

ANALYSIS OF STUDENTS' ALGEBRAICAL THINKING ABILITIES IN GRADE VIII MTS IN SOLVING SPLDV PROBLEMS IN STORY FORM

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Abstract

Algebraic thinking is an important aspect for students in the mathematics learning process, but some students still have low algebraic thinking skills. Therefore, this study aims to see how students' algebraic thinking skills are in solving mathematics problems with SPLDV material in the form of stories. The research method is descriptive qualitative. The results of the study are that students with high algebraic thinking skills are able to solve SPLDV problems in the form of stories perfectly and fulfill all algebraic thinking indicators. Meanwhile, students with average abilities are able to solve the problems correctly but only fulfill most of the algebraic thinking indicators. Meanwhile, students with low abilities are only able to fulfill a small part of the algebraic thinking indicators

Keywords: *Algebraic thinking, SPLDV, Story Problems*

Abstrak

Algebraic thinking is an important aspect for students in the mathematics learning process, but some students still have low algebraic thinking skills. Therefore, this study aims to see how students' algebraic thinking skills are in solving mathematics problems with SPLDV material in the form of stories. The research method is descriptive qualitative. The results of the study are that students with high algebraic thinking skills are able to solve SPLDV problems in the form of stories perfectly and fulfill all algebraic thinking indicators. Meanwhile, students with average abilities are able to solve the problems correctly but only fulfill most of the algebraic thinking indicators. Meanwhile, students with low abilities are only able to fulfill a small part of the algebraic thinking indicators.

Keywords : keywords 1; algebraic thinking 2; SPLDV 3; story problems

1. INTRODUCTION

Algebraic thinking skills are a fundamental aspect of mathematics learning, particularly in solving story-based math problems that require conceptual understanding and analytical skills. This ability encompasses students' ability to process and represent an event or question using algebraic symbols and operations. According to research conducted by Dwirahayu et al. (2019), improving algebraic thinking skills can be achieved through schema-based learning with the FOPS strategy. This study demonstrated that this approach is effective in improving students' ability to understand and solve algebraic problems. Furthermore, research by Farida and Hakim (2021) revealed that junior high school students' algebraic thinking skills on the topic of systems of linear equations in two variables (SPLDV)

still need to be improved. This study emphasizes the importance of appropriate learning strategies to improve students' understanding of algebraic material.

Research by Badawi et al. (2016) shows that the algebraic thinking skills of eighth-grade junior high school students still need to be improved. This study emphasizes the importance of developing learning materials and methods that can improve students' algebraic thinking skills. Based on the various studies above, it can be concluded that algebraic thinking skills are an important component in mathematics learning that requires special attention. Developing effective learning strategies that are appropriate to student characteristics is key to improving this ability. Students' algebraic thinking skills in solving story-based mathematics problems in mathematics subjects are a crucial aspect in learning. Mathematics does not only focus on numerical calculations, but also on developing logical, analytical, and problem-solving skills. Story-based mathematics problems are an effective medium for measuring the extent to which students are able to apply mathematical concepts in real-life contexts. According to Utami et al. (2018), mathematics plays an important role in shaping students' mindsets, because it requires logical, systematic, analytical thinking skills, and problem-solving abilities.

However, various efforts made by teachers to improve students' ability to understand mathematics often do not achieve optimal results. The learning and teaching process becomes unpleasant and tends to be boring for students. One problem often encountered is students' difficulty in solving story-based math problems, even though story-based math problems are a form of evaluating students' ability to understand the basic mathematical concepts they have learned. Research by Wasiah et al. (2020) shows that many students experience difficulty in solving story-based math problems. Several contributing factors include students' inattention in reading and understanding sentences, and difficulty in determining what is known and what is asked in the problem. Furthermore, students also have difficulty in determining the correct solution.

