Analysis of High Order Thinking Skill (HOTS) in Problem Solving Reviewed from the Mathematical Reasoning of Students of SMA Negeri 5 Medan

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Abstrak. The issue of pupils' poor reasoning and high-level thinking skills is the driving force for this study. Thus, the purpose of this study is to characterize students' high-level thinking and reasoning skills, as well as the challenges they face while attempting to solve HOTS issues and the important relationship between their reasoning skills and their higher-level thinking skills. This study examines the causal relationship between students' challenges in completing HOTS and their reasoning and higher order thinking skills. The impact of reasoning skills on advanced thinking skills should therefore be examined inferentially. Students in Class X of SMA Negeri 5 Medan served as the research subjects. There were thirty-five individuals in this study. Six kids who fell into the very low, low, medium, high, and very high categories of thinking ability were the interview subjects. Reasoning ability tests and HOTS, which were taken straight from the PISA problem collection, were utilized to gather data on high-level thinking and reasoning skills. To learn more about the challenges students face when tackling HOTS tasks, researchers conducted in-person interviews. According to the study's findings, students' reasoning skills fall into the low group with an average score of 58.88, and their high-level thinking skills fall into the same area with an average score of 60.85. Every indicator of high-level thinking skills is affected by students' mistakes when completing HOTS, including (a) misinterpreting picture problems, (b) manipulating algebraic variables and establishing relationships between them, (c) guessing, and (d) calculation errors in algebraic operations. Students face a variety of challenges, including factual issues, conceptual difficulties, principle difficulties, and procedural obstacles. The high-level thinking skills of class X MIA students at SMA Negeri 5 Medan are significantly impacted by their reasoning abilities.

Keywords: Application, Analysis, Evaluation, Higher Level Thinking, and Creative Thinking.

1 Introduction

Over the course of 17 years, Indonesia's educational system saw four curriculum revisions to create productive human resources capable of handling global trends in a range of disciplines. A competency-based curriculum was initially introduced in 2004, then KTSP in 2006, the 2013 curriculum in 2013, and the most recent, the national curriculum, which was unveiled and began

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to be implemented in 2016 (Fitriani, D., Suryana, Y., & Hamdu, G., 2018: 88). In Kodriana, W., Mulyana, E. h., & Nugraha, A. (2017:62) came next. states that the Indonesian education curriculum needs to be developed swiftly in order to produce graduates with high-level thinking skills, an Indonesian personality, the capacity to sustain high national culture, sociocultural skills, and global awareness. Fitriani, D., Suryana, Y., & Hamdu, G. (2018:88) state that the ability to think critically is one of the qualities of graduates that are expected to be developed. A person with advanced thinking abilities may solve problems, become an expert in technology, create jobs for others, adjust to change, and alter the world. Accordingly, HOTS is essential for addressing impending challenges (Sriraman, 2005). However, in practice, students' HOTS skills remain extremely low (Sasmita et al, 2015). Indonesia ranked 36th out of 48 countries in the 2015 TIMSS research on worldwide maths scores for class VIII.

The results of the study indicate that the mathematical ability of Indonesian students is inferior to that of the average international student. This implies that the decline in UNBK results can be explained by the HOTS questions, which require the use of critical thinking and reasoning skills to respond (Gradini, 2018). According to Minister of Education and Culture Regulation No.21 of 2016.

Reasoning is the process of thinking logically based on a variety of facts or mental operations. Solso et al. (2008) define reasoning as logical cognition supported by information, including complex linkages. Reasoning is the process of arriving at a conclusion by logically considering mental processes based on a variety of facts or concepts.

According to Ball and Bass (2003), mathematical reasoning advances mathematical knowledge, even if mathematics is linked to concepts, reasoning, and methods. Consequently, a math teacher must support students' logic during their studies. The ability to reason is one of the mathematical abilities that pupils must have. According to Rosnawati (2013), learning mathematics requires the ability to reason mathematically. Mathematical reasoning is an essential part of mathematics education since without it, mathematics will just be a series of processes and examples that students must follow without comprehending.

