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Mathematical Reasoning Analysis Based on Students' Emotional Stability

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Abstract: High school students enter adolescence, a period full of challenges, including changes in their physical, emotional, cognitive, social, and behavioral aspects. The inability to adapt to these changes often leads to problems. Therefore, problem-solving skills are necessary. This study explores the relationship between students' emotional stability and their mathematical reasoning abilities. The research aims to understand how variations in emotional stability impact the cognitive process involved in mathematical reasoning. A descriptive qualitative approach was used to examine the mathematical reasoning abilities of twelfth-grade students in Bandung. Participants were selected using purposive sampling based on specific criteria related to their emotional stability and reasoning abilities. The instruments included a mathematical reasoning test and an emotional stability questionnaire measured on a Likert scale. The results indicate that students with high emotional stability demonstrate very good mathematical reasoning abilities, meeting all relevant indicators. In contrast, students with medium emotional stability show good reasoning skills, meeting three to four indicators. Students with low emotional stability, however, fall into the poor category, meeting only one or two indicators. These findings suggest that emotional stability significantly influences students' ability to reason mathematically. The study recommends that educators create engaging and supportive learning environments to enhance students' emotional stability and, consequently, their mathematical reasoning abilities. Training programs for students with low emotional stability are advised to help them focus better and improve their cognitive abilities. Future research should further investigate the interplay between emotional stability and mathematical reasoning across different subjects and educational levels to develop more effective educational strategies.

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INTRODUCTION

The National Council of Teachers of Mathematics formulated a conceptual framework, *Focus in High School Mathematics: Reasoning and Sense-making*, as a guideline for developing mathematics curriculum and instruction. Mathematical reasoning involves the ability to think logically, form hypotheses, and solve problems through deductive and inductive reasoning (National Council of Teachers of Mathematics, 2009). This cognitive process might be influenced by students' emotional ability. As both emotional and logical creatures, humans' psychological well-being might affect cognitive ability and vice versa. In that regard, students' emotional stability might influence their cognitive process. Based on (Smithson, 1974), Smithson described emotional stability as a noncognitive, multi-trait psychological concept. A person's emotional stability is defined as a process in which they continually strive to achieve greater emotional health on both an intrapsychic and intrapersonal level. When a person has emotional stability, they can perceive life's problems in an integrated and balanced manner.

In recent years, researchers have examined the relationship between mathematical reasoning abilities and emotional stability in educational settings. This has revealed significant insights into students' academic performance and emotional well-being. A student response questionnaire and descriptive qualitative study were employed to assess students' perceptions and capabilities in the

domain of mathematical reasoning, in particular in the context of geometry (Ayuningtyas & Pramudya, 2019; Wahyuni, Susanto, & Hadi, 2019). According to (Ayuningtyas & Pramudya, 2019), these studies reveal a wide range of reasoning abilities among students, highlighting students' positive responses to geometry reasoning test instruments and their ability to enhance mathematical reasoning abilities. As in (Wahyuni, Susanto, & Hadi, 2019), the different levels of reasoning abilities required to solve geometry problems are identified, indicating that targeted instructional strategies will be necessary to enhance these abilities. Considering geometry as a critical area of mathematical reasoning provides a solid foundation for further investigation into educational interventions that can enhance students' analytical abilities.

Students' emotional and cognitive experiences in educational contexts provide significant insights, particularly concerning their ability to reason mathematically and emotionally. (Ayuningtyas & Pramudya, 2019) provides an in-depth assessment of the geometry reasoning abilities of high school students, using essays and interviews to gather the necessary information. According to this approach, students exhibit varying levels of reasoning abilities, with many demonstrating average abilities and struggling to formulate generalizations and validate arguments. In the same vein, (Bieleke, et al., 2023) examines the impact of emotions on mathematics achievement by using the Achievement Emotions Questionnaire—Mathematics (AEQ-M). As a result of this study, it has been demonstrated that emotions have a powerful impact on students' mathematics learning outcomes, both positive and negative. In this study, cognitive skills and emotional experiences are intertwined, emphasizing the need for educational strategies that address both aspects to enhance students' overall performance in academics.

Articles (Manlunas, et al., 2021; Kumaravelu, 2018) provide valuable insights into the relationship between academic achievement and emotional stability. (Manlunas, et al., 2021) explores this connection. According to the results, emotional stability positively correlates with stress management ability, although the correlation is weak using Likert-type questionnaires to assess emotional stability and stress management among Grade 12 students. This indicates that supportive educational and home environments are critical to nurturing students' emotional resilience. Similarly, (Kumaravelu, 2018) examines high school students' emotional stability and academic achievement, revealing significant differences according to gender, location, and management style. The findings highlighted the complex relationship between emotional stability and academic performance, advocating for integrated education approaches that consider cognitive and emotional factors.

In their article, (Wani, et al., 2016) examine this dimension within Annamalai University's diverse student population by taking a different approach to emotional stability among university students. According to the study, there are no significant differences in emotional stability between genders or between students in general and SC categories using the Emotional Stability Test developed by A. S. Gupta and A.K. Singh. This study's results suggest that students' emotional well-being is uniform, highlighting the need for inclusive emotional support programs. As a result of these studies, educational institutions must consider the full spectrum of students' experiences, both cognitive and emotional, in order to develop environments conducive to learning and growth. Educators can support students in navigating their academic and emotional landscapes better by addressing the challenges and leveraging the strengths identified in these works.

