Journal of Mathematics Education
Website: http://usnsj.id/index.php/JME
Email: pengelolajme@gmail.com
p-ISSN 2528-2468; e–ISSN 2528-2026

DOI: https://doi.org/10.31327/jme.v11i1.2752

ANALYSIS OF GRADE XII STUDENTS' CRITICAL THINKING SKILLS IN SOLVING LINEAR PROGRAMMING PROBLEMS BASED ON MATHEMATICAL ABILITY

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Article Info

Article history:

Received Apr 17, 2026
Revised Apr 30, 2026
Accepted May 09, 2026

Keywords:

Critical Thinking
Linear Programming
Mathematical Skills

ABSTRACT

This study aims to describe students' critical thinking skills in solving linear programming problems in grade XII in terms of their mathematical ability level. This study uses a qualitative descriptive approach with three grade XII students selected through purposive sampling technique as subjects, each representing high, medium, and low levels of mathematical ability. The research data were obtained through a linear programming problem-solving test instrument and in-depth interviews which were analyzed through data condensation, data presentation, and conclusion drawing. The results obtained indicate that high-ability students use all critical thinking indicators. They are able to formulate problems, model mathematics, check and solve problems, draw detailed conclusions, write and explain the final answer in detail, and review the answers obtained. Meanwhile, students with medium ability also fulfill all indicators. They are able to formulate problems, model mathematics, check and solve problems, draw conclusions, write and explain the final answer, and review the answers. Meanwhile, low-ability students only master three critical thinking indicators: formulating problems, modeling mathematics, and checking and solving problems. Overall, the difference in students' mathematical ability levels is directly proportional to the depth of achievement of critical thinking indicators in solving linear programming problems.

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How to Cite:

Wahid, A., Nur, Alfisyahra, & Rizal, M. (2026). Analysis of Grade Xii Students' Critical Thinking Skills in Solving Linear Programming Problems Based On Mathematical Ability. *JME:Journal of Mathematics Education*, *11*(1), 154-168

1) INTRODUCTION

Critical thinking can be developed through mathematics learning because mathematics has a comprehensive and clear structure and study between concepts (Kartin et al., 2021). Kurniawati & Ekayanti (2020) stated that learning mathematics requires critical thinking skills. Critical thinking can be practiced and developed through the mathematics learning process, while mathematical material is understood through critical thinking. Thus, mathematics functions not only as a science containing concepts, formulas, and procedures, but also as a means to practice and develop critical thinking skills.

Wulandari & Warmi (2022) stated that critical thinking can find appropriate solutions to problems involving facts, data, and concepts. Kutni (2022) stated that critical thinking involves inductive thinking skills such as recognizing relationships, analyzing open-ended problems, determining cause and effect, drawing conclusions, and calculating relevant data. Fitria et al. (2024) stated that critical thinking is important for students because it can aid in problem-solving and effective and accurate communication. Therefore, mathematical critical thinking is crucial for students in problem-solving.

In general, students' critical thinking skills are still relatively low in Indonesia. This is because teachers have not yet fully adapted the learning process to their students' needs (Badalu et al., 2025). This is in line with the reality that Indonesian students still fall below international standards in critical thinking, as evidenced by the results of the 2022 Programme for International Student Assessment (PISA), which showed Indonesia ranked 69th out of 81 participating countries. Although Indonesia's ranking rose 5-6 positions compared to 2018 (Kemendikbudristek, 2023), Indonesia's math proficiency score actually decreased by 13 points (OECD, 2023). PISA, implemented globally by the Organisation for Economic Cooperation and Development (OECD), is a periodic assessment that assesses student performance in reading, mathematics, and science.

One of the topics in high school mathematics that demands critical thinking is linear programming. Wulandari (2024) states that linear programming is a topic that heavily utilizes critical thinking processes. Hasana et al. (2022) stated that learning linear programming is a topic that can familiarize students with improving their critical thinking skills. Therefore, learning linear programming can help students improve their critical thinking.

Interviews with school mathematics teachers revealed that students experience difficulty understanding and solving problems, especially in linear programming. This difficulty is primarily due to a lack of understanding of basic concepts, with many students simply memorizing formulas and procedures without truly understanding the rationale behind their use. Furthermore, the linear programming material previously taught in grade 11 is no longer included in the Merdeka curriculum, so this study focused on grade 12 students who had studied the material during the K13 curriculum. Consequently, many students simply follow example problems when solving problems, thus lacking critical thinking skills and struggling to explain solution steps based on their own understanding. This aligns with research conducted by Fitri et al. (2024) on the analysis of critical thinking skills in solving linear programming problems among students at SMA Negeri 5 Model Palu, which showed that many students relied solely on example problems when solving problems. This hindered their critical thinking skills and prevented them from explaining their understanding, particularly in linear programming.

Although previous studies have examined students' critical thinking skills in mathematics, most of them focused on general critical thinking performance without specifically considering differences in students' mathematical ability levels. In fact, mathematical ability may influence how students interpret problems, select strategies, and construct logical arguments during the problem-solving process (Facione, 2015). Therefore,

understanding students' critical thinking from the perspective of mathematical ability becomes important in order to provide more targeted instructional strategies.

Based on this gap, this study offers novelty by analyzing students' critical thinking skills in solving linear programming problems based on different levels of mathematical ability among Grade XII students. This study is expected to provide a more comprehensive understanding of how students with different mathematical abilities demonstrate critical thinking in mathematical problem-solving. Therefore, the purpose of this study is to analyze and describe Grade XII students' critical thinking skills in solving linear programming problems based on their levels of mathematical ability.