Over a 17-year period, Indonesia's education system experienced four curriculum modifications to create productive people resources capable of handling global trends in a range of disciplines. Competency-based curricula were first introduced in 2004, then KTSP in 2006, the 2013 curriculum in 2013, and the most recent, the national curriculum, which was unveiled and began to be implemented in 2016 (Fitriani, D., Suryana, Y., & Hamdu, G., 2018: 88). In Kodriana, W., Mulyana, E. h., & Nugraha, A. (2017:62), came next. claims that the Indonesian curriculum needs to be updated rapidly in order to produce graduates with high-level cognitive abilities, an Indonesian personality, the capacity to maintain high national culture, sociocultural skills, and global awareness. The ability for higher-level thinking is one of the qualities of graduates that are expected to be cultivated, claim Fitriani, D., Suryana, Y., & Hamdu, G. (2018:88), asserts that a person with advanced thinking abilities can solve problems, become an expert in technology, create jobs for others, adapt to change, and alter the world. Accordingly, HOTS is essential for conquering impending challenges (Sriraman, 2005). However, in practice, students' HOTS skills remain extremely low. Indonesia's class VIII international math rankings ranked it 36th out of 48 countries, according to a 2015 TIMSS survey. The results of the study show that Indonesian pupils are less proficient in mathematics than the average international student. This implies that the decline in UNBK results can be explained by the HOTS questions, which require the use of critical thinking and reasoning skills to respond (Gradini, 2018). According to Minister of Education and Culture Regulation No.21 of 2016, students should be able to

reason. Reasoning is the process of thinking logically based on a variety of facts or mental processes. Solso et al. (2008) define reasoning as logical cognition supported by information, including complex linkages. According to the Department of National Education (2006), reasoning is the process of arriving at a conclusion by logically considering mental processes from a variety of facts or principles. Mathematical reasoning creates mathematical knowledge, whereas mathematics is linked to concepts, reasoning, and procedures. Consequently, a math teacher must support students' logic during their studies. The ability to think is one of the mathematical skills that pupils must have. According to Rosnawati (2013), learning mathematics requires the ability to reason mathematically. Since mathematics will merely be a series of steps and examples that students must imitate without understanding if their reasoning abilities are not developed, argued that mathematical reasoning is an essential part of mathematics education.

1.1 Problems Found in the Research

Students' HOTS proficiency is still comparatively low. According to TIMSS research from 2015, Indonesia's class VIII international maths scores place it 36th out of 48 nations. The study's findings demonstrated that Indonesian pupils' arithmetic proficiency lagged behind that of international students on average. Indonesia is ranked 36th out of 48 countries in terms of reasoning proficiency. This indicates that just 17% of Indonesian pupils are capable of reasoning. Students' poor thinking skills are the cause of their lack of HOTS ability. According to a 2015 PISA analysis, Indonesian students' HOTS proficiency placed them 46th out of 51 nations. Indonesia received a score of 7.95 in the creative category, placing it 86th out of 93 nations according to the 2015 Global Creativity Index report. In contrast, Indonesia scored 72 out of 79 participating nations in the 2018 PISA maths exam. In the meantime, math classes fell into the lower group according to UNBK findings from 2014–2015 to 2017–2018 The analysis's findings suggest that the presence of HOTS questions, which call for critical thinking and reasoning to answer, was the reason behind the drop in UNBK scores (Gradini, 2018).

2 Method

This research will reveal the essence of students' high-level thinking processes in solving problems based on reasoning. According to Moleong (2019: 31) this kind of research is classified as mixed qualitative and quantitative research (mixing method). This research focuses on looking at causalistic patterns between Reasoning abilities and Higher Order Thinking Abilities (HOTS) as well as finding students' difficulties in solving HOTS problems by using systematic methods of observing, collecting data, analyzing information, and solving problems. Next, analyze inferentially the influence of reasoning abilities on high-level thinking abilities. This research was carried out at SMA Negeri 5 Medan. The research time is planned for the even semester of FY 2023/2024. Prospective research subjects are Class X Mia students at SMA Negeri 5 Medan. The number of subjects in this research was 35 people. In the analysis of the influence of reasoning abilities on higher level thinking abilities, the population was determined to be all class X students at SMA Negeri 5 Medan. Next, students from one class were selected randomly to be used as samples for this research. The objects of this research are (1) students' reasoning abilities, (2) high-level thinking abilities in problem solving, and (3) students' difficulties in solving HOTS problems. Reasoning abilities include skills in explaining problems, determining problem solving strategies, testing the correctness of problem solutions, reflective thinking and logical thinking. This can be measured in (1) the ability to make

