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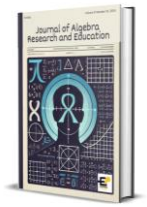

Exploring Potential: Analysis of Students' Mathematical Problem-Solving Ability on System of Linear Inequalities in Two Variables (SLITV) Material

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Abstract

This research analyses students' mathematical problem-solving abilities in dealing with the material on the System of Linear Inequalities in Two Variables (SLITV). The research method used is descriptive quantitative with data collection through written tests. The subjects of this research were class XI students at SMAN 2 Tualang, Siak Regency, consisting of 34 students who had studied SLITV material. The technique in this research is tests. The test contains four questions at easy, medium, and difficult levels. Based on the analysis results, it shows that in question number 1, with indicators of the ability to identify elements that are known, asked about, and the adequacy of the required elements, a very good category was obtained with a cumulative percentage of 88.3%. In question number 2, with the indicator of being able to create or compile mathematical models, the category was quite good, with a cumulative percentage of 58.3%. In question number 3, with the indicator of choosing and developing a problem-solving strategy, a bad category was obtained with a cumulative percentage of 5.8%. In question number 4, with the indicator of being able to explain and check the correctness of the answers obtained, students received a fairly good category with a cumulative percentage of 53.0%. This means that mathematical problem-solving abilities are good but also need to be developed further to achieve maximum mathematical understanding abilities so that students better understand the basic concepts of the previous material used to solve the problems that have been given.

Keywords: Mathematics, Problem-solving ability, System of linear inequalities in two variables (SLITV).

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1. Introduction

Education is one thing that cannot be separated from every human being's life. Education is the background for every person's insight; every insight can be used as a reference for a person's life. (Buyung et al., 2023). Education is a means to make the nation's life smarter. (Jais et al., 2023). Education is a human need because, with education, a person can build a better future. (Pandiangan et al., 2020). Mathematics education taught in school education is basic and necessary to master science and technology. (Fitriani, 2018). Studying mathematics aims to educate people to think logically, critically, rationally and confidently. (Astuti & Wijayanti, 2021).

Mathematics is an applied science that is very fun to learn but seems difficult for some students to understand (Akbar et al., 2018). Mathematics lessons are considered difficult because they come from students' initial perception of mathematics, which already assumes that mathematics is difficult. (Aprilia & Fitriana, 2022). The opinion that mathematics is a difficult subject has been passed down from generation to generation by students and has become a bad mindset. Mathematics is a science field related to one topic and another. (Nugraha et al., 2018). Mathematics is an abstract science requiring logical thinking and a strong understanding. (Handayani et al., 2019). Mathematics, as one of the subjects in school, is considered to play an important role in forming quality students because mathematics is a means of thinking and studying things logically and systematically. Suningsih (2021) Mathematics has an important and mandatory role in education, so mathematics needs to be taught at all levels of education.

Mathematics learning in schools is studied from elementary to tertiary level to meet mathematics learning objectives. Holmes in Nadhifa et al., (2019) States that someone needs to learn to solve mathematical problems to keep up with their life needs, become more productive workers, and understand complex issues related to global society. Learning mathematics is very important because, in everyday life, we cannot be separated from using mathematics, ranging from simple to complex problems. Mathematics learning at school is expected to not only be limited to taking notes and doubting its correctness, but students can grasp the meaning and significance of the learning given by the teacher. (Fajar et al., 2019).

Problem-solving is a learning approach that optimally involves active students, allowing them to explore, observe, experiment, and investigate. This aims to facilitate students' understanding of the learning material obtained and a supporting medium, method or technique to make students more active and independent. (Handayani et al., 2023). He said that problem-solving skills in mathematics are very important for those who are or will study mathematics and those who apply it to other fields of study and everyday life. Sumartini (2016) It states that problem-solving as a process is an activity that prioritises the importance of procedures, strategic steps taken by students in solving problems, and ultimately finding answers to questions.