Based on this description, the purpose of this study is to describe the critical thinking skills of 12th-grade students in solving linear programming problems from a mathematical perspective.

2) METHOD

This research is a descriptive study using a qualitative approach. The descriptive research model was chosen because it aimed to provide an in-depth description of students' critical thinking phenomena through descriptive data in the form of written and spoken words. The qualitative approach was used because the research was conducted in a natural context without any special treatment or intervention for the subjects.

This research was conducted at Tadulako University, SMA LABSCHOOL UNTAD PALU, during the even semester of the 2025/2026 academic year. The subjects consisted of three 12th-grade students selected using a purposive sampling technique. Subject selection was based on their mathematical ability level (high, medium, and low) as measured by their odd semester report card grades. The classification of students' mathematical ability was based on mathematics achievement scores from the odd semester report card, supported by recommendations from the mathematics teacher to ensure the consistency of students' academic performance. The ability categories were determined using score intervals: students with scores $\geq 90{,}7$ were categorized as high, students with scores between 85,3–90,7 as medium, and students with scores $< 85{,}3$ as low. In addition to academic performance, subject selection also considered students' communication ability, willingness to participate, and their ability to express mathematical reasoning verbally during the interview process.

Data were collected through tests and in-depth interviews, referring to six critical thinking indicators according to Facione: interpretation, analysis, evaluation, inference, explanation, and self-regulation. These indicators were used as the conceptual framework for constructing the test items and interview guidelines.

The tests were administered in two stages to assess students' critical thinking processes, followed by interviews to clarify the subjects' answers. Before being administered, the research instruments were validated by experts in mathematics education to ensure content validity, construct relevance, language clarity, and alignment with the research objectives. Revisions were made based on the experts' suggestions until the instruments were considered suitable for data collection.

Data credibility was tested using time triangulation, comparing the consistency of test and interview data collected at different times. If the results of both data collections show a consistent pattern, the data is considered valid and reliable (Sugiyono, 2013).

The data analysis technique applied in this study refers to the data analysis model by Miles, Huberman, and Saldana, as cited in Wanto (2017). This model includes three main stages: data condensation, data display, and conclusion drawing.

Table 1. Critical thinking indicators according to Facione

Aspects	Indicators
Interpretation	Can formulate what the problem is in the question as shown by the way he writes what is known and what is asked in the question.
Analysis,	Identify the relationship between the statements, given in the problem shown by creating an appropriate mathematical model.
Evaluation	Check and use the right strategy to solve problems, complete and correct calculations.
Inference,	Able to draw logical conclusions and answer questions appropriately.
Explanation	Explain the reasons for writing the final answer.
Self-Regulation	Review the answers obtained by using skills in reviewing questions, proving answers through substitution, and recalculating the answers obtained.

3) RESULTS AND DISCUSSION

3.1. Results

The selection of subjects in this study refers to the results of the odd semester report card scores for the mathematics subject of class XII MIA 3 in the 2025/2026 academic year. The results of the recapitulation of the grouping of students' mathematical abilities can be seen in the following table.

Table 2. Results of Grouping Students' Mathematical Abilities

Mathematical Ability	Amount
High	4
Medium	9
Low	4

Next, one subject was selected from each level of mathematical ability to provide more focused and in-depth data. The initials SR were selected as a subject with high mathematical ability, the initials MR were selected as a subject with medium mathematical ability, and the initials NA were selected as a subject with low mathematical ability. This selection was based on several considerations, including advice from the mathematics subject teacher, good communication skills, and the students' willingness to participate in the research. The selected research subjects are presented in the following table:

Tabel 3. Research Subjects

No.	Student Name (Initials)	Report Card Grades	Subject Code	Mathematical Ability
1.	SR	93	ST	High
2.	MR	88	SS	Medium
3.	NA	85	SR	Low

1) Subject ST

Interpretation Indicators

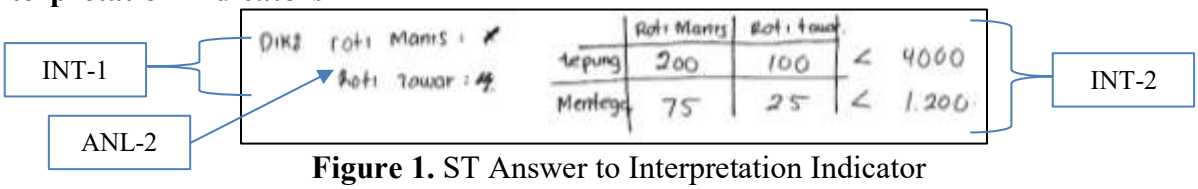

Figure 1. ST Answer to Interpretation Indicator

To obtain further information, the researcher conducted an interview with ST. The following is an excerpt from the transcript of the interview with subject ST.

ST1005P : From this question, what is known and what problem is being asked?

ST1006S : (see question) there is a shop "lezat bakery" makes two types of bread, sweet bread and white bread. To make sweet bread, you need 200 grams of flour and 75 grams of butter. To make white bread, you need 100 grams of flour and 25 grams of butter. The ingredients are 4,000 grams of flour and 1,200 grams of butter. And the selling price of sweet bread is Rp. 5,000 and white bread is Rp. 3,000. That's all, sis. (INT-1)

Based on the test results data, the answer that has been done by subject ST shows that ST is able to understand the problem of the question and the subject ST did not write down everything that was known and asked, only drawing a table to find out. However, in the interview answers ST showed that he was able to explain again what information was known and what was asked.