conjectures or hypotheses, (2) mathematical manipulation, (3) evaluating problem solving and making conclusions, and (4) the ability to generalize. High-level thinking abilities include: (1) various transferable abilities. This is expressed in mathematical concepts and rules in problem solving, (2) the ability to analyze, (3) the ability to evaluate, (4) the ability to think creatively. These four abilities are based on students' reasoning abilities in problem solving. Next, test the influence of reasoning abilities on higher-order thinking abilities.This research uses two data collection techniques: written tests and interviews. After students follow the material, they are given a test of high-level thinking and reasoning abilities, the results of which are categorized into high, medium and low abilities. Interviews were conducted with students selected based on their level of thinking ability (very low to very high) to explore difficulties in higher order thinking. Interviews focused on errors and idiosyncrasies in solving problems and were recorded for further analysis. Interview data complements information from the written test. The validity of the data was tested through triangulation of sources, techniques and time, including direct observation by researchers to gain an in-depth understanding of students' thinking difficulties.The supporting instruments in this research are test sheets and interview guidelines. The test sheet that will be given to students will be a test of students' mathematical reasoning abilities and high-level thinking abilities. Data on students' mathematical reasoning abilities was obtained through giving reasoning tests. This test instrument is used to measure students' high-level reasoning and thinking abilities in mastering class X material. The form of this instrument is a description test which is prepared based on indicators of reasoning ability. The number of questions used in this test instrument is 4 questions with the maximum score for each question being 25. Other test sheets are used to collect data on students' high-level thinking abilities in solving problems. This test covers 4 abilities, namely: (1) students' mathematical application abilities, (2) analytical abilities, (3) evaluating abilities, (4) creative thinking abilities. The form of test instrument used is an essay test which consists of 6 questions designed with each question having a maximum value of 50.

Interviews were conducted to collect data on students' high-level thinking difficulties in solving problems. The students' difficulties that will be revealed are related to the difficulties of facts, concepts, principles and procedures in 4 sub-skills of high-level thinking, namely: understanding problems, planning solutions, solving problems and evaluating problem solutions.

3. Result and Discussion

Thirty-five students from class X MIA SMA Negeri 5 Medan served as the research subjects. The following are the outcomes of the Siawa Mathematical Reasoning ability test and the Higher Order Thinking Skills (HOTS) ability test:

Table 1. Recapitulation of Students' Mathematical Reasoning Ability Scores

No	Inverval Score	Category	Number of Students	Percentage	Average Ability
1	$0 \leq SKP < 50$	Very Low	10	28.57	58.88 (Low)
2	$50 \leq SKP < 68$	Low	16	45.71	
3	$68 \leq SKP < 78$	Currently	5	14.29	
4	$78 \leq SKP < 88$	Tall	3	8.57	
5	$88 \leq SKP \leq 100$	Very high	1	2.86	

Amount	35	100%

According to Table 1 above, the Low category includes the average that would be obtained if translated to a predefined ability category. Ten students had very low mathematical reasoning abilities, sixteen had low mathematical reasoning abilities, five had medium mathematical reasoning abilities, and five had low mathematical reasoning abilities out of all the subjects that were studied. One kid possesses mathematical reasoning skills in the very high category, while three others have high category skills. Twenty-six pupils (74.28%) had scores that were below average.

Table 2. Recapitulation of Ability Scores to Make Allegations

No	Inverval Score	Category	Number of Students	Percentage	Average Ability
1	0 ≤ SKP < 50	Very Low	0	00.00	66.85 (Low)
2	50 ≤ SKP < 68	Low	6	17.14	
3	68 ≤ SKP < 78	Currently	17	48.57	
4	78 ≤ SKP < 88	Tall	0	00.00	
5	88 ≤ SKP≤ 100	Very high	1 2	34.29	
Amount			35	100%	

It is evident from Table 2 above that students' average mathematical reasoning (X) ability to generate hypotheses during test completion is 66.85. This average falls into the Low ability group if it is converted to a predefined ability category. There were no students who could submit conjectures in the very low category, six students who could submit conjectures in the low category, seventeen students who could submit conjectures in the medium category, no students who could raise conjectures in the high category, and two students who could raise conjectures in the very high category out of all the subjects that were studied. Six pupils (17.14 percent) received results that were below average. Errors, namely in the formulation of issue solutions, were discovered after reviewing the students' answer sheets.