Moreover, the development of reliable tools for assessing emotional stability represents a crucial advancement in psychological and educational research. (Chaturvedi & Chander, 2010) concerned with developing a comprehensive emotional stability scale encompassing multiple emotional dimensions. After carefully analyzing and validating item data, a 50-item scale demonstrating strong reliability and validity has been developed. This tool facilitates a nuanced understanding of emotional stability to support students' emotional well-being.

An article from (Serebryakova, et al., 2016) emphasizes the importance of integrating emotional support and adaptive strategies within educational settings by investigating the psychological adaptation of first-year university students. The study highlights that emotional stability plays an essential role in facilitating students' adaptation to the academic and social demands of higher education. Students exhibited significant adaptiveness in group settings despite emotional discomfort in group settings, as determined by established psychological tests. According to the results of this study, psychological

programs are necessary for the development of students' emotional stability, thereby supporting their overall academic achievement and adaptation process. The contribution of this research lies in the analysis of mathematical reasoning indicators viewed through the lens of emotional stability levels, specifically at the high school level, offering new insights into how emotional factors influence cognitive abilities during this critical educational stage.

This paper examines the relationship between students' mathematical reasoning abilities and their emotional stability, examining how variations in emotional stability may affect mathematical reasoning abilities. To provide insight into educational strategies that can be applied in academic settings to enhance emotional stability and mathematical reasoning, this study investigates the underlying mechanisms by which emotional well-being impacts students' ability to engage with and solve mathematical problems.

METHOD

In this study, we conducted a descriptive qualitative study to examine students' mathematical reasoning abilities in solving three-dimensional problems from the perspective of emotional stability. For this study, we investigated the mathematical reasoning abilities of twelfth-grade students in Bandung. Based on specific criteria relating to mathematical reasoning abilities and emotional stability levels, purposive sampling was used to select participants representative of the broader student population.

The instruments used in this study consisted of two main components: a mathematical reasoning ability test comprising 5 questions with a reliability of 0.834 and an emotional stability test consisting of 11 questions with a reliability of 0.72. The latter was measured on a Likert scale ranging from 1 to 5, with scores between 1 and 5.

This research was initiated by categorizing the students' emotional stability levels as the first step. Based on a reference assessment scale, students were divided into three categories: high, medium, and low emotional stability. Table 1 provides information on the emotional stability of students based on their level (Jyosthna & Shakila, 2023).

Table 1. Emotional Stability Classification

Emotional stability	Category
$X < (\bar{x} - 1{,}0\ SD)$	Low
$(\bar{x} - 1{,}0\ SD) \leq X \leq (\bar{x} + 1{,}0\ SD)$	Medium
$(\bar{x} + 1{,}0\ SD) \leq X$	High

Based on the (National Council of Teachers of Mathematics, 2000) standards, the indicators for mathematical reasoning ability were aligned, including formulating hypotheses, performing mathematical manipulations, drawing conclusions, constructing proofs, proving the validity of solutions, verifying the validity of arguments, and identifying patterns and properties in mathematical phenomena (see Table 2).

Table 2. Mathematical Reasoning Indicators

No.	Indicator
1	Presenting mathematical statements in written and graphical form.
2	Formulating hypotheses.
3	Performing mathematical manipulations.
4	Constructing proofs, providing reasons or evidence for solution validity.
5	Drawing final conclusions.

This methodological approach provided a comprehensive analysis of the relationship between students' emotional stability and their mathematical reasoning abilities, providing insight into how emotional factors can influence academic performance in mathematics (Jyosthna & Shakila, 2023).

Research Instruments

This study used an emotional stability questionnaire adapted from (Manlunas, et al., 2021) which demonstrated a reliability of 0.72. The instrument includes a series of questions intended to assess a number of emotional stability aspects among the participants. A Likert scale is used to measure respondents' level of emotional stability, from "Strongly Agree" (SA) to "Strongly Disagree" (SD), allowing a more nuanced understanding of the respondents' emotional stability. Table 3 shows the questions that are included in the questionnaire.

Table 3. Emotional Stability Questionnaire

No.	Question	SD (1)	D (2)	N (3)	A (4)	SA (5)
1	I am aware of the relationship between my feelings and what I think, do, and say.					
2	I understand how feelings affect my performance.					
3	I have a guiding awareness of my values and goals.					
4	I am aware of my strengths and weaknesses.					
5	I am reflective and try to learn from experiences.					
6	I am open to honest feedback, new perspectives, continuous learning, and self-development.					
7	I can show humor and perspective about myself.					
8	I present myself with confidence; I have "presence."					
9	I can voice unpopular views and take risks for what is right.					
10	I always know what emotions I am feeling and why.					
11	I am assertive and able to make correct decisions under uncertainty and pressure.					

This questionnaire is a valuable tool for assessing the emotional stability of high school students. It provides insight into how their emotional awareness and control abilities may impact their ability to reason mathematically and their overall academic performance.

Table 4 shows an example of questions and solutions in this mathematical reasoning assessment instrument. The process of mathematical reasoning within our study is exemplified by using calculus-based problems to evaluate students' analytical capabilities. As depicted in our research instruments, students are presented with a scenario that requires a thorough comprehension of the given mathematical facts and the application of logical reasoning. In one instance, students were given a quadratic function $f(x) = 2x^2 - 3x - 2$, and asked to determine the presence and nature of its extreme points, a fundamental aspect of calculus. The process involves identifying the critical points by setting the derivative $f'(x) = 4x - 3$ to zero, and solving for x, which leads to a critical point at $x = \frac{3}{4}$. Further analysis, involving the second derivative $f''(x) = 4$, confirms the nature of the extremum, with $f''\left(\frac{3}{4}\right) > 0$ indicating a minimum extreme point. This methodical approach assesses the student's mastery of calculus concepts and their ability to draw logical conclusions from a set of mathematical premises—skills crucial for their academic development in mathematics. As we examine the correlation between such cognitive exercises and emotional stability, it is apparent that the depth of mathematical understanding is potentially influenced by the student's emotional state, reinforcing the importance of our study's objective.

