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ANALYSIS OF MATHEMATICAL LITERACY ABILITY IN TERMS OF STUDENT'S HABITS OF MIND

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Abstract

Mathematical literacy ability is an individual's ability to formulate, apply, interpret, solve problems, reason logically, communicate, and explain mathematics in solving everyday problems and sharing contexts. This paper describe result of research students' mathematical literacy skills, students' habits of mind, and determine the relationship between students' mathematical literacy abilities in terms of students' habits of mind. The method used in this research is descriptive quantitative with data collection techniques using test instruments and questionnaires. The subjects of this study were students of class VIII at an MTs Negeri in Jakarta with a sample of 110 students with cluster random sampling. Based on this research shown that there is a positive relationship between mathematical thinking habits and mathematical literacy skills. Students who already have good mathematical habits of mind are able to respond with awareness and strategies to get the right solution so as to improve the quality of mathematical literacy in solving problems in everyday life.. These results indicate that there is a significant relationship between students' mathematical literacy skills and mathematical thinking habits.
Keywords: *literacy skills, mathematical literacy, mathematical thinking, thinking habits.*

Abstrak

Kemampuan literasi matematis merupakan kemampuan individu dalam merumuskan, menerapkan, menafsirkan, memecahkan masalah, menalar secara logis, mengkomunikasikan, dan menjelaskan matematika dalam pemecahan masalah sehari-hari dan berbagi konteks. Penelitian ini bertujuan untuk mendeskripsikan kemampuan literasi matematis siswa, mendeskripsikan kebiasaan berpikir matematis siswa, dan mengetahui hubungan kemampuan literasi matematis siswa ditinjau dari kebiasaan berpikir matematis siswa. Subjek penelitian ini adalah siswa kelas VIII suatu MTs Negeri di Jakarta dengan sampel berjumlah 110 siswa. Metode yang digunakan dalam penelitian ini adalah deskriptif kuantitatif dengan teknik pengumpulan data menggunakan instrumen tes dan angket. Hasil penelitian menunjukkan bahwa terdapat hubungan positif antara kebiasaan berpikir matematis dengan kemampuan literasi matematika. Siswa yang memiliki kebiasaan berpikir matematis yang baik mampu menyikapi dengan kesadaran dan strategi untuk mendapatkan solusi yang tepat sehingga meningkatkan kualitas literasi matematika dalam menyelesaikan masalah dalam kehidupan sehari-hari. Hasil tersebut menunjukan bahwa terdapat hubungan yang signifikan kemampuan literasi matematis siswa dengan kebiasaan berpikir matematis.
Kata kunci: berpikir matematis, kemampuan literasi, kebiasaan berpikir, literasi matematis.

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INTRODUCTION

Mathematical literacy is knowledge used to apply a good mathematical basis so that it has meaning in using mathematical concepts that correspond to the phenomenon or problem faced. Mathematical literacy helps a person to understand the role or usefulness of mathematics in everyday life while using it to make the right decisions (OECD, 2013). If students have mathematical literacy skills, students will know better what steps to choose, because students are able to understand concepts, interpret mathematics in various contexts, and relate them to everyday life. Thus, the ability of mathematical literacy can be said to be the goal to be achieved in learning mathematics. Mathematical literacy makes students understand the role and usefulness of mathematics in dealing with problem solving in everyday life.

According to the Organisation for Economic Coperation and Development (OECD, 2018), mathematical literacy is a person's ability to formulate, apply and interpret mathematics in a variety of contexts, including the ability to perform mathematical reasoning and use concepts, procedures, and facts to explain an event. The ability of mathematical literacy is very closely related to everyday life because it relates to how a student can apply knowledge in real-world problems or everyday life, so that the knowledge can be felt more directly by students. According to Jusmiana (2014) the definition of mathematical literacy is in line with five basic competencies in mathematical learning according to NCTM (National Council of Teachers Mathematics), namely mathematical problem solving, mathematical communication, mathematical reasoning, mathematical connections, and mathematical representations.

Although mathematical literacy skills are very important, in fact, based on pisa (Program for International Student Assessment) OECD (Organisation for Economic Coperation and Development) conduct research on Indonesian students, the result is that 28% of Indonesian students only reach level 2 i.e. students can only recognize and interpret situations in contexts that require nothing more than direct conclusions. Students who are at level 2 can use information and utilize relavan information. The results for Indonesian students also showed that only 1% of students managed to reach level 5, namely students who can model complex situations systematically, identify obstacles and determine assumptions. Students at level 5 can already choose, compare, and evaluate appropriate problem-solving strategies and can use well-developed thinking and reasoning skills. Students at this level can also reflect on results to communicate conclusions and interpretations in written form.

A student's mathematical literacy skills are more influenced by his or her own experience. To learn meaningful mathematics and gain experience, coaching is required for students through a process to construct knowledge, because knowing not only results or products, but also processes that start from experience. This ability is essential and needs further development in order to be

useful and more meaningful. Mathematical literacy is a high-level mathematical ability. To achieve the success of such abilities there needs to be a role in the affective aspect, one of which is the habit of mathematical thinking.