The material on Systems of Linear Inequalities in Two Variables (SLITV) is usually in the form of story problems, so the solution must first be converted into a mathematical model. SLITV material also has long and systematic completion steps. So, the process requires more understanding (Qoniah, 2023). Students need help turning story problems into mathematical models (Birrul Walidain et al., 2022). This material takes examples from real life, and the questions are presented in the form of story questions. Presenting questions in the form of stories is an attempt to stimulate students so that they can imagine the concepts of this material in everyday life (Baskorowati et al., 2021). The application of this story problem then makes the material on systems of linear equations with three variables quite difficult material. This makes it difficult for students to find a solution. Equations and inequalities for the linear absolute values of two variables are material that contains story problems related to problem-solving. In mathematics learning, problem-solving is the core of learning, a basic learning ability. Rahayuningsih et al. (2014) said that in mathematics, there are story problems related to problems in everyday life that can be solved with statements or open sentences.

Types of student errors in solving mathematics problems in the Newman procedure include reading errors, comprehension errors, transformation errors, processing skills errors, and errors in concluding (encoding errors) (Armita et al., 2020). Previous research conducted by Jais et al., (2023) In science class V, as many as 25 people at SMAN 1 Pasarwajo obtained the results of an analysis of students' mathematical abilities; in problem-solving abilities, it was found that in high-ability subjects, there were 16% of students and 24% in medium ability subjects. Students, and in low ability subjects, 60%, for reasoning abilities, it is known that in high ability subjects, there are 4% of students, and in medium ability subjects, there are 8%. In low ability subjects, 88% of students, for mathematical communication abilities it is known that in high ability subjects, there are 4% students, in the medium subject there were six students. In the low ability subject, 72% of students have mathematical connection abilities. In the high-ability subject, 16% of students were students, and in the medium-ability subject, 20% were students. In the low-ability subjects, 64% of students are students; for representation ability in high-ability subjects, 4% are students; in medium-ability subjects, 6% are students. In low-ability subjects, there are 80% of students. Meanwhile, the research carried out by the researcher was related to story problems on SLITV material at SMAN 2 Tualang school. Therefore, this research aimed to analyse students' mathematical problem-solving abilities when working on story problems on SLITV material.

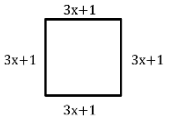
Therefore, this research aims to explore the ability of class XI high school students to solve mathematical problems, especially on the systems of inequalities in two variables. So, after the research is complete, the difficulties students face in understanding and solving problems on the topic of systems of linear inequalities in two variables will be identified (SLITV).

2. Methods

The method used in this research is a quantitative descriptive method. Quantitative descriptive research collects, organises, summarises, and analyses quantitative data to describe or explain observed phenomena. Therefore, this research was conducted to analyse the difficulties experienced by students in solving the questions given in the material on systems of linear inequalities in two variables (SLITV). This research was conducted on May 2, 2024, during the even semester of the 2023/2024 academic year at SMAN 2 Tualang. The subjects of this

research were students of class XI at SMAN 2 Tualang, Tualang District, Siak Regency, consisting of 34 students. The technique in this research is tests. The test contains four essay questions at easy, medium and difficult levels. The reason for using description questions is that researchers know how to teach these questions from beginning to end. The data analysis technique used is the IBM SPSS Statistics 21 program. The following indicators are used in this research, namely problem-solving indicators according to Kesumawati (in Mawaddah et al., 2015) as follows:

Table 1 – Problem-solving indicators and questions

Problem-solving indicators	Questions
Demonstrate understanding of the problem, including the ability to identify elements that are known, asked about, and the adequacy of the elements needed.	A rectangle has length $(2x + 11)\ cm$ and width $(3x - 5)\ cm$. Its circumference is not less than 62 cm. We will look for the value of x; is this data sufficient? If the data is sufficient, solve the problem. If not enough, add some supporting information and then finish it.
Able to create or compile mathematical models, including the ability to formulate problems in everyday mathematics situations.	Novi buys fertiliser and plants for her garden. Novi has IDR 100,000.00. Each bag of fertiliser costs IDR 20,000.00, and each plant costs IDR 10,000.00. Novi wants to buy at least five plants. How many plants and fertilisers can Novi buy?
Selecting and developing problem-solving strategies, including the ability to generate various possibilities or alternative ways of solving formulas or knowledge that can be used in solving the problem.	Mr Budi has IDR 10,000,000.00. He wants to deposit his money. Bank A gives an interest of 4%, and bank B gives an interest of 6%. Mr Budi wants to get interest of at least IDR 550,000.00, but he doesn't want to deposit the money in just one bank. Is that possible? If yes, state one possibility.
Able to explain and check the correctness of the answers obtained, including the ability to identify calculation errors and errors in using formulas, check the match between what has been found and what was asked, and be able to explain the correctness of the answer.	 Determine the value of x so that the perimeter of the square is not less than 120!