In her research, Safira (2021) found that students' ability to solve mathematical story problems on fractions was still low. Many students made mistakes in understanding the problem, planning solutions, and performing calculations. This indicates that efforts are needed to improve students' critical and analytical thinking skills in solving mathematical story problems. Furthermore, research by Tunu et al. (2022) showed that there were differences in the ability to solve mathematical story problems between male and female students. However, both male and female students achieved three of the five indicators of ability to solve mathematical story problems: writing down known aspects, writing down questions, and creating mathematical models. Female students tended to write the problem-solving steps clearly and completely, while male students wrote them briefly .

From the various studies above, it can be concluded that students' thinking skills in solving math problems in the form of mathematical stories still need to be

improved. Teachers need to find effective learning strategies to improve this ability, so that students can more easily understand and solve math problems in the form of mathematical stories. Based on this explanation, the researchers were interested in examining the algebraic thinking skills of junior high school students in solving math problems in the form of mathematical stories.

From the various explanations, this study aims to see the algebraic thinking skills of eighth grade Mts students in solving SPLDV problems in the form of stories.

2. RESEARCH METHOD

Approach research used in study This is approach qualitative. Type of research This is study qualitative descriptive. Research objectives This For see and describe ability think algebra participant educate in finish SPLDV questions in the form of story. Approach qualitative chosen because the data results in study This produce descriptive data from results analysis sheet answer SPLDV assignments, and results transcript interview.

Research purposes This is For know ability think algebra participant educate class VIII in finish SPLDV based questions story in PBL learning. The subjects of the research This is participant educate class VIII (eight) at Mts Qomarul Huda in the year academic year 2026/2027. Subject study consists of of 26 subjects However will taken sample as much as six participant educate, subject chosen based on mark ability test think its algebra, namely categorized from level ability mathematics high, medium and low can seen from table 1 below.

Table 1. Criteria ability mathematical

Category	Value interval
Tall	$66,67 \leq \bar{x} \leq 100$
Currently	$33,34 \leq \bar{x} \leq 66,66$
Low	$0 \leq \bar{x} \leq 33,33$

In study this research data in the form of results test participant educate. As for the question test amount to three question essay. Test questions in the form of question in the form of a two-variable linear equation system based on story.

Data sources in study This is participants 8th grade junior high school students. The data source was 26 participants educate, from 26 data sources will grouped in three category , namely participants educate with ability high , medium low . Of the three category the will taken two of each every selected category So sample For described. Two participants education taken selected from results answer with mark highest from each category. The data and data sources used For

do analysis ability think algebra participant educate in finish question generalization pattern.

As for the procedure in This research is 1) Stage preparation, namely researchers do observation early in the research location aim For get information related school and problems learning mathematics. 2) stage implementation research, namely researchers do study like give test write, interview, and determine subject. 3) data processing and analysis, namely researchers process the data that has been obtained and done analysis. Data analysis techniques in study This use Creswell's theory (2015), namely 1) data reduction, the data that is reduced is the data that will be reduced in study This in the form of. a) Test results written, b) *Recording* results interview 2) data presentation, where the data presented in the form of description or description from results ability think algebra participant educate in finish question generalization pattern. In addition to being shaped data description is also presented in table form. 3) Interesting conclusion, in study This conclusion the end result obtained in study This in the form of description ability think algebra participant educate.

3. RESULTS AND DISCUSSION

In this study, students were divided into three groups: a high-ability algebraic thinking group, a medium-ability algebraic thinking group, and a low-ability algebraic thinking group. The results and discussion of the research are as follows.

3. 1 high-ability algebraic thinking group

Judging from the results of the answers from the tests carried out by students with high algebraic thinking skills, they can solve the problems correctly. The indicators that can be met by students with high algebraic thinking skills are: Being able to know the contents of mathematical terms in story problems, Being able to understand what is known and desired in story problems, Being able to substitute the values in the problems into the correct answers, Being able to solve problems correctly, Being able to simplify the form of problems into the right answers, Being able to determine form equivalent and determining algebra settlement from something equality in algebra . Exposure the can seen from results participant educate following.