The data analysis was conducted by describing each indicator of mathematical reasoning based on the levels of emotional stability. Specifically, the study examined how students at different levels of emotional stability performed across various indicators of mathematical reasoning. This involved a detailed analysis of the students' ability to present mathematical statements, formulate hypotheses,

perform mathematical manipulations, construct proofs, and draw conclusions. The analysis was structured to compare and contrast the performance of students within each emotional stability category—high, medium, and low—providing insights into how emotional factors influence cognitive abilities in mathematical reasoning. This methodical approach ensured a comprehensive understanding of the interplay between emotional stability and mathematical reasoning abilities.

Table 4. Mathematical Reasoning Problem Sample

Mathematical Reasoning Indicator	No.	Question	Sample solution	Bloom's Level
		…		
Drawing final conclusion	5	Given the following facts: If $f(x) = 2x^2 - 3x - 2$, then $f(x)$ has at least one extreme point. If $f(x)$ has only one extreme point, then $f(x)$ has either a minimum or maximum extreme. Draw a conclusion from both statements and determine the extreme point and its type! Note: Syllogism $p \to q$ $q \to r$ $\therefore p \to r$	The conclusion of the statements: $p \to r$: If $f(x) = 2x^2 - 3x - 2$, then $f(x)$ has either a minimum or maximum extreme. Determine extreme point and its type through calculus methods: Determine the derivative of $f(x)$ to zero and solve x. $f'(x) = 4x - 3 = 0$ $x = \frac{3}{4}$ Determine the $y = f(x)$ by substituting $x = 3/4$ to. $f\left(\frac{3}{4}\right) = 2\left(\frac{3}{4}\right)^2 - 3\left(\frac{3}{4}\right) - 2$ $y = -25/8$ $\therefore (x, y) = \left(\frac{3}{4}, -\frac{25}{8}\right)$ Determine the second derivative of $f(x)$ to find the nature of the extremum. $f''(x) = 4 > 0$ ∴ Extremum is a minimum extreme point.	C4
		…		

RESULTS

Data from questionnaires distributed to 36 twelfth-grade students were analyzed to assess their levels of emotional stability. The students were classified into three categories: low, medium, and high emotional stability, based on their scores. As shown in Table 5, students with scores of 33 or below were classified as having low emotional stability, those with scores between 33 and 45 were classified as medium, and those with scores above 45 were classified as high. This classification provides a clear understanding of the emotional stability distribution among the students. Transitioning from

classification, we now examine the distribution percentages.

Table 5. Classification of Emotional Stability

Emotional stability	Category
$X \leq 33$	Low
$33 < X < 45$	Medium
$45 \geq X$	High

Table 6 depicts the percentage distribution of emotional stability among the students. It reveals that 19% of the students were categorized as having high emotional stability, 58% as medium, and 22% as low. This distribution indicates that a majority of the students fall into the medium category, with a smaller percentage in the high and low categories. Understanding this distribution is crucial for identifying how emotional stability might influence mathematical reasoning abilities. With this foundation, we can now explore the selected subjects for deeper analysis.

Table 6. Percentage Distribution of Emotional Stability

Category	Frequency	Percentage
High	7	19%
Medium	21	58%
Low	8	22%

For the analysis of mathematical reasoning abilities, two students from each emotional stability category were selected. These subjects were coded as P-1 and P-2 for high stability, P-3 and P-4 for medium stability, and P-5 and P-6 for low stability, as presented in Table 7. This selection process ensures that the analysis covers a representative sample from each stability category, providing a comprehensive view of how emotional stability affects reasoning abilities. We begin our detailed examination with subjects exhibiting high emotional stability.

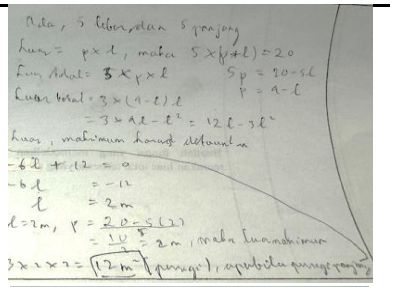
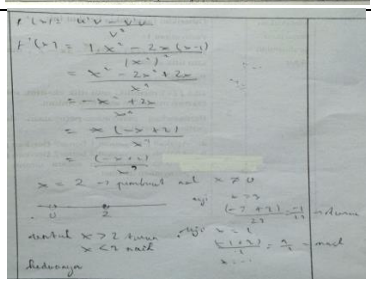
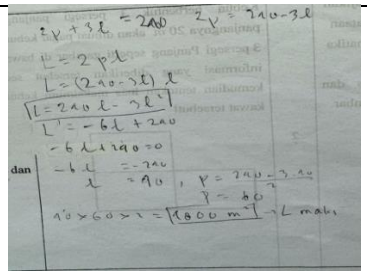
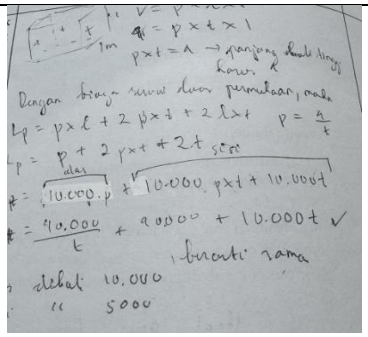
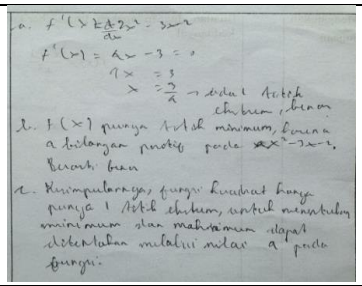
Table 7. Selected Subjects for Analysis