Analysis Indicators

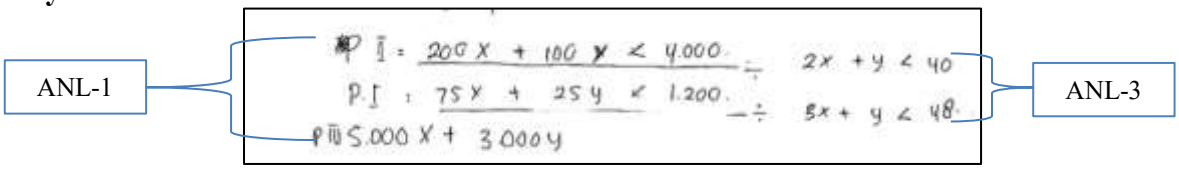

Figure 2. ST Answers to the Analysis Indicator

To obtain further information, the researcher conducted an interview with ST. The following is an excerpt from the transcript of the interview with subject ST.

ST1013P : Okay, How do you model it in mathematical form?

ST1014S : I first created a table, then wrote down the known values in the problem, such as sweet bread requiring 200 grams of flour and 75 grams of butter, and the same goes for white bread, as well as the profit margin for a table and chairs. (INT-2)

Based on the test results data, the answers of subject ST showed that ST was able to create a mathematical model by identifying the statements in the problem, but the subject still made a mistake in using the inequality sign (<) in equations 1 and 2. Based on the results of the interview answers, subject ST showed that ST was able to explain how to create a mathematical model.

Evaluation Indicators

To obtain further information, the researcher conducted an interview with ST. The following is an excerpt from the transcript of the interview with subject ST.

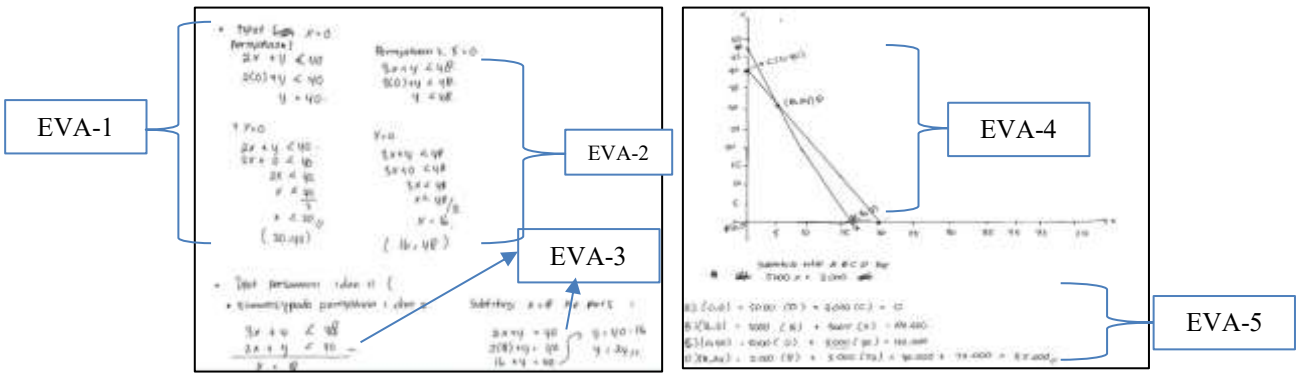

Figure 3. ST Answers to the Evaluation Indicators

ST1019P : Are you sure that the method/steps you are using are the most effective and correct?

ST1020S : Sure, sis. First of all (while looking and pointing to the answer to problem 1) I will look for the values of x and y in the first equation, which is 2x + 1y < 40. I assume x = 0, sis, then I change the value of x to 0, getting the value of y = 40, sis. After that, I assume y = 0 again, sis. Then I change the value of y to 0, getting x = 20, sis. (EVA-1)

ST1036S : For f(0,0) the answer is zero, sis, for f(16,0) the result is 80,000, for f(0,40) the result is 120,000, and for f(8,24) the result is 112,000, sis. (EVA-5)

Based on the test results, subject ST's answers showed that ST was able to determine the intersection point using the substitution and elimination methods, enter the points into the graph and perform point testing correctly on the objective function. Based on the interview results, it showed that ST was able to describe the steps for solving equations accurately, systematically and recheck the results of his answers.

Inference Indicator

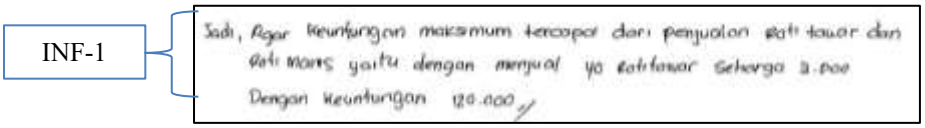

Figure 4. ST Answers to the Inference Indicator

To obtain further information, the researcher conducted an interview with ST. The following is an excerpt from the transcript of the interview with subject ST.

ST1037P : Based on all the data and steps you've taken, can you draw a conclusion from your answer? If so, what is your conclusion?