3. Results and Discussion

3.1. Results

From the results of the analysis of answers on student test sheets, it was found that the percentage of high school students' mathematical problem-solving abilities in solving story problems on the System of Linear Inequalities in Two Variables (SPtLDV) material. Student problem-solving ability test data was analysed by calculating each student's score using the IBM SPSS Statistics 21 program. The percentages obtained were converted into a table according to the source (Kharisma et al., 2018).

Table 2 – Criteria for mathematical problem-solving abilities

No	completeness	Category
1	X > 80%	Very good
2	60% < X ≤ 80%	Good
3	40% < X ≤ 60%	Pretty good
4	20% < X ≤ 40%	Not good
5	X < 20%	Not good

The following are the results obtained from indicator 1, which shows mass understanding:

Table 3 – Demonstrate understanding of the problem

Category	Frequency	Per cent	Valid per cent	Cumulative per cent
Very good	22	64.7	64.7	64.7
Good	8	23.5	23.5	88.3
Pretty good	2	5.9	5.9	94.1
Not good	1	2.9	2.9	97.0
Not good	1	2.9	2.9	100.0
Total	34	100.0	100.0	

In Table 3, it is explained that out of 34 students, there are 22 students in the very good category with a percentage of 64.7%; in the good category, there are eight people with a percentage of 23.5%, in the quite good category there are two people with a percentage of 5 .9%, the unfavourable category is also one person with a percentage of 2.9%. The unfavourable category is one person with a percentage of 2.9%. The following is a histogram from Table 3.

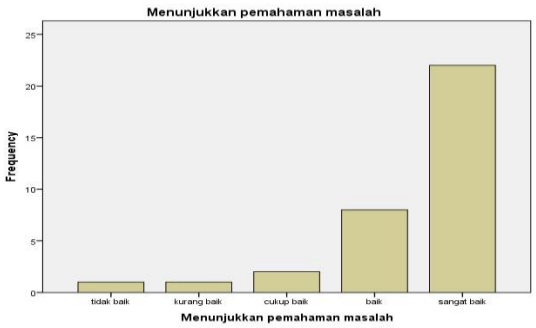


Figure 1 Histogram shows problem-solving

Based on the criteria for mathematical problem-solving ability, students at SMA Negeri 2 Tualang are in the very good category in terms of indicators showing understanding of the problem, including the ability to identify known elements, questions, and the adequacy of the required elements with a cumulative percentage of 88.3%. This is in line with (Lestanti et al., 2016) This states that in solving problems, students are expected to understand the process of solving the problem and become skilled in selecting and identifying relevant conditions and concepts, looking for generalisations, formulating a resolution plan, and organising relevant skills. Previously owned.

Furthermore, indicator two is being able to create or compile mathematical models; the following table is presented:

Table 4 – Create or compile mathematical models

Category	Frequency	Per cent	Valid per cent	Cumulative per cent
Very good	8	23.5	23.5	23.5
Good	12	35.3	35.3	58.3
Pretty good	4	11.8	11.8	70.6
Not good	5	14.7	14.7	85.3
Not good	5	14.7	14.7	100.0
Total	34	100.0	100.0	

In Table 4, it is explained that out of 34 students, there are eight students in the very good category with a percentage of 23.5%; in the good category, there are 12 people with a

percentage of 35.3%, in the quite good category, there are four people with a percentage of 11 .8%, in the unfavourable category there are five people with a percentage of 14.7%. In the unfavourable category, there are five people with a percentage of 14.7%. The following is a histogram from Table 4.