Table 3. Recapitulation of Scores for the Ability to Perform Mathematical Manipulations

No	**Inverval Score**	**Category**	**Number of Students**	**Percentage**	**Average Ability**
1	0 ≤ SKP < 50	Very Low	2	5.71	62.90 (Low)
2	50 ≤ SKP < 68	Low	12	34.29	
3	68 ≤ SKP < 78	Currently	1 6	45.71	
4	78 ≤ SKP < 88	Tall	1	2.86	
5	88 ≤ SKP ≤ 100	Very high	4	11.43	
Amount			**35**	**100%**	

It is evident from Table 3 above that students' average mathematical reasoning (X) capacity to do mathematical operations during exam completion is 62.90. This average falls into the Low ability group if it is converted to a predefined ability category. Two students in the very low category, twelve in the low category, one in the medium category, six in the medium category, one in the high category, and four in the very high category were able to perform mathematical manipulations out of all the subjects that were studied. Fourteen pupils, or 40% of the total,

earned scores that were below average. Errors were discovered after looking at the students' answer sheets; specifically, mistakes were made when working on or resolving a problem by using mathematical manipulations to accomplish the intended outcome.

Table 4. Recapitulation of Ability Scores to Draw Conclusions

No	Inverval Score	Category	Number of Students	Percentage	Average Ability
1	$0 \leq SKP < 50$	Very Low	6	17.14	59.11 (Low)
2	$50 \leq SKP < 68$	Low	1 1	31.43	
3	$68 \leq SKP < 78$	Currently	10	28.57	
4	$78 \leq SKP < 88$	Tall	0	0.00	
5	$88 \leq SKP \leq 100$	Very high	8	22.86	
Amount			35	100%	

The average student's mathematical reasoning ability (X) to derive conclusions during the test is 59.11, as shown in Table 4 above. This average falls into the Low ability group if it is converted to a predefined ability category. Six students were in the very low category, eleven were in the low category, ten were in the medium category, none were in the high category, and eight were in the very high category for the ability to draw conclusions across all the subjects that were studied. 17 pupils (48.57%) received scores that were below average. Following an examination of the students' response sheets, mistakes were discovered, specifically in the inferences made from the assertions.

Table 5. Interval Table for Students' Mathematical Reasoning Ability Scores

No	Inverval Score	Category	Number of Students	Percentage	Average Ability
1	$0 \leq SKP < 50$	Very Low	19	54.29	48.38 (Very Low)
2	$50 \leq SKP < 68$	Low	13	37.14	
3	$68 \leq SKP < 78$	Currently	0	00.00	
4	$78 \leq SKP < 88$	Tall	1	2.86	
5	$88 \leq SKP \leq 100$	Very high	2	5.71	
Amount			35	100%	

The average capacity of students' mathematical reasoning (X) to draw generalizations while finishing the test is 48.38, as shown in Table 5 above. This average falls into the Very Low ability group if it is converted to a predefined ability category. Out of every subject that was studied, 19 students fell into the very low category for generalization ability, 13 students fell into the low category, none of the students fell into the medium category for generalization ability, and three students fell into the medium category for generalization ability. Two pupils were able to create generalizations in the very high category, while one person made generalizations in the high category. Thirty-two students (91.42%) had scores that were below average. Errors in identifying the pattern of an existing statement so that it might be transformed into a mathematical sentence were discovered after looking at the students' answer sheets.