Category	Student Code
High	P-1
	P-2
Medium	P-3
	P-4
Low	P-5
	P-6

Mathematical Reasoning of Subject P-1 (High Emotional Stability)

Table 8 summarizes the test results for Subject P-1. Subject P-1 demonstrated a high level of mathematical reasoning ability based on the test results. In question 1, P-1 effectively translated statements into mathematical form. For question 2, P-1 accurately estimated the method to solve the problem, leading to the correct answer. In question 3, P-1 solved the problem using the prescribed method. Question 4 saw P-1 proving the correctness of statements systematically and thoroughly. However, in question 5, although P-1 drew accurate conclusions, the steps to reach these conclusions were not fully detailed. This indicates that while P-1 has strong reasoning skills, there is room for improvement in elaborating solution steps. Transitioning to the next subject, we analyze P-2's performance.

Table 8. Summary of Test Results for Subject P-1

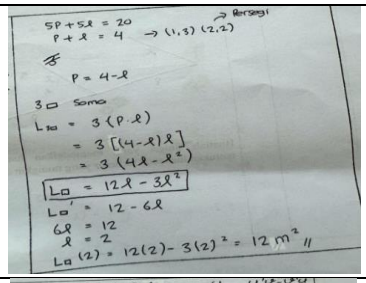
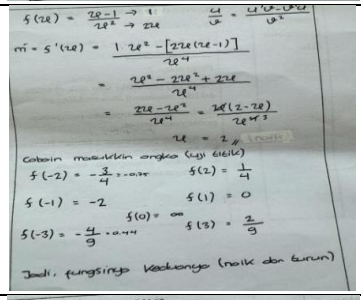
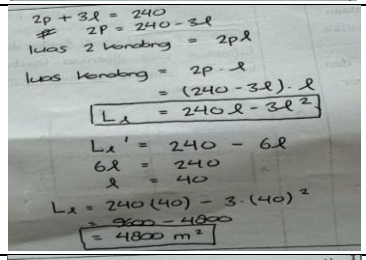
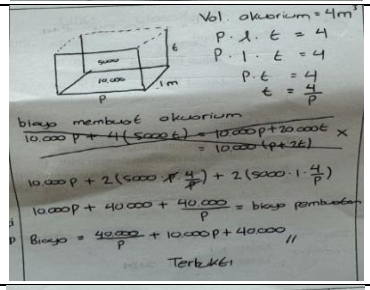
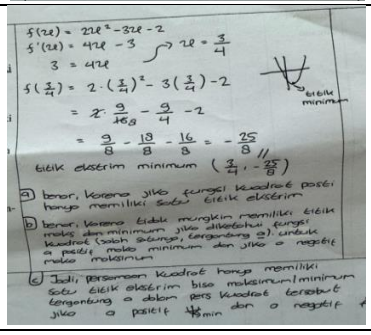
Mathematical Reasoning Capability Indicator	Mathematical Reasoning Evaluation Result	Student's Work Image
Presenting mathematical statements in writing and images	Subject P-1 correctly and accurately presented statements in written mathematical models, effectively restating problem information mathematically.	
Making conjectures	Subject P-1 accurately estimated or determined the method to solve the problem and provided detailed explanations for the conjectures.	
Performing mathematical manipulations	Subject P-1 correctly solved the problem as per the determined method and explained the steps used.	
Constructing proofs and providing reasons	Subject P-1 accurately provided proof for the solution and explained the proof method well.	
Making conclusions	Subject P-1 correctly wrote the conclusion but did not detail all the solution steps. However, the final conclusion was accurate.	

Mathematical Reasoning of Subject P-2 (High Emotional Stability)

Table 9 summarizes the test results for Subject P-2. Subject P-2 displayed comprehensive mathematical reasoning ability across all test indicators. In question 1, P-2 effectively presented mathematical statements. For question 2, P-2 accurately determined the appropriate method to solve the problem, resulting in a correct answer. P-2 followed the prescribed method correctly in question 3. In question 4, P-2 provided complete and systematic proof of the statements. Additionally, P-2 outlined the

solution steps and conclusions comprehensively in question 5. These results highlight that P-2's high emotional stability contributes to an excellent overall performance in mathematical reasoning. Moving on, we now evaluate subject P-3, who has medium emotional stability.