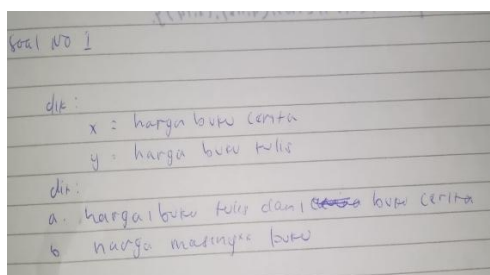


Figure 3.1 results test student

From the results answer student the can seen that student start finish question with method write information question like x represents the price of a story book (in rupiah) and y represents the price of a notebook (in rupiah). From the information obtained from the questions, students write to change the story problem into a mathematical equation, namely 2 notebooks and 3 story books equal 90,000 and a notebook and 5 story books equal 85,000 to $2x + 3y = 90,000$ and $x + 5y = 85,000$. From the results of the students' answers, it can be seen that students know the mathematical terms in the story problem and students know what is known and what is asked in the problem. This also shows that students with high abilities can simplify the form of the problem into a simpler form, namely from the story form into algebraic form and are able to determine form equivalent and determining algebra settlement from something equality in algebra.

In solving story-based problems, students with high ability take several steps. The first step is to eliminate one of the variables. In this case, the students eliminate the variable x using the elimination method. This can be seen from the students' answers below.

a. dia
 1. $2x + 3y = 90.000$
 2. $x + 5y = 85.000$
 dik:
 $x + y = ?$
 $2x + 3y = 90.000$ | 1 | $2x + 3y = 90.000$
 $x + 5y = 85.000$ | 2 | $2x + 10y = 170.000$
 $7y = 80.000$
 $y = \frac{80.000}{7} = 11.428$

Figure 3.2 Student test results

From the results of the students' answers, students with high abilities tend to eliminate the variable x first. In this case, the students successfully eliminated and got the result $2(x+5y)=2(85,000) \Rightarrow 2x+10y=170,000$. Then the students subtracted equation (1) from equation (2): $(2x+10y)-(2x+3y)=170,000-90,000$. $7y = 80,000$. $y=80,000/7$ $y=11,428.57$

Next, to find the value of y, students with high abilities carry out the second step, namely substitution. Students substitute the value of y into the second equation. Substitute the value of $x + 5 (11,428.57) = 85,000$. After distributing the value of y into the second equation, students carry out a simple simplification as follows: $x + 5 (11,428.57) = 85,000$. $x = 85,000 - 57,142.85$. $x = 27,857.15$. The results of the students' answers are as follows:

Handwritten student work on lined paper:

$$x + 5y = 85.000$$

$$x + 5(11.928) = 85$$

$$x = 27.852$$

jadi harga 1 buku tulis = 11.928
 harga 1 buku tulis = 27.852

Figure 3.3 student answer results

From this presentation, students wrote and completed questions accurately and in detail, and were able to substitute the values in the questions into the correct answers. Therefore, students with high abilities were able to correctly conclude the test results.

3.2. Moderate level algebraic thinking skills

Judging from the results of the answers from the tests carried out by students with moderate algebraic thinking skills, they can solve the problems correctly. The indicators that can be met by students with high algebraic thinking skills are: Being able to know the contents of mathematical terms in story problems, Being able to understand what is known and desired in story problems, Being able to substitute the values in the problems into the correct answers, Being able to solve problems correctly, Being able to simplify the form of problems into the correct answers, Being able to determine form equivalent and determining algebra settlement from something equality in algebra .

From the results of the students' answers, it can be seen that students start solving problems by writing what is known and asked in the problem. Next, changing the story problem into a mathematical equation, namely 2 notebooks and 3 story books equals 90,000 and a notebook and 5 story books equals 85,000 to $2x + 3y = 90,000$ and $x + 5y = 85,000$. From the results of the students' answers, it can be seen that students know the mathematical terms in the story problem and students know what is known and what is asked in the problem. This also shows that students with moderate abilities can simplify the form of the problem into a simpler form, namely from the story form into algebraic form and are able to determine the equivalent algebraic form and determine the solution to an equation in algebra. The answers of students with moderate abilities are as follows.