Table 6. High Level Thinking Ability Score Interval Table

No	Inverval Score	Category	Number of Students	Percentage (%)	Average Ability
1	0 ≤ SKH < 50	Very Low	6	17.14	60.85 (Low)
2	50 ≤ SKH < 68	Low	18	51.43	
3	68 ≤ SKH < 78	Currently	9	25.71	
4	78 ≤ SKH < 88	Tall	1	2.86	
5	88 ≤ SKH ≤ 100	Very high	1	2.86	
Amount			35	100	

Table 6 above shows that Student HOTS Ability (Y) has a mean of 60.86, a standard deviation of 11.363, and a minimum value of 45 to a maximum value of 88. When converted to the predefined ability category, the average HOTS ability of 60.86 falls within the Low ability level. Six students had very low HOTS abilities, eighteen had low HOTS abilities, nine had medium HOTS abilities, nine had one person's high HOTS abilities, and no students had very high category Mathematical Reasoning abilities out of all the subjects that were studied. Twenty-four pupils (68.571%) had results that were below average.

Table 7. Analyzing Ability Score Interval Table

No	Inverval Score	Category	Number of Students	Percentage (%)	Average Ability
1	0 ≤ SKH < 50	Very Low	7	20	66.34 (Low)
2	50 ≤ SKH < 68	Low	9	25.71	
3	68 ≤ SKH < 78	Currently	7	20	
4	78 ≤ SKH < 88	Tall	10	28.57	
5	88 ≤ SKH ≤ 100	Very high	2	5.71	
Amount			35	100	

It is evident from Table 7 above that the average Higher Level Thinking ability (HOTS) (Y) for analysis during test completion is 66.34. This average falls into the Low ability group if it is converted to a predefined ability category. Out of all the subjects that were studied, seven students fell into the very low category of analytical ability, nine into the low category, seven into the medium category, ten into the high category, and two into the very high category. Fifteen pupils (42.8%) earned results that were below average. Errors were discovered after looking at the students' answer sheets; specifically, the pupils were unable to recognize and reduce the issues in the questions. In addition, students lack the ability to recognize issues.

Table 8. Recapitulation of Evaluating Ability Scores

No.	Inverval Score	Category	Number of Students	Percentage (%)	Average Ability
1	0 ≤ SKH < 50	Very Low	4	11.43	64.60 (Low)
2	50 ≤ SKH < 68	Low	17	48.57	
3	68 ≤ SKH < 78	Currently	3	8.57	
4	78 ≤ SKH < 88	Tall	10	28.57	
5	88 ≤ SKH ≤ 100	Very high	1	2.86	
Amount			35	100	

The average Higher Level Thinking (HOTS) ability (Y) for assessing test completion is 64.60, as shown in Table 8 above. This average falls into the Low ability group if it is converted to a predefined ability category. There were four students who could evaluate in the very low category, seventeen who could evaluate in the low category, three who could evaluate in the medium category, three who could evaluate in the ten people in the high category, and one who could evaluate in the very high category out of all the subjects that were studied. Twenty-one students (60%) received results that were below average. After looking over the students' response sheets, mistakes were discovered, specifically in the way the students evaluated their knowledge, abilities, or approaches to problem-solving and inference.

Table 9. Interval Table for Creative Thinking Ability Scores

No.	Inverval Score	Category	Number of Students	Percentage (%)	Average Ability
1	$0 \leq SKH < 50$	Very Low	16	45.71	51.63 (Low)
2	$50 \leq SKH < 68$	Low	15	42.86	
3	$68 \leq SKH < 78$	Currently	2	5.71	
4	$78 \leq SKH < 88$	Tall	1	2.86	
5	$88 \leq SKH \leq 100$	Very high	1	2.86	
Amount			35	100	

The average Higher Order Thinking (HOTS) capacity (Y) for creative thinking in finishing the test is 51.63, as shown in Table 9 above. This average falls into the Low ability group if it is converted to a predefined ability category. Out of all the subjects that were studied, 16 students had very low creative thinking abilities, 15 had low creative thinking abilities, 2 had medium creative thinking abilities, 2 had one person with high creative thinking abilities, and 1 had very high creative thinking abilities. Thirty-one pupils (88.57%) had scores that were below average. Errors, specifically students' blunders in rearranging existing items to create something new or mixing diverse things in a novel way, were discovered after looking at the students' answer sheets. First, a normality and linearity test must be performed in order to ascertain the impact of the independent variable on the dependent variable.