Table 9. Summary of Test Results for Subject P-2

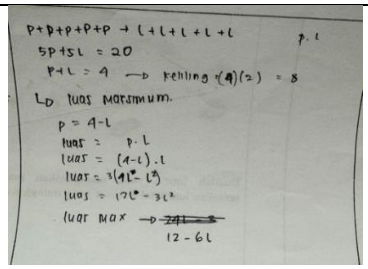
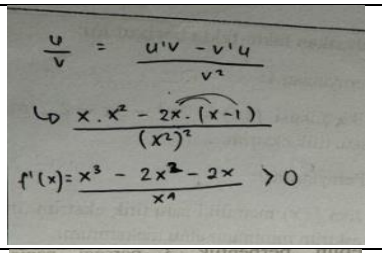
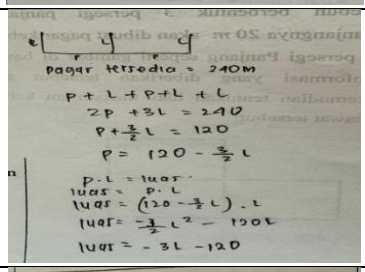
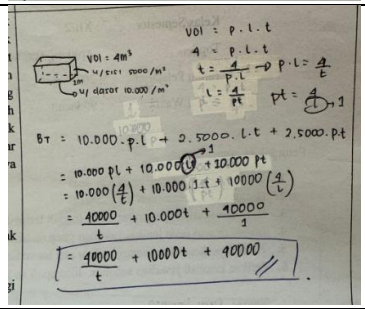
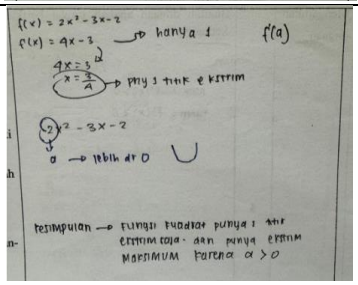
Mathematical Reasoning Capability Indicator	Mathematical Reasoning Evaluation Result	Student's Work Image
Presenting mathematical statements in writing and images	Subject P-2 correctly and accurately presented statements in written mathematical models, effectively restating problem information mathematically.	
Making conjectures	Subject P-2 accurately estimated or determined the method to solve the problem and provided detailed explanations for the conjectures.	
Performing mathematical manipulations	Subject P-2 correctly solved the problem as per the determined method and explained the steps used.	
Constructing proofs and providing reasons	Subject P-2 accurately provided proof for the solution and explained the proof method well.	
Drawing conclusions	Subject P-2 correctly wrote the conclusion and detailed the solution steps.	

Mathematical Reasoning of Subject P-3 (Medium Emotional Stability)

Table 10 summarizes the test results for Subject P-3. Subject P-3 demonstrated moderate proficiency in mathematical reasoning, meeting three out of five indicators. In question 1, P-3 presented

mathematical statements accurately but did not complete the task. For question 2, P-3 struggled to determine the correct solution method, leading to an incorrect answer. Question 3 revealed errors in distributive multiplication, preventing correct problem resolution. P-3, however, provided systematic proof in question 4 and wrote conclusions based on previous knowledge rather than the current material in question 5. These results suggest that P-3's fluctuating emotional state impacts their reasoning ability. Next, we analyze subject P-4's performance, also within the medium stability category.

Table 10. Summary of Test Results for Subject P-3

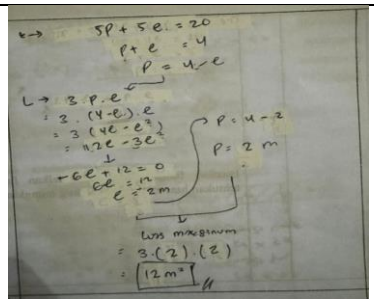
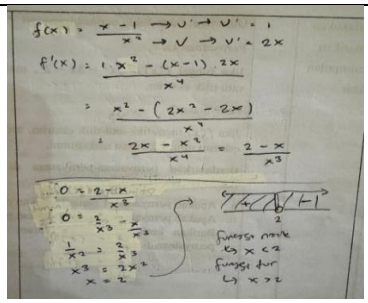
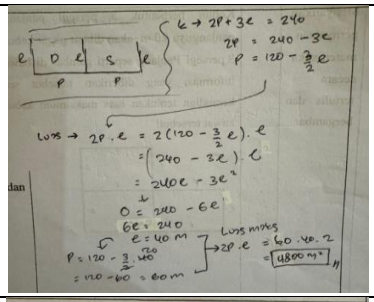
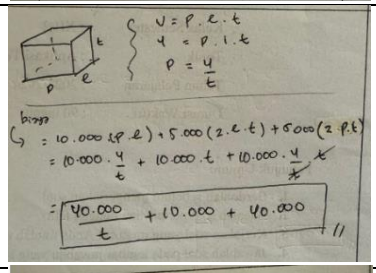
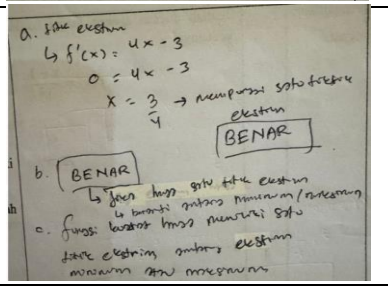
Mathematical Reasoning Capability Indicator	Mathematical Reasoning Evaluation Result	Student's Work Image
Presenting mathematical statements in writing and images	Subject P-3 correctly presented statements in written mathematical models but did not complete them.	
Making conjectures	Subject P-3 did not accurately estimate or determine the method to solve the problem.	
Performing mathematical manipulations	Subject P-3 did not correctly solve the problem due to errors in distributive multiplication.	
Constructing proofs and providing reasons	Subject P-3 accurately provided proof and explained the solution steps.	
Drawing conclusions	Subject P-3 wrote conclusions based on previous knowledge rather than the current material.	