ST1038S : Yes, sis. (while pointing to the answer to problem 1) So, to achieve maximum profit from selling white bread and sweet bread, you need to sell 40 white breads for 3,000, with a profit of 120,000, sis. (INF-1)

Based on the test results, subject ST's answers indicate that ST is able to write detailed conclusions about the benefits obtained accurately.

Explanation Indicator

To find out more information, the researcher conducted an interview with ST. The following is an excerpt from the transcript of the interview with subject ST

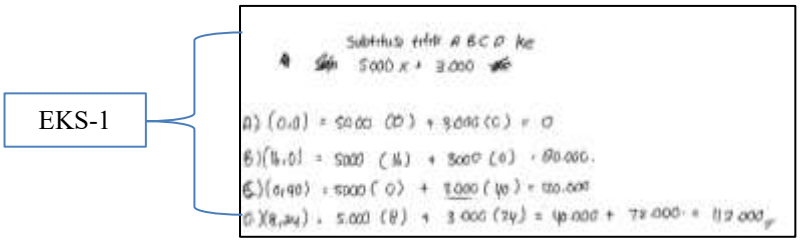

Figure 5. ST Answer to the Explanation Indicator

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ST1041P : Explain why you chose that answer?
ST1042S : (pointing to problem sheet 1) I chose this answer because I have tested the points on the graph I made, sis. I compared points A, B, C and D, sis, the largest result is point C (0.40) with a profit of 120,000, sis. (EXP-1)

Based on the test results, subject ST's answers indicate that ST is able to write detailed conclusions about the benefits obtained accurately. Based on the interview results, subject ST is able to provide logical reasons for conclusions regarding the precise benefits obtained.

Self-Regulation Indicators

ST1045P : Please check your answer again, is there a way to prove it is correct?
ST1046S : (while looking at the answer sheet for problem 1) because what is being asked is the maximum profit, sis. So, I chose the largest value, namely point C (0.40) with a profit of 120,000, sis.

Based on the interview answers, subject ST was able to review the answers obtained by using skills in reviewing questions, proving answers through substitution, and recalculating the answers obtained.

2) Subject SS

Interpretation Indicators

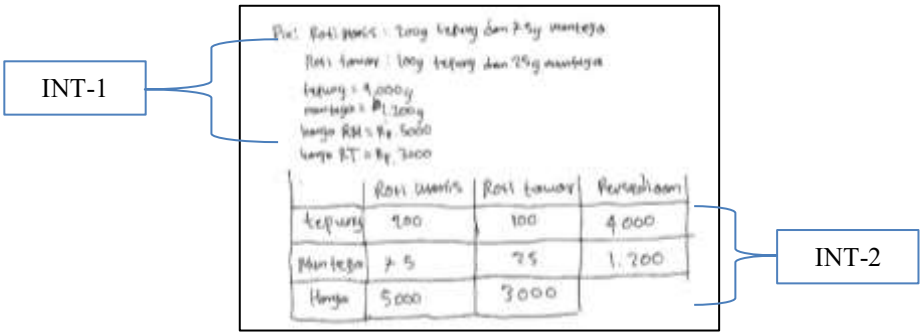

Figure 6. SS Answers to the Interpretation **Indicator**

To find out more information, the researcher conducted an interview with SS. The following is an excerpt from the transcript of the interview with subject SS.

SS1005P : From this question, what is known and what problem is being asked?
SS1006S : (see question) The "delicious bakery" shop makes sweet and plain bread. To make sweet bread, you need 200 grams of flour and 75 grams of butter, while to make plain bread, you need 100 grams of flour and 25 grams of butter. The ingredients are 4,000 grams of flour and 1,200 grams of butter. The price of sweet bread is Rp. 5,000 and plain bread is Rp. 3,000. (INT-1)

Based on the test results, subject SS answers indicate that SS is able to write down everything he knows and use a table. However, he did not write down what was asked. Based

on his interview answers, subject SS was able to determine or state what he knows and what was asked in the question.

Analysis Indicators

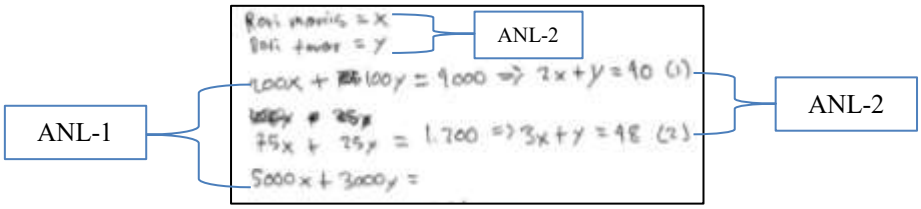

Figure 7. SS Answers to the Analysis Indicator

To obtain further information, the researcher conducted an interview with SS. The following is an excerpt from the transcript of the interview with subject SS.

SS1013P : Okay, how do you model it mathematically?

SS1014S : I first write down what I know, then create a table, then enter the knowns into the table. (INT-2)

Based on the test results data, the answers of subject SS showed that SS was able to create a mathematical model by identifying the statements in the problem. However, the subject still made a mistake in using the equal sign (=) in equations 1 and 2. Based on the results of the interview answers, subject SS showed that SS was able to explain how to create a mathematical model.