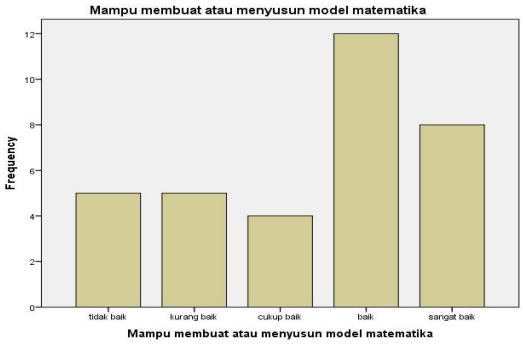


Figure 2 Able to create or compile mathematical models

Based on the criteria for mathematical problem-solving ability, students at SMA Negeri 2 Tualang are in the fairly good category in the indicator of creating or compiling mathematical models, including the ability to formulate problems in everyday situations in mathematics, with a cumulative percentage of 58.3%. In line with (Noviyana, 2019) Who says that when creating or compiling a mathematical model, look for relationships between the information provided and the unknown, which allows you to calculate unknown variables?
Furthermore, indicator three is being able to choose and develop problem-solving strategies; the following table is presented:

Table 5 – Select and develop problem-solving strategies

Category	Frequency	Per cent	Valid per cent	Cumulative per cent
Very good	1	2.9	2.9	2.9
Good	1	2.9	2.9	5.8
Pretty good	6	17.6	17.6	23.4
Not good	4	11.8	11.8	35.3
Not good	22	64.7	64.7	100.0
Total	34	100.0	100.0	

In Table 5, it is explained that out of 34 students, the number of students in the very good category is one person with a percentage of 2.9%; in the good category, there is also one person with a percentage of 2.9%, in the quite good category there are six people with a percentage 17.6%, in the unfavourable category there were four people with a percentage of 11.8%. In the unfavourable category, there were 22 people, with a percentage of 64.7%. The following is a histogram from Table 5.

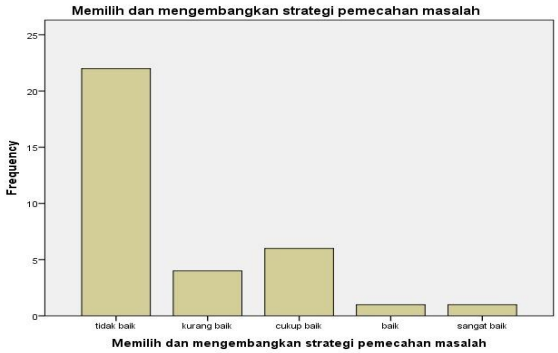


Figure 3 Select and develop problem-solving strategies

Based on the criteria for mathematical problem-solving ability, students at SMA Negeri 2 Tualang are in the poor category on the indicator of selecting and developing problem-solving strategies, including the ability to generate various possibilities or alternative ways of solving formulas or knowledge that can be used in solving the problem, because with a cumulative percentage of 5.8%. In line with (Asni et al., 2021) This states that at the stage of selecting and developing a problem-solving strategy or implementing a plan, the plan that has been prepared can then be used to solve the problem by implementing the plan that has been made.

Furthermore, indicator four is being able to choose and develop problem-solving strategies; the following table is presented:

Table 6 – Explain and check the correctness of the answers obtained

Category	Frequency	Per cent	Valid per cent	Cumulative per cent
Very good	9	26.5	26.5	26.5
Good	9	26.5	26.5	53.0
Pretty good	5	14.7	14.7	67.7
Not good	1	2.9	2.9	70.6
Not good	10	29.4	29.4	100.0
Total	34	100.0	100.0	

In Table 6, it is explained that out of 34 students, there are nine students in the very good category with a percentage of 26.5%; in the good category, there are nine people with a percentage of 26.5%, in the quite good category there are five people with a percentage of 14 .7%, in the unfavourable category there is one person with a percentage of 2.9%. In the unfavourable category, there are ten people with a percentage of 29.4%. The following is a histogram from Table 6.