Mathematical Reasoning of Subject P-4 (Medium Emotional Stability)

Table 11 summarizes the test results for Subject P-4. Subject P-4 exhibited good mathematical reasoning abilities, meeting four out of five indicators. In question 1, P-4 effectively translated statements

into mathematical form. However, in question 2, P-4 struggled with determining the appropriate solution method, resulting in an incorrect answer. P-4 accurately followed the prescribed method in question 3 and provided complete and systematic proof in question 4. In question 5, P-4 wrote accurate conclusions but did not detail all the solution steps. These findings indicate that P-4's performance is generally good, though affected by their ability to manage situational fluctuations. We now turn to subject P-5, who has low emotional stability.

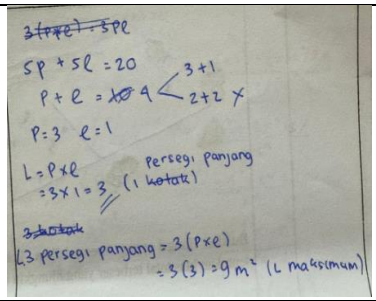
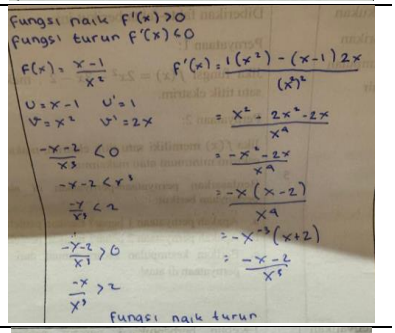
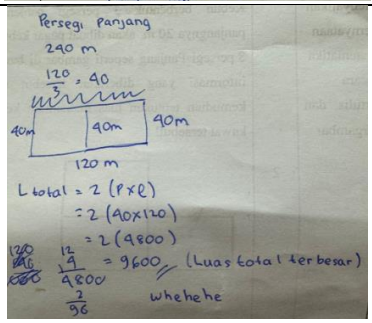
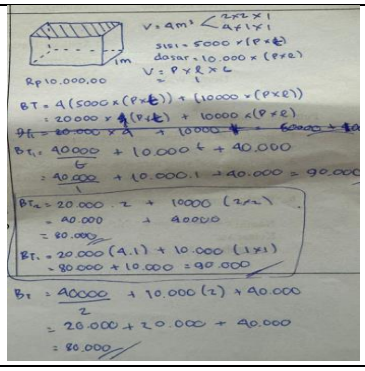
Table 11. Summary of Test Results for Subject P-4

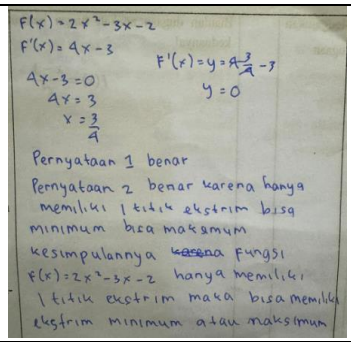
Mathematical Reasoning Capability Indicator	Mathematical Reasoning Evaluation Result	Student's Work Image
Presenting mathematical statements in writing and images	Subject P-4 correctly and accurately presented statements in written mathematical models, effectively restating problem information mathematically.	
Making conjectures	Subject P-4 did not accurately estimate or determine the method to solve the problem.	
Performing mathematical manipulations	Subject P-4 correctly solved the problem as per the determined method.	
Constructing proofs and providing reasons	Subject P-4 accurately provided proof and explained the proof method well.	
Drawing conclusions	Subject P-4 correctly wrote the conclusion but did not detail all solution steps.	

Mathematical Reasoning of Subject P-5 (Low Emotional Stability)

Table 12 summarizes the test results for Subject P-5. Subject P-5 showed limited mathematical reasoning abilities, meeting only two out of five indicators. In question 1, P-5 struggled to present mathematical statements effectively. P-5 could not accurately determine the solution method in question 2, leading to incorrect answers. In question 3, P-5 failed to solve the problem using the prescribed method. However, P-5 provided systematic proof in question 4 and wrote correct but incomplete conclusions in question 5. These results suggest that P-5's low emotional stability significantly hinders their reasoning skills. Lastly, we examine subject P-6's performance.

Table 12. Summary of Test Results for Subject P-5

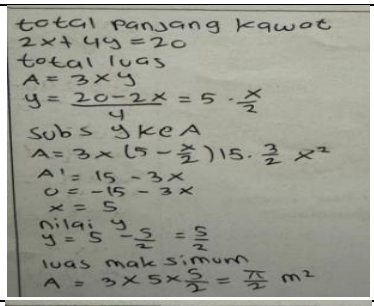
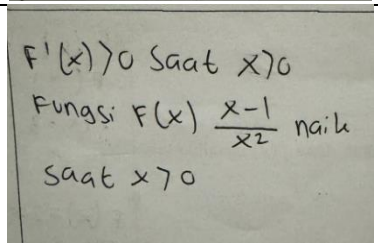
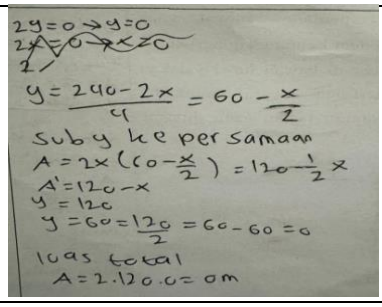
Mathematical Reasoning Capability Indicator	Mathematical Reasoning Evaluation Result	Student's Work Image
Presenting mathematical statements in writing and images	Subject P-5 did not fully present statements in written mathematical models and struggled with variable understanding, leading to incorrect final answers.	
Making conjectures	Subject P-5 did not accurately estimate or determine the method to solve the problem.	
Performing mathematical manipulations	Subject P-5 did not correctly solve the problem as per the determined method.	
Constructing proofs and providing reasons	Subject P-5 accurately provided proof and explained the solution steps.	