Evaluation Indicators

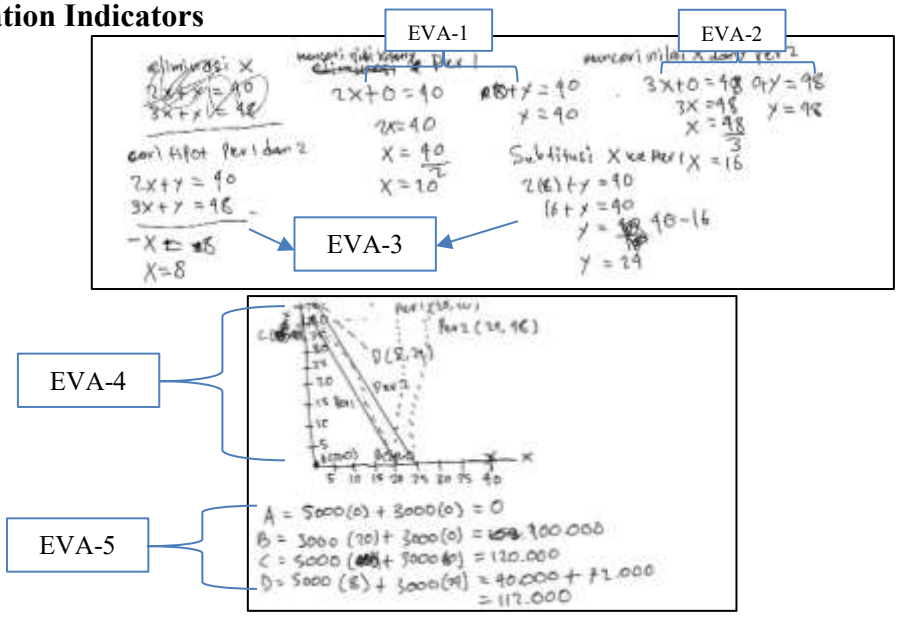

Figure 8. SS Answers to the Evaluation Indicator

To obtain further information, the researcher conducted an interview with SS. The following is an excerpt from the transcript of the interview with subject SS.

SS1019P : Are you sure that the method/steps you are using are the most effective and correct?

SS1036S : For f(0,0), the answer is zero, sis. For f(20,0), the result is 100,000, for f(0,40) the result is 120,000, and for f(8,24), the result is 112,000, sis. (EVA-5)

Based on the test results data, the SS subject's answers showed that SS was able to determine the intersection point using the substitution and elimination methods, enter the points into the graph and test the points on the objective function. However, the subject still made mistakes in entering the points into the graph, resulting in an error at point B. Based on the interview results, it showed that SS was able to describe the steps for solving the equation precisely and systematically.

Inference Indicator

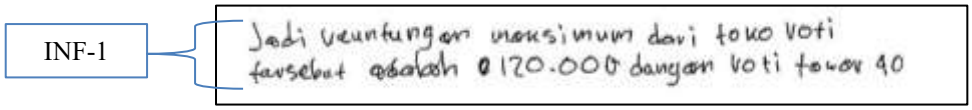

Figure 9. SS Answers to the Inference Indicator

To obtain further information, the researcher conducted an interview with SS. The following is an excerpt from the transcript of the interview with subject SS.

SS1037P : Based on all the data and steps you've taken, can you draw a conclusion from your answer? If so, what is your conclusion?

SS1038S : Yes, sir. (pointing to the answer to problem 1) So, the maximum profit for the bakery is 120,000 with 40 loaves of bread. (INF-1)

Based on the test results, subject SS's answers indicate that SS is able to write accurate conclusions about the profits obtained. Based on the interview answers, subject SS is able to provide accurate conclusions about obtaining profits.

Explanation Indicator

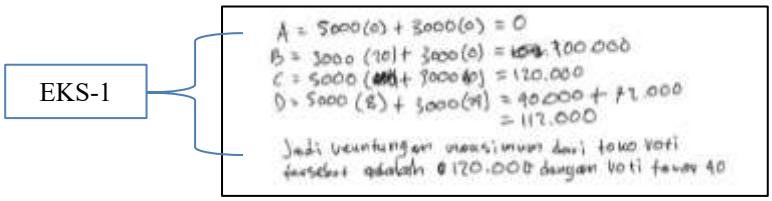

Figure 10. SS answer to the explanation indicator

To obtain further information, the researcher conducted an interview with SS. The following is an excerpt from the transcript of the interview with subject SS.

SS1041P : Explain why you chose that answer?

SS1042S : (pointing to problem sheet 1) I chose this answer because the highest result is point D (0.40) with a profit of 120,000, sis. (EXP-1)

Based on the test results, subject SS's answers indicate that he was able to write a detailed conclusion about the benefits obtained accurately. Based on the interview results, subject SS was able to draw logical conclusions about obtaining benefits accurately.

Self-Regulation Indicators

SS1045P : Please double-check your answer. Is there a way to prove it's correct?

SS1046S : (While looking at the answer sheet for problem 1) Since the question is about maximum profit, I chose the highest value, which is point C (0.40), with a profit of 120,000.

Based on the interview results, subject SS was able to review the answers obtained by looking at what was asked in the questions. This indicates that subject SS was able to systematically verify the accuracy of the answers and perform recalculations to ensure data accuracy.

3) Subject SR

Interpretation Indicators

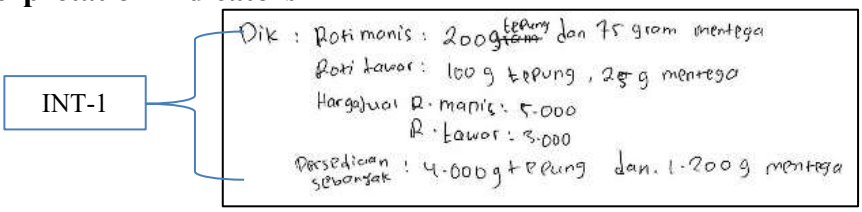

Figure 11. SR Answers to the Interpretation Indicator

To obtain further information, the researcher conducted an interview with SR. The following is an excerpt from the transcript of the interview with subject SR.