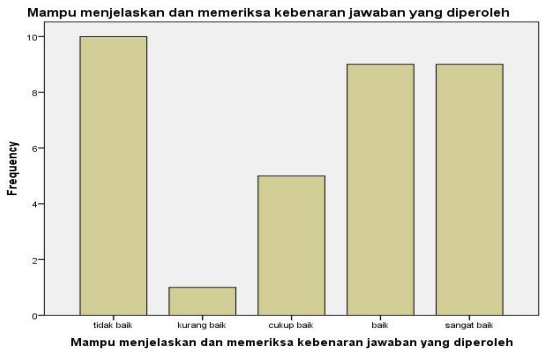


Figure 4 Able to explain and check the correctness of the answers obtained

Based on the criteria for mathematical problem-solving ability, students at SMA Negeri 2 Tualang are in the fairly good category on the indicator of being able to explain and check the correctness of the answers obtained, which includes the ability to identify calculation errors, errors in using formulas, check the match between what has been found and what is found. I asked, and I can explain the correctness of the answer because the cumulative percentage is 53.0%. In line with (Sumartini, 2016) Who says that when students have successfully implemented their solution plan, found and written down the solution to the problem and have checked each step of the solution, then the student must be able to provide good reasons to be sure that the solution they obtained is correct.

3.2 Discussion

The following is a display of the results of class XI students' answers, which are still not correct and still have errors:

Analyse the results of students' answers to question number 1

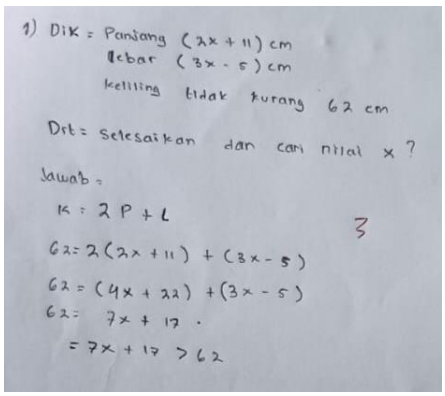


Figure 5 Answer to question number 1

In Figure 5 above for question number 1, it can be seen that students can still not solve the questions given. Students cannot solve problems until the end, where the value of x is not yet known. Students can only demonstrate an understanding of the problem, such as identifying elements that are known and asked about and the adequacy of the elements. Still, they must complete it as desired in the question asked, even though the student is quite capable and can substitute known values into the equation. However, if you look at the overall results for question number 1, 22 students or 64.7% of the 34 students, were good at answering and completing the questions that had been given.

Analyse the results of students' answers to question no. 2

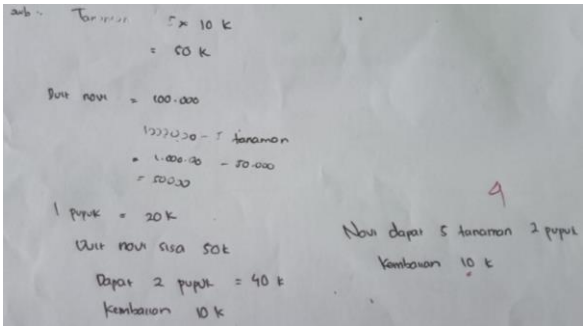


Figure 6 Answer to question number 2

In Figure 6 above for question number 2, it can be seen that students can solve the questions given. Students can create or compile mathematical models, including the ability to formulate problems in everyday mathematics situations. However, students must be more creative in completing the final results. Because with the amount of money you have, you can still buy one more plant because, in the case of Novi, you want to buy at least five plants; it doesn't have to be five plants, but it can be more. Judging from the overall results for question number 2, 12 students or 35.3% of the 34 students, were good at answering and completing the questions that had been given. This means many of them still understand how the problem should be resolved.