Table 10. Normality Test Using Kolmogorov-Sminorv

One- Sampel Kolmogorov- Smirnov Test		
		Unsatndasrdized residual
N		35
Normal Parameters	Mean	.00000000
	Std. Deviation	7.10635088
Most Extreme Differences	Absolute	.082
	Positive	.082
	Negative	.069
Kolmogorv-smirnov Z		.486
Asymp.Sig.(2-tailed)		.972
a. Test distribution is normal		

The probability value, or Asymp, is known based on the information in Table 10 above. Since the two-tailed sig. is 0.972 > α (0.05), it may be said that the data originates from a population that is normally distributed and that H 0 is accepted.

Table 11. ANOVA

				Sum of Squares	df	Mean Square	F	Sig.
HOTS Reasoning	*	Between Groups	(Combined)	3466.952	16	216,685	4,224	,002
			Linearity	2673.278	1	2673.278	52.114	,000
			Deviation from Linearity	793,674	15	52,912	1,031	,469
		Within Groups		923,333	18	51,296		
		Total		4390.286	34			

With a significance level of 0.000, the value F = 52.11 is derived from the above table. Because it employs a significance level, or α = 5%, the significance level will be compared with 0.05. To make a judgment, apply the test conditions listed below:
a) H0 is rejected if the sig value is less than α.
b) H0 is allowed if the sig value is greater than α.
There is a linear link between students' reasoning skills and higher level thinking abilities, as indicated by the data in the preceding table, which shows that 0.000 < 0.05 indicates that H0 is rejected. The regression model can be used to forecast students' reasoning skills in relation to their higher level thinking abilities because the sig value of 0.000 is significantly smaller than 0.05. Furthermore, to ascertain the impact of the independent variable Reasoning (X) on the dependent variable HOTS (Y), this study employed a straightforward linear regression analysis technique.

Table 12. Simple Regression Analysis Test

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	Q	Sig.
1	(Constant)	22,326	5,512		4,050	,000
	Reasoning	,654	,091	,780	7,168	,000
a. Dependent Variable: HOTS						

The following are the outcomes of the basic linear regression equation based on Table 12:
22.326 + (0.654)X = Y
This equation can be understood to mean that:

1. HOTS (Y) has a value of 22.326 units if the independent variable value is 0 or constant, as shown by the constant value (β0) of 22.326.
2. Reasoning (β) has a positive regression coefficient value of 0.654. This indicates that HOTS is positively impacted by the Reasoning variable. HOTS rises in tandem with an increase in Reasoning, and vice versa.

Table 13. F Test

ANOVA [b]						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	2673.278	1	2673.278	51,379	,000 [a]
	Residual	1717.008	33	52,031		
	Total	4390.286	34			
a. Predictors: (Constant), Reasoning						
b. Dependent Variable: HOTS						

The computed F is 51.379 with a probability of 0.000, which is less than 0.05, according to Table 4.13 above. and it is determined that F count (51.379) > F table (4.03) by computing F count > F table, where F count is 51.379 and F table: F(k -1; n – k) yields F table 3.03. This demonstrates that students' higher order thinking skills (HOTS) are significantly impacted by the variable Student Mathematical Reasoning Ability.

Table 14. Significance Test

ANOVA [b]						
Model		**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
1	Regression	2673.278	1	2673.278	51,379	,000 [a]
	Residual	1717.008	33	52,031		
	Total	4390.286	34			
a. Predictors: (Constant), Reasoning						
b. Dependent Variable: HOTS						

Table 14 shows whether the significant value is 0.000 or less than 5%. The conclusion is that the high-level thinking ability variable and the reasoning variable are significantly correlated. The size of the coefficient of determination, which is shown in the accompanying table, is then used to gauge how much reasoning skills contribute to students' higher-level thinking abilities.

Table 15. Determination Test

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,780 [a]	,609	,597	7,213
a. Predictors: (Constant), Reasoning				

From the coefficient of determination table 4.15 above, it shows a correlation (R) of 0.780, which means the relationship between the independent variable (reasoning ability) and the dependent variable (HOTS ability) is 78%, including the medium category. Adjusted R Square (R^2) of 0.609 indicates that students' reasoning abilities explain 60.9% of the variation in HOTS abilities, while the remaining 39.1% is influenced by other factors such as IQ, learning environment, learning model, and understanding of concepts. The findings of this research indicate that students' high-level thinking abilities in solving HOTS questions are low. The average score for high-level thinking skills in solving HOTS questions is 60.85. There were 24

students (68.57%) who had scores below the average and 11 students (31.43%) who had scores above the average. This is in accordance with the results of research by Saraswati (2020) which stated that the high level thinking abilities of class V students at SD Negeri 1 Padang Sambian showed that, of the 85 students who took the test, there were 48% in the low category, 16% in the sufficient category, and 36% in the good category.