SR1005P : From this problem, what are the knowns and what are the problems being asked?

SR1006S : (Looking at the problem) What is known is that sweet bread requires 200 grams of flour and 75 grams of butter, while white bread requires 100 grams of flour and 25 grams of butter. The selling price of sweet bread is Rp 5,000 and white bread Rp 3,000. Supplies are 4,000 grams of flour and 1,200 grams of butter. (INT-1)

Based on the test results, subject SR's answers indicate that SR was able to write down everything he knew. However, he did not write down what was asked or draw a table. Based on the interview results, subject SR was able to determine or state what was known and what was asked in the question.

Analysis Indicator

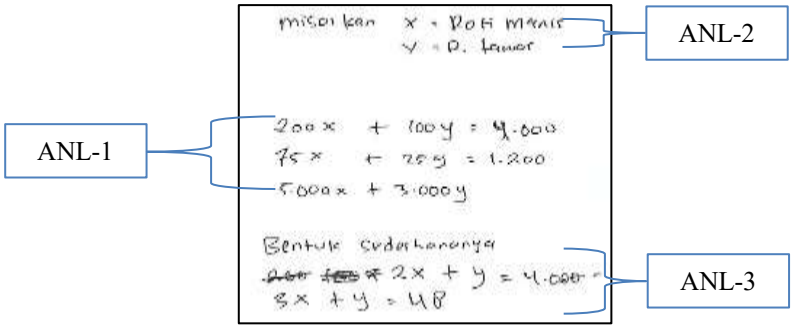

Figure 12. SR Answers to the Analysis Indicator

To obtain further information, the researcher conducted an interview with SR. The following is an excerpt from the transcript of the interview with subject SR.

SR1013P : Okay, how do you model it mathematically?

SR1014S : I'll let the sweet bread be X and the white bread be Y. (ANL-2)

SR1016S : The mathematical model is 200x + 100y = 4,000, 75x + 25y = 1,200. Then I'll simplify it to 2x + 1y = 40, 3x + y = 48. The function is 5,000x + 3,000y. (ANL-3)

Based on the test results, the answer of subject SR shows that SR is able to create a mathematical model by identifying the statements in the problem even though he does not use a table to model the mathematics. However, the subject still makes a mistake in using the equal sign (=) in equations 1 and 2. Based on the interview answers, subject SR shows that SR is able to explain how to create a mathematical model.