1. Dik :
 $X = \text{buku tulis}$
 $Y = \text{buku cerita}$
 Dit :
 harga masing-masing buku = ...
 $2 \text{ buku tulis} + 3 \text{ buku cerita} = 90.000$
 $1 \text{ buku tulis} + 5 \text{ buku cerita} = 85.000$

$$\begin{array}{rcl}
 2x + 3y = 90.000 & | \times & 2x + 3y = 90.000 \\
 x + 5y = 85.000 & | \times 2 & 2x + 10y = 170.000 \\
 \hline
 & & 7y = -80.000 \\
 & & y = -80.000 / 7 \\
 & & y = 11.428
 \end{array}$$

$x + 5y = 85.000$
 $x + 5(11.428) = 85.000$
 $x + 57.140 = 85.000$
 $x = 85.000 - 57.140$
 $x = 27.857$

Gabmar3.4 student answer results

In solving problems, students with average abilities tend to eliminate the variable x first. From the test results, students write $2(x+5y)=2(85,000)$. $2x+10y=170,000$. Then, students subtract equation (1) from equation (2): so that they get the result $(2x+10y)-(2x+3y)=170,000-90,000$. $7y = 80,000$. $y=80,000/7$ $y=11,428$.

Next, to find the value of x , students with high abilities do the second step, namely substitution. Students substitute the value of y into the second equation. Substitute the value of $x + 5(11,428) = 85,000$. After distributing the value of y into the second equation, students carry out simple simplifications as follows: $x + 5(11,428) = 85,000$. $x = 85,000 - 57,142$. $x = 27,857$ From this explanation, students write and solve questions correctly and in detail and students can substitute the values in the questions into the correct answers. So that students with high abilities can conclude the test results correctly.

3.3 low-ability algebraic thinking group

Judging from the test results, students with low algebraic thinking skills were able to solve the problems correctly. The indicators that students with low algebraic thinking skills were able to meet were being able to understand the mathematical terms in the story problem and being able to understand what is known and desired in the story problem. The details of the students' answers are as follows:

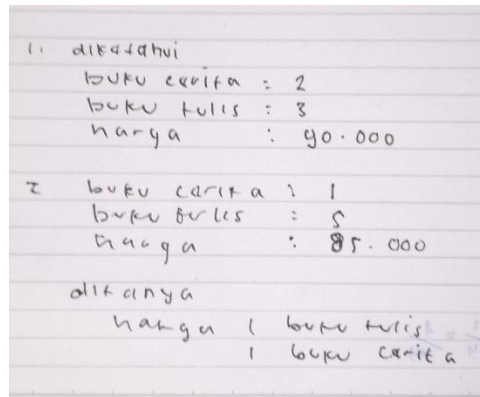


Figure 3.5 Student test results

The test results show that students with low ability tend to only be able to solve story problems up to the first stage, which is writing down what is known and what is asked in the problem. Therefore, it can be said that students with low ability only meet a few indicators, such as being able to understand the mathematical terms in the story problem and being able to understand what is known and what is asked in the story problem.

4. CONCLUSION

From the discussion, it can be concluded that students with high abilities can fulfill all indicators of algebraic thinking ability correctly, such as: The indicators that can be fulfilled by students with high algebraic thinking ability are: Being able to know the contents of mathematical terms in story problems, Being able to understand what is known and desired in story problems, Being able to substitute the values in the problem into the correct answer, Being able to solve problems correctly, Being able to simplify the form of the problem into the correct answer, Being able to determine form equivalent and determining algebra settlement from something equality in algebra . Meanwhile, students who have average abilities only fulfill most of the indicators of algebraic thinking such as being able to know the contents of mathematical terms in story problems, being able to understand what is known and desired in story problems, being able to substitute the values in the problem into the correct answer, being able to solve problems correctly, being able to simplify the form of the problem into the correct answer, determining settlement from something equality in algebra . For low ability, it only fulfills a small part of all the indicators of algebraic thinking ability, such as being able to understand what is known and desired in story problems.

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6. RECOMMENDATIONS

This study recommends that more research be conducted to improve students' algebraic thinking skills, using creative and innovative learning models. This study has limitations, such as focusing only on systems of linear equations in two variables. Future research may explore different and more complex materials.

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