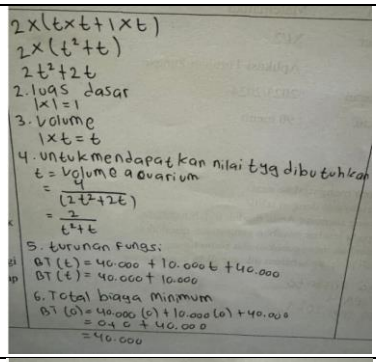
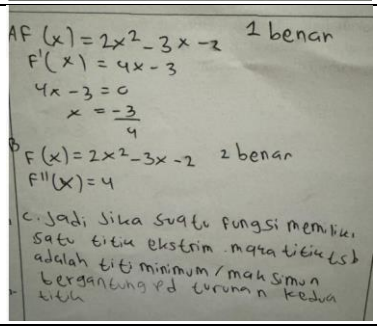
Mathematical Reasoning Capability Indicator	Mathematical Reasoning Evaluation Result	Student's Work Image
Drawing conclusions	Subject P-5 correctly wrote the conclusion but did not detail all solution steps.	

Mathematical Reasoning of Subject P-6 (Low Emotional Stability)

Table 13 summarizes the test results for Subject P-6. Subject P-6 met only one of the five indicators, reflecting significant challenges in mathematical reasoning. In question 1, P-6 effectively translated statements into mathematical form. However, in question 2, P-6 struggled to determine the correct method, leading to incorrect answers. P-6 could not follow the prescribed method in question 3 and failed to provide accurate proof in question 4. In question 5, P-6 drew conclusions accurately but did not detail the solution steps. These results highlight the substantial impact of low emotional stability on reasoning skills, underscoring the need for strategies to improve emotional regulation among these students.

Table 13. Summary of Test Results for Subject P-6

Mathematical Reasoning Capability Indicator	Mathematical Reasoning Evaluation Result	Student's Work Image
Presenting mathematical statements in writing and images	Subject P-6 did not correctly present statements in written mathematical models, leading to incorrect final answers.	
Making conjectures	Subject P-6 did not accurately estimate or determine the method to solve the problem.	
Performing mathematical manipulations	Subject P-6 did not correctly solve the problem as per the determined method.	

Mathematical Reasoning Capability Indicator	Mathematical Reasoning Evaluation Result	Student's Work Image
Constructing proofs and providing reasons	Subject P-6 did not accurately provide proof or explain the solution steps.	
Drawing conclusions	Subject P-6 correctly wrote the conclusion but did not detail all the solution steps.	

DISCUSSION

Mathematical Reasoning Ability of Subject P-1 with High Emotional Stability

Subject P-1 demonstrated proficiency in four out of five mathematical reasoning indicators. P-1 effectively wrote mathematical statements, made conjectures, determined problem-solving methods, and provided clear and systematic proofs. However, P-1's conclusions were not entirely based on solving all problem statements. This indicates that students with high emotional stability possess excellent reasoning skills, likely due to their ability to manage their emotions. This observation is consistent with (Wylie & Burus, 1979), who noted that emotionally stable students have higher self-confidence and greater success. (Jyosthna & Shakila, 2023) also found a positive relationship between emotional stability, social intelligence, and academic performance. Moving forward, we will examine the reasoning abilities of another student with high emotional stability, Subject P-2.

Mathematical Reasoning Ability of Subject P-2 with High Emotional Stability

Subject P-2 met all five mathematical reasoning indicators, showcasing a complete set of skills. P-2 effectively wrote mathematical statements, made detailed conjectures, determined problem-solving methods, provided thorough proofs, and drew well-founded conclusions. This comprehensive performance reinforces the correlation between high emotional stability and excellent reasoning skills. Similar to P-1, P-2's ability to manage emotions effectively contributes to their strong performance. This aligns with findings by (Wylie & Burus, 1979) and (Jyosthna & Shakila, 2023), who emphasized the positive impact of emotional stability on academic success. Transitioning to the next category, we will now analyze the reasoning abilities of Subject P-3 with medium emotional stability.

Mathematical Reasoning Ability of Subject P-3 with Medium Emotional Stability

Subject P-3 demonstrated moderate proficiency in mathematical reasoning, meeting three out of five indicators. P-3 accurately wrote mathematical statements, provided systematic proofs, and drew conclusions based on problem statements but struggled with making conjectures and determining solution methods. This suggests that while P-3 has good reasoning skills, their fluctuating emotional state affects their performance. The ability to manage situational and emotional fluctuations plays a significant role in P-3's reasoning abilities. This finding supports (Sukatin, Kharisma, & Safitri, 2023), who highlighted that good emotional stability helps maintain concentration, manage anxiety, and stay focused on learning

goals. We will now examine Subject P-4, another student with medium emotional stability.

Mathematical Reasoning Ability of Subject P-4 with Medium Emotional Stability

Subject P-4 exhibited strong mathematical reasoning abilities, meeting four out of five indicators. P-4 effectively wrote mathematical statements, performed manipulations, provided systematic proofs, and drew accurate conclusions but did not make accurate conjectures. This further demonstrates that students with medium emotional stability can perform well but are influenced by their ability to manage situational fluctuations. P-4's performance aligns with (Sukatin, Kharisma, & Safitri, 2023), who emphasized the importance of emotional stability in maintaining focus and managing anxiety. We will now discuss the reasoning abilities of Subject P-5 with low emotional stability.