Indicators in HOTS questions include analyzing (C4), evaluating (C5), and creating (C6). Research shows that students' abilities in these three aspects are in the low category, with an average analytical ability of 66.34, evaluation 64.60, and creativity 51.62. The low HOTS ability of students is caused by the habit of solving routine questions and difficulties in dealing with problems that require analytical, evaluative and creative thinking. Only two students had high abilities with scores above 78, which shows the ability to think independently, analytically and creatively in solving problems.

Research findings regarding errors made by students at the analyzing stage include: (1) Students are unable to identify the problem, and (2) students are unable to simplify the problem so that it can be solved correctly, (3) students are unable to create a mathematical model of the problem posed. , (4) perform calculations inaccurately.

Students' difficulties in solving higher order thinking problems (HOTS) can be identified in several ways, including:

a. Difficulty in creating mathematical function models
b. Difficulty in understanding and interpreting mathematical symbols such as elements and sets of numbers.
c. Difficulty in the principle of selecting function rules, including determining the results and boundaries of the function domain.
d. Difficulty in manipulating objects and illustrating problems into images.
e. Difficulty executing problem solving algorithms.
f. Difficulty building alternative problem solutions, tends to be fixated on existing mathematical rules and principles.

When students' mathematical reasoning abilities experience problems, students will have difficulty analyzing the context of the problem, difficulty building relationships in building problem solving models, difficulty carrying out problem solving steps, difficulty in proposing new ideas in building alternative problem solutions that have an impact on low ability to analyze, evaluate and think creatively in solving problems. Students' difficulties in higher level thinking in problem solving are seen from students' mathematical reasoning abilities. Analysis of higher order thinking difficulties is described through students' understanding of mathematical objects. The mathematical objects in question are facts, concepts, principles and procedures. Students' high-level thinking difficulties were identified after direct interviews were conducted with 5 (five) students as representatives of students whose high-level thinking abilities were in the very low category (S1, S2), students whose high-level thinking abilities were in the low category (S3), students who thought high-level thinking ability in the medium category (S4), and students with high-level thinking abilities in the high category (S5). Students who have very low levels of high-level thinking abilities experience fact difficulties, principle difficulties and procedural difficulties in solving problems. The research results found that students who had low reasoning abilities also had low higher order thinking skills (HOTS) abilities. The findings in this study indicate that there is a significant influence between mathematical reasoning abilities on higher-order thinking abilities. This is because reasoning abilities greatly influence problem-solving abilities.

4. Conclusion

The following are the research's conclusions, which are based on the conducted research.

1. With an average score of 60.85, class X MIA students at SMA Negeri 5 Medan fall into the poor category for high-level thinking skills.
2. Students' mathematical reasoning, specifically their challenges with mathematical objects in terms of facts, concepts, principles, and procedures, reveals the challenges they have in using higher-level thinking processes to solve problems.
    a. Facts: The set of natural numbers, represented by the sign N, and mathematical symbols like (elements) are hard for students to understand.
    b. Concept: Students struggle to come up with alternative solutions to challenges. Students are still only allowed to solve issues using mathematical concepts and rules, such as elimination rules and pictorial approaches when working with mathematical models that take the shape of linear equation systems.
    c. Principle: Students struggle to decide which function rule principle to use to calculate newspaper sales data. The same is true for figuring out the function's domain boundaries. Similarly, figuring out the function rules concept to determine the tower's height in the problem is challenging.
    d. Process: Due to their inability to depict the problem in visuals, students struggle to manipulate the objects in the problem in order to find a mathematical model of it. They also encounter procedural challenges when executing algorithms to solve tower problems.
3. The high-level thinking skills of the class are greatly impacted by the reasoning abilities of the students.

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