low
Determine the pattern of properties of a phenomenon to make mathematical generalists	33.33	Low
Perform manipulation	20.63	Low
Draw a conclusion	5.29	Low
Give reasons or evidence of some solutions	14.81	Low
Checking the validity of an argument	13.22	Low

The table above shows the overall percentage of students' mathematical reasoning ability indicators in the low category. After getting the percentage results from all of the following indicators, the results of the percentage of students' mathematical reasoning abilities on each indicator based on categories can be seen in table 6.

Table 6. Results of Students' Mathematical Reasoning Ability on Each Indicator

Category	Indicator					
	1	2	3	4	5	6
Tall	66.66 %	66.66 %	66.66 %	66.66 %	66.66 %	66.66 %
Currentl y	88.88 %	66.66 %	83.33 %	22.22 %	22.22 %	11.11 %
Low	47.53 %	24.07 %	11.11 %	0	11.11 %	10.49 %

The table above shows mathematical reasoning abilities based on per indicator according to students' answers belonging to the high , medium , low categories. Students' mathematical reasoning abilities are categorized as low on each indicator based on story questions which can be explained as follows:

1. Suspect

Researchers analyze indicators of mathematical reasoning abilities that propose conjectures, these indicators are expected students to be able to guess various possibilities and determine existing mathematical concepts from the problems given. From the results of the analysis, it was found that the percentage of the average value on the indicator proposing a guess was 52.38 which was classified in the low category, in this indicator students were more dominant and less complete in estimating the mathematical concepts stated from the questions, and students tended to directly answer the questions without making assumptions beforehand. formerly. The ability to propose conjectures must determine a mathematical concept first to find the possibilities used in solving mathematical problems.

2. Determining the Pattern or Nature of a Mathematical Generalist

Researchers analyze indicators of mathematical reasoning ability that determine the pattern or nature of a mathematical generalist, in this indicator students are expected to be able to make mathematical generalists such as making an example in solving a problem. From the results of the analysis, it was found that the percentage of the average value on the indicators determining the pattern or nature of a mathematical generalist was 33.33 which was classified in the low category, in this indicator students were more dominant in not answering what was stated in the questions, students were less able to use their reasoning abilities in solving problems. problem. Ability determine the pattern or nature of a mathematical generalist students must use the generalist results from the previous solution to determine a pattern or example. Agrees with Aisyah (2016) stating that generalist results can be used to solve problems.

3. Doing Manipulation

Researchers analyze indicators of mathematical reasoning ability that perform manipulation, in this indicator students are expected to be able to manipulate examples of an allegation in solving a problem. From the results of the analysis, it was found that the percentage of the average value on the indicator for manipulation was 20.63 which was classified in the low category, in this indicator the students were more dominant, less precise and thorough in solving the story problems that had been given, because students were more concerned with solving problems directly. The ability to manipulate is done in order to be able to complete mathematical operations correctly. in line with Rahmawati (in Afinnas, Masrukan, & Kurniasih 2018) if the manipulation in solving the problem is not thorough, the mathematical operation will experience errors until the end of the answer.

4. Drawing conclusions from statements

Researchers analyze indicators of mathematical reasoning abilities that draw conclusions from statements, in this indicator students are expected to be able to draw conclusions from statements to complete the next step based on previous solutions in solving a problem. From the results of the analysis, it was found that the percentage of the average value on the indicator drawing conclusions from the statement was 5.29 which was classified in the low category, in this indicator students answered the next question rather than drawing conclusions on what method they would use to answer the question. The ability to draw conclusions from statements based on facts which further develop their reasoning to be used in solving a problem.

5. Provide Reasons or Evidence of Multiple Solutions

Researchers analyze indicators of mathematical reasoning ability that provide reasons or evidence of several solutions, in this indicator students are expected to be able to draw conclusions from statements to complete the next step based on previous solutions in solving a

problem. From the results of the analysis, it was found that the percentage of the average value on the indicator drawing conclusions from the statement was 14.81 , which was classified in the low category, on this indicator students were able to answer questions but were incomplete in solving them because students tended to directly answer without using a formula. The ability to provide reasons or evidence from several solutions is done so that the existing answers are actually done and not only use general mathematical operations to draw a conclusion (Afinnas, Masrukan, & Kurniasih, 2018) .

6. Checking the Validity of an Argument

Researchers analyze indicators of mathematical reasoning ability that check the validity of an argument, in this indicator students are expected to be able to test their answers to draw conclusions from statements based on previous solutions in solving a problem. From the results of the analysis, it was found that the percentage of the average value on the indicator of checking the validity of an argument was 13.22 , which was classified in the low category, on this indicator students could not test the answer back into a new statement from the question. The ability to check the validity of an argument, students can test and re-check all the answers so that their abilities develop. In line with Polya (in Afinnas, Masrukan, & Kurniasih, 2018) students can strengthen or find out the truth of the answer by re-examining the answers that have been found previously in order to develop the ability to solve problems.

Based on the research that has been done, the results obtained that the average percentage value of the mathematical reasoning ability of grade IX students at SMP Negeri 1 Lemembu Jaya for the 2020/2021 school year is 24.50 in the low category. There is a finding of mathematical reasoning ability data in table 6, it is known that the mathematical reasoning ability of students in the high category with indicators one to six appears the same percentage, on the mathematical reasoning ability of students in the medium category indicators one and three appear better percentages than other indicators even though in the solution is less precise, while the mathematical reasoning ability of students in the low category there is one indicator that does not appear, namely the fourth indicator. The cause of the low mathematical reasoning ability of students is that students do not understand each lesson given so they still feel confused when given questions other than the examples given.

CONCLUSION

Based on the results of the analysis, it can be concluded that the overall mathematical reasoning ability of junior high school students in solving story problems is categorized as low. This is reinforced by the low category of mathematical reasoning ability in each indicator. The indicator of the mathematical reasoning ability of junior high school students in solving story problems is the highest indicator of making conjectures, while the indicator of mathematical reasoning ability of junior high school students in solving story problems is the indicator of drawing conclusions from a statement.

SUGGESTION

From the results of the data that has been achieved in this study, there are several suggestions, including: For teachers who already know students' mathematical reasoning abilities, teachers can pay more attention to students and teachers must involve students in the learning process by giving HOTS questions that are different from sample questions so that students can have better mathematical reasoning skills in solving story problems.

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