Evaluation Indicators

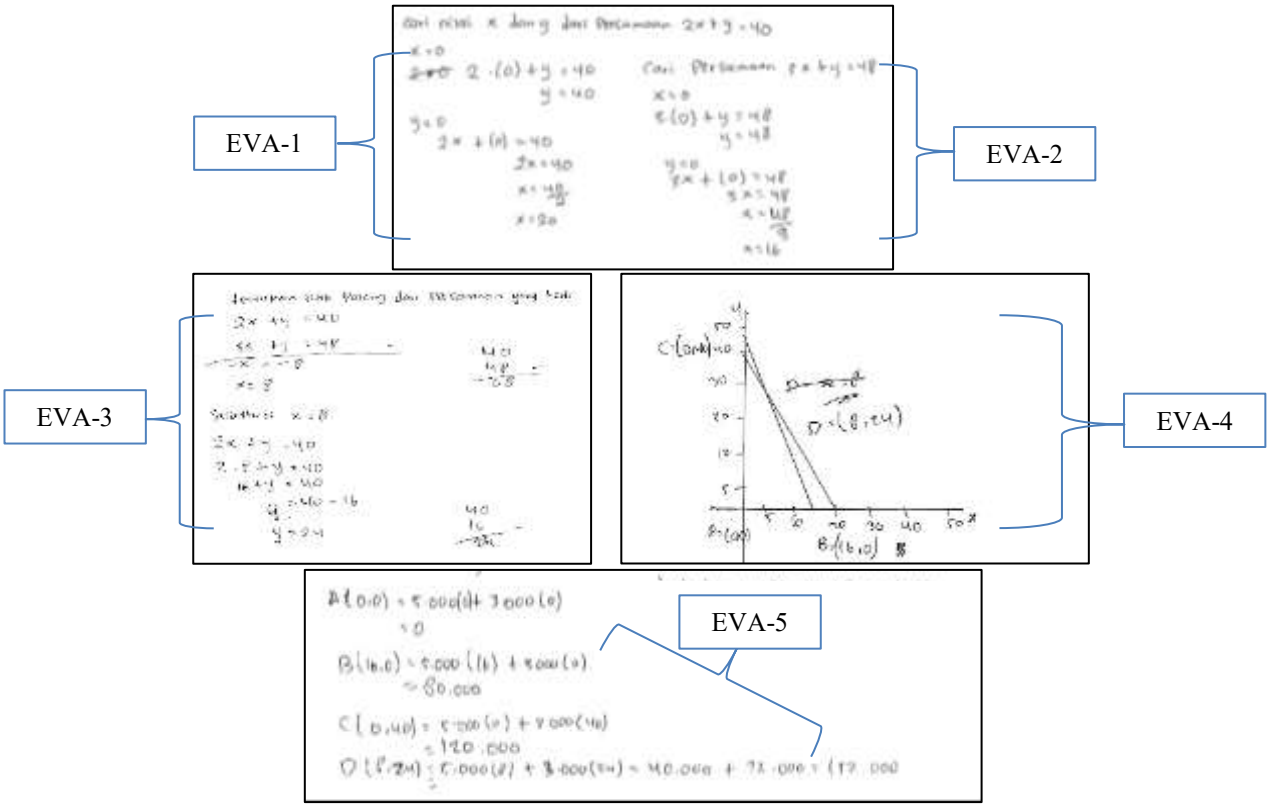

Figure 13. SR Answers to the Evaluation Indicators

To obtain further information, the researcher conducted an interview with SR. The following is an excerpt from the transcript of the interview with subject SR.

SR1017P : Are you sure the method/steps you're using are the most effective and correct?

SR1034P : For f(0,0), the answer is zero, for f(20,0) the result is 100,000, for f(0,40) the result is 120,000, and for f(8,24) the result is 112,000. (EVA-5)

Based on the test results data, the SR subject's answers indicate that SR is able to determine the intersection point using the substitution and elimination methods, enter these points into the graph and perform point testing on the objective function. Based on the interview results, it shows that SR is able to recheck and describe the steps for solving the equation precisely and systematically.

Inference indicator

Subject SR was unable to write a conclusion. To obtain further information, the researcher conducted an interview with SR. The following is an excerpt from the transcript of the interview with subject SR.

SR1035P : Based on all the data and steps you've taken, can you draw a conclusion from your answer?

SR1036S : I don't know how to draw a conclusion, sis.

Based on the interview results, subject SR was unable to draw conclusions about how to obtain profits.

Explanation Indicator

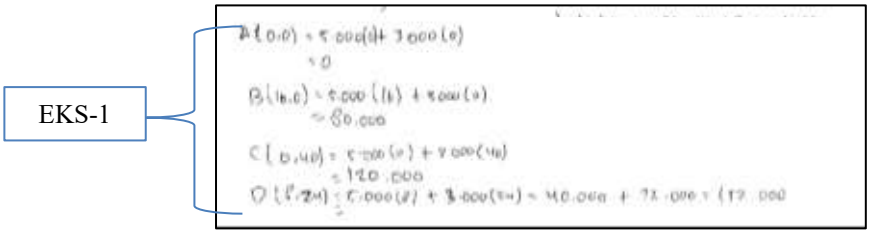

Figure 14. SR Answer to the Explanation Indicator

To obtain further information, the researcher conducted an interview with SR. The following is an excerpt from the transcript of the interview with subject SR.

SR1037P : Explain why you chose that answer?
SR1038S : (pointing to the answer sheet for problem 1) Hmm, because it has the highest score, sis.

Based on the test results, subject SR's answers indicate that she was able to write down the values of the points, although she did not write down her conclusions. Based on the interview results, subject SR was able to provide answers, but her answers were not explained in detail and she only knew them because they had the highest score.

Self-Regulation Indicators

SR1039P : Please double-check your answer. Is there a way to prove it's correct?
SR1040S : (While looking at the answer sheet for problem 1) Hmm, I don't know.

Based on the results of the interview, subject SR was unable to review the answers obtained by using skills in reviewing questions, proving answers through substitution, and recalculating the answers obtained.

3.2. Discussion

1) Critical Thinking Analysis of High-Ability Subjects (ST)

Subjects with high mathematical ability in solving linear programming problems. In the interpretation criteria, subjects with high mathematical ability were able to formulate the problem, indicating a strong understanding of the problem. However, they did not write down all the known and asked questions, using only tables to find the answer. This aligns with Fitri et al.'s (2024) opinion. In the interpretation criteria, subjects with high mathematical ability were able to formulate the problem, as demonstrated by their way of writing down the known and asked questions. However, they did not write down the known information in detail, but instead used tables to accurately represent the known information.

In the analysis criteria, subjects were able to create mathematical models by identifying the statements in the problem, but they still incorrectly used the inequality sign (<) in equations 1 and 2. This aligns with Fitri et al.'s (2024) opinion that in the analysis criteria, subjects were able to identify the questions in the problem and therefore design the mathematical model correctly.

Furthermore, in the evaluation criteria, subjects were able to use appropriate strategies to solve problems, perform calculations, and complete the solution. This aligns with the opinion of Fitri et al. (2024) who stated that the evaluation criteria include the subject's ability to use strategies to solve problems, as seen from the subject's ability to determine coordinate points, determine intersection points, and determine the objective function or maximum value.

In the inference criterion, the subject was able to accurately summarize the benefits obtained in detail. This aligns with the opinion of Fitri et al. (2024) who stated that in the

inference criterion, the subject was able to draw logical conclusions and write down the final results correctly.

Furthermore, in the explanation criterion, the subject was able to write down the final answer and explain the conclusions drawn. This aligns with the opinion of Astuti et al. (2022) who stated that the explanation indicator requires students to explain the reasons for the conclusions drawn from the problem and thus draw correct conclusions.

In the self-regulation criterion, the subject was able to review the answers obtained by using skills in re-examining questions, proving answers through substitution, and recalculating the answers obtained. This aligns with the opinion of Astuti et al. (2022) who stated that in the self-regulation indicator, students are able to understand the problem sufficiently to provide opinions that are acceptable to others.