Analysis of the results, students' answers to question no. 3

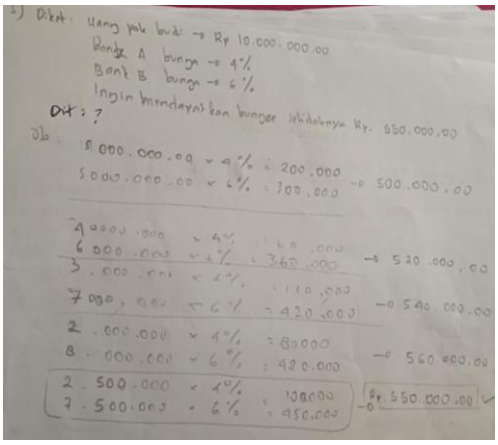


Figure 7 Answer to question number 3

In Figure 7 above for question number 3, it can be seen that students can solve the questions given. Students can choose and develop problem-solving strategies, including the ability to generate various possibilities or alternative ways of solving formulas or knowledge that can be used in solving the problem. However, students needed to be more careful in answering, namely, not explaining what was asked in the question and not providing a conclusion.

Judging from the overall results for question number 3, many students still need help understanding how to answer the question. There were 22 people in the very poor category, with a percentage of 64.7%; many students still needed help answering these questions. This means many still need to understand how the problem should be resolved.

Analyse the results of students' answers to question No. 4

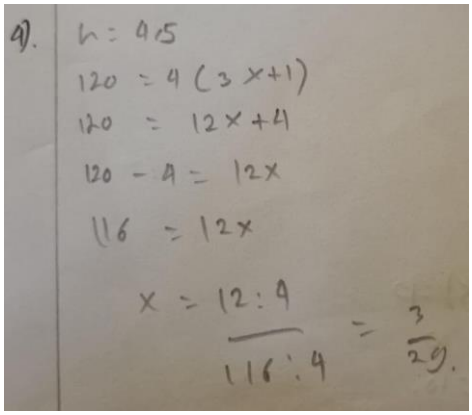


Figure 8 Answer to question number 4

Figure 8 above, for question number 4, it can be seen that the student solved the question given. Students can explain and check the correctness of the answers obtained, including the ability to identify calculation error errors using formulas to check the match between what was found and what was asked. They can explain the correctness of the answer. However, the student still needed to be corrected in the final result, where to find the required x value, the student instead created the equation 3/29, which should be 29/3. Judging from the total number of students in the excellent category, there are nine people and nine people in the good category, with a percentage of 26.5%. However, ten people received the very poor category, with a percentage of 29.4%. This means many of them still understand how the problem should be resolved.

4. Conclusions

Based on the results and discussion that have been described, students' mathematical problem-solving abilities in the material of linear inequalities in two variables (SPtLDV) can be concluded as follows:

4.1 Based on the results and discussion described, students' mathematical problem-solving abilities in the material on linear inequalities in two variables (SPtLDV) are considered good, although they could be better. In this research, several students solved the questions perfectly and got the maximum score. There are quite a lot of students who can solve and understand the questions that have been given.

4.2 On average, students could answer questions no. 1, 2, and 4. In question no. 1, which included indicators of the ability to identify known and asked-about elements and the adequacy of the required elements, a very good category was obtained with a cumulative percentage of 88.3 %. In question number 2, with the indicator of being able to create or compile mathematical models, the category was quite good, with a cumulative percentage of 58.3%. In question number 3, with the indicator of choosing and developing a problem-solving strategy, a bad category was obtained with a cumulative percentage of 5.8%. In question number 4, with the indicator of being able to explain and check the correctness of the answers obtained, students received a fairly good category with a cumulative percentage of 53.0%.

4.3 In this research, it was found that mathematical problem-solving abilities were good but also needed to be developed further to achieve maximum mathematical understanding

abilities so that students better understand the basic concepts of the previous material used to solve the problems that have been given. To improve students' mathematical problem-solving abilities, students need to be given a fun learning model so that learning does not get boring and is centred on the students, making learning more active.

The suggestion from the researcher to future researchers is to develop students' mathematical problem-solving abilities further based on other theories and also add interview instruments because, in this study, interview procedures have yet to be implemented due to time constraints.

Conflict of Interest

The authors declare no conflicts of interest.

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