Mathematical Reasoning Ability of Subject P-5 with Low Emotional Stability

Subject P-5 showed limited proficiency in mathematical reasoning, meeting only two out of five indicators. P-5 successfully constructed proofs and drew conclusions but struggled with writing mathematical statements, making conjectures, and performing manipulations accurately. This suggests that low emotional stability hinders reasoning skills due to difficulties in concentration and anxiety management. P-5's performance highlights the significant role of emotional stability in academic success. (Fitriyah, Wijayadi, Manasikana, & Hayati, 2019) also emphasized the importance of good emotional stability for facing learning challenges positively and confidently. We will now evaluate the reasoning abilities of Subject P-6, another student with low emotional stability.

Mathematical Reasoning Ability of Subject P-6 with Low Emotional Stability

Subject P-6 met only one of the five mathematical reasoning indicators, reflecting significant challenges. P-6 was able to draw conclusions but failed to write mathematical statements, make conjectures, perform manipulations, or provide systematic proofs accurately. This highlights the substantial impact of low emotional stability on reasoning skills. P-6's performance underscores the need for strategies to improve emotional regulation among students. (Fitriyah, Wijayadi, Manasikana, & Hayati, 2019) noted that good emotional stability is crucial for maintaining focus and managing anxiety, which are essential for successful learning. This concludes the analysis of mathematical reasoning abilities based on emotional stability.

Summary of Findings

Based on the findings from the discussion, students with high emotional stability, such as Subject P-1 and Subject P-2, consistently exhibit strong mathematical reasoning abilities across various indicators. Both students effectively present mathematical statements, make conjectures, and provide systematic proofs. Although Subject P-1 shows a slight limitation in concluding, the overall performance of these students suggests that high emotional stability closely correlates with effective engagement in mathematical tasks. These students can manage their emotions and focus on complex cognitive processes, which aligns with Piaget's theory. Piaget posited that cognitive development, including mathematical reasoning, is closely tied to the stages of thinking influenced by emotional stability (Gelman, 1971). Additionally, (Wylie & Burus, 1979) emphasize that emotionally stable students tend to have higher self-confidence, which translates into better academic performance, further supporting these findings.

In contrast, students with medium emotional stability, such as Subject P-3 and Subject P-4, demonstrate good but variable mathematical reasoning abilities. Both subjects meet several indicators, such as writing mathematical statements and providing systematic proofs. However, they struggle with consistently making conjectures and applying problem-solving methods. The fluctuating emotional states of these students likely impact their cognitive performance, indicating that while they possess potential for strong reasoning skills, their ability to manage situational and emotional fluctuations is less robust. This variability aligns with (Sukatin, Kharisma, & Safitri, 2023) findings, which highlight the importance of emotional stability in maintaining concentration and focus during learning tasks.

Finally, the comparison between Subject P-5 and Subject P-6, both of whom have low emotional stability, reveals significant challenges in mathematical reasoning. These students meet only one or two indicators, such as constructing proofs or drawing conclusions, and they struggle considerably with tasks that require the formulation of mathematical statements, conjectures, and systematic proofs. The low

emotional stability of these students likely hinders their cognitive processes, leading to difficulties in concentration and anxiety management, which are essential for successful problem-solving. (Fitriyah, Wijayadi, Manasikana, & Hayati, 2019) observed that students with low emotional stability often face challenges in learning environments. The findings emphasize the need for strategies to improve emotional regulation to support academic success.

CONCLUSION AND RECOMMENDATIONS

Based on the results and data analysis, several conclusions were drawn regarding the mathematical reasoning abilities of students with varying levels of emotional stability. Students with high emotional stability demonstrated "very good" mathematical reasoning abilities, as they were able to meet all the indicators effectively. For instance, Subject P-1 presented mathematical statements in writing and images, made conjectures, provided proof of the correctness of statements, and drew accurate conclusions from multiple statements. Similarly, Subject P-2 made conjectures, presented mathematical statements, performed mathematical manipulations, and effectively provided proof of the correctness of statements. In contrast, students with medium emotional stability fell into the "good" category, meeting three to four out of the five indicators. Subject P-3 could write mathematical statements, provide systematic proofs, and draw conclusions based on problem statements, while Subject P-4 demonstrated similar abilities, performing manipulations and drawing accurate conclusions. However, students with low emotional stability were categorized as "poor," meeting only one or two indicators. Subject P-5 managed to construct proofs, provide reasons for the correctness of solutions, and draw conclusions based on problem statements, while Subject P-6 could only draw conclusions, indicating significant challenges in their reasoning abilities.

Educators are encouraged to be responsive to changes and issues faced by students, creating engaging, creative, and enjoyable learning environments that can enhance students' emotional stability and, consequently, their mathematical reasoning abilities. Additionally, students, particularly those with low emotional stability, should receive training to improve their focus, which will aid in developing their mathematical reasoning abilities effectively. This is crucial, as mathematical reasoning helps students solve various real-life problems. The scope of this study is limited to examining mathematical reasoning abilities at different levels of emotional stability within the context of derivative applications. Future researchers are advised to conduct further studies on the relationship between mathematical reasoning abilities and students' emotional stability across different subjects and educational levels. Such research will provide deeper insights into effective educational strategies that can foster both emotional stability and academic success.

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