Based on the discussion, the critical thinking skills of high-ability subjects meet the criteria of interpretation, analysis, evaluation, inference, explanation, and self-regulation. This aligns with Wulandari & Warmi's (2022) finding that students in the high category are capable of performing mathematical processes, including critical thinking skills.

2) Critical Thinking Analysis of Medium Ability Subjects (SS)

Subjects with moderate mathematical ability in solving linear programming problems demonstrated that, in the interpretation criteria, the subjects were able to understand the problem, write down all known information, and use tables. However, the subjects did not write down what was asked. This aligns with the opinion of Nahdia et al. (2022), who found that subjects with moderate ability were able to write down what was known, even though some information was omitted, and did not write down the information asked based on their ability to understand the problem.

In the analysis criteria, the subjects were able to create mathematical models by identifying the statements in the problem, but they still made errors in using the equal sign (=) in equations 1 and 2. This aligns with the opinion of Fitri et al. (2024), who stated that in the analysis criteria, the subjects were able to identify the questions in the problem and therefore design the mathematical model correctly.

Furthermore, in the evaluation criteria, the subjects were able to solve the existing equations. They were also able to determine the intersection points using the substitution and elimination methods, and plot these points on a graph. However, the subjects still made errors in plotting these points on the graph. This resulted in an error at point B. This aligns with Fitri et al.'s (2024) assessment criteria, which state that the subject is able to use strategies to solve problems, as seen by determining coordinate points, determining intersection points, and determining the objective function or maximum value.

In the inference criterion, the subject is able to accurately deduce the benefits obtained. This aligns with Fitri et al.'s (2024) assessment. In the inference criterion, the subject is able to draw logical conclusions and correctly write down the final results.

In the explanation criterion, the subject is able to write down the final answer and explain the conclusions drawn. This aligns with Astuti et al.'s (2022) assessment. For the explanation indicator, students are able to explain the reasons for the conclusions drawn from the problem and thus draw correct conclusions.

In the self-regulation criterion, the subject is able to review the answers obtained by using skills in re-examining questions, proving answers through substitution, and recalculating the answers obtained. This aligns with Astuti et al.'s (2022) assessment. For the self-regulation indicator, students are able to adequately understand the problem and provide opinions that are acceptable to others.

Based on the discussion, the critical thinking skills of subjects with moderate abilities meet the criteria for interpretation, analysis, evaluation, inference, explanation, and self-regulation. This is in line with Nuraina et al. (2024) who found that students with moderate abilities were able to meet all indicators of critical thinking skills.

3) Critical Thinking Analysis of Low Ability Subjects (SR)

Subjects with low mathematical ability in solving linear programming problems, according to the interpretation criterion, were able to understand the problem and write down everything they knew. However, they did not write down the questions asked or draw a table. This is in line with the opinion of Nahdia et al. (2022), who stated that subjects with low mathematical ability were able to write down known information but did not include the information asked based on their ability to understand the problem.

In the analysis criterion, subjects were able to create mathematical models by identifying the statements in the problem, but still incorrectly used the equal sign (=) in equations 1 and 2. This is in line with the opinion of Nahdia et al. (2022), who stated that subjects with low mathematical ability were able to write down the relationships and concepts given in the problem, namely by writing examples and mathematical models, but there were inaccuracies in writing the mathematical models.

The evaluation criterion also demonstrated the ability to correctly explain how to solve the equations. Subjects were also able to determine the intersection points using the substitution and elimination methods and plot these points on a graph. This aligns with Fitri et al.'s (2024) assessment criteria, which demonstrates the subject's ability to use strategies to solve problems, as evidenced by the subject's ability to determine coordinate points, determine intersection points, and determine the objective function or maximum value.

In the inference criterion, the subject was also unable to draw logical conclusions and correctly write down the final results. This aligns with Astuti et al.'s (2022) finding that, for the inference indicator, students were unable to connect and explain data and concepts from the material they had learned to draw conclusions from the problem.

In the explanation criterion, the subject was unable to write down the final answer and explain the conclusions drawn. This aligns with Astuti et al.'s (2022) finding that, for the explanation indicator, students were unable to explain the reasoning behind the conclusions drawn from the problem, thus making it impossible to draw conclusions.

In the self-regulation criterion, the subject was unable to review the answers obtained by using skills in re-examining questions, proving answers through substitution, and recalculating the answers obtained. This aligns with Astuti et al.'s (2022) finding that, for the self-regulation indicator, students were unable to explain written proofs.

Based on the discussion, the critical thinking skills of low-ability subjects only met the interpretation, analysis, and evaluation criteria. This aligns with Hatria (2024) who found that low-ability students were only able to meet the interpretation, analysis, and evaluation indicators.

CONCLUSION

1. High-ability subjects fulfill all critical thinking indicators: interpretation, analysis, evaluation, inference, explanation, and self-regulation. They can understand, model, solve, conclude, and re-evaluate the problem completely and accurately.
2. Medium-ability subjects also fulfill all critical thinking indicators, but with noted inaccuracies in the analysis (using wrong sign) and evaluation (graph plotting error) stages. They can still reach a correct final conclusion through logical reasoning.
3. Low-ability subjects only meet the interpretation, analysis, and evaluation indicators. They fail at the inference, explanation, and self-regulation stages, unable to conclude meaningfully, justify their answers, or self-correct their work.

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