The habit of mathematical thinking is an affective aspect related to the way a person interprets problem solving such as; Confidence, perseverance, accuracy, and flexibility in finding alternative strategies for solving problems in mathematics. Habits of thinking equip individuals to work on real-life situations, complementing the individual's ability to respond with awareness, thinking, and strategy to come up with the right solution. Habit thinking can be used to assess their mathematical skills by understanding, looking for strategies, and solving the problems they face.

Mathematical thinking habits are formed from thought processes and knowledge that are structured to respond to mathematical situations we face in everyday life. This is in line with mathematical literacy which refers to the process of solving mathematical problems in the real world. In this study will analyze the mathematical literacy skills of students reviewed from the mathematical thinking habits of students. .The urgency of analyzing the mathematical literacy skills of students in relation to their mathematical thinking habits stems from the need to ensure a solid foundation, promote critical thinking, address misconceptions, provide personalized instruction, prevent math anxiety, assess curriculum effectiveness, prepare for future careers, contribute to global competitiveness, and support data-driven decision-making in education. By implementing these strategies, educational institutions can actively work towards improving mathematical literacy by nurturing and enhancing students' mathematical thinking habits. The category of mathematical thinking habits used is the habit of mathematical thinking according to Arthur L. Costa and Benna Kallick which is limited to three categories, namely flexible thinking, thinking and thinking metacognition, thinking and communicating clearly and precisely. This category was chosen because of its suitability to mathematical literacy skills. The three categories selected support students in developing problem-solving skills.

The first category of mathematical thinking habits is the ability to overcome problems from a new point of view using new approaches. Their minds are open to change based on additional information, new data, or even reasoning that goes against their beliefs. Flexible thinkers have and can develop choices and alternatives with confidence in their intuition. This habit helps a person in solving problems by finding alternative ways to solve any kind of problem and trying something when they are not sure what to do. So it can be said that individuals who have flexible thinking habits have an open nature and are able to change their views based on additional information to show confidence. The next category is metacognition thinking, namely the ability to monitor his thoughts, perceptions, decisions and behavior, understand what he knows and does not know,

assess readiness, and think things with good comparison. The main component of metacognition is when faced with a problem to solve, develop a plan of action, maintain that plan of mind over a period of time, and then reflect on and evaluate the plan once it is completed. The last category is to think and communicate clearly and precisely explaining that language improvement is the knowledge base for effective action. Mathematical thinking habits are a cornerstone of mathematical literacy. They contribute to the acquisition of skills and competencies essential for understanding, applying, and communicating mathematical concepts effectively. A strong emphasis on developing positive thinking habits ensures that students not only gain mathematical knowledge but also cultivate the mindset and skills necessary for a high level of mathematical literacy. Enriching the complexity and specificity of language simultaneously results in effective thinking.

METHOD

The method used in this study is a quantitative desriptive method that aims to describe a student's mathematical literacy skills, students' mathematical thinking habits, and the relationship between students' mathematical thinking habits and students' mathematical literacy abilities. The population of this study is a student of MTs Negeri 1 Jakarta with a random sampling technique and numbered 110 samples.

The technique of accumulating data through mathematical thinking habits questionnaire instruments that sum up 32 statements and 12 questions of mathematical literacy ability tests. The scale used in this questionnaire is a likert scale consisting of 4 alternative answers indicated by Table 1.

Table 1. Likert scale used.

Pilihan Jawaban	Positive Score	Negative Score	Note*
Always (SL)	4	1	SL : Selalu
Often (SR)	3	2	SR : Sering
Sometimes (KK)	2	3	Kadang-kadang (KK)
Never (TP)	1	4	Tidak Pernah (TP)

*code in Bahasa

After the data is collected, the validity test and reliability test are carried out. The validity test in this study used SPSS version 26 with product moment correlation, while reliability test used SPSS version 26 with Cronbach's Alpha. The validity test results stated that the 32 statements and 12 ability tests used in the study were valid. While the results of reliability tests showed independent and dependent variables both have very strong degrees of reliability, which is 0.872 for mathematical thinking habits and 0.757 for mathematical literacy skills.

Next is the data to find out the level of students' mathematical thinking habits and students' mathematical literacy abilities based on the following formulas.

Table 2. Percentage score of mathematical literacy skills and mathematical thinking habits

Percentage Range (%)	Category
84,01-100	Excellent
68,01-84,00	Good
52,01-68,00	Enough
36,01-52,00	Less Good
20,00-36,00	Bad

Table 3. Interpretation of Correlation Coefficient

Interval Koefesien	*Relationship Level*
0,80 - 1,00	Very Strong
0,60 - 0,799	Strong
0,40 - 0,599	Strong Enough
0,20 - 0,399	Low
0,00 - 0,199	Very Low

A response in the form of thinking is present when a person is confronted by a problem, Rugierro and Vincent state that thinking as a mental activity helps formulate a problem, make a decision, or fulfill a desire for curiosity.

$$\mathrm{P} = \frac{F}{N} \times 100\%$$

P states the percentage, F states the earned score, and N states the total score. Category results can be seen in Table 2.

The data analysis used in this study is a product moment correlation test that aims to find the relationship between mathematical thinking habits and mathematical literacy skills. After that, the correlation coefficient is categorized by Table 3.

RESULTS AND DISCUSSION

Habits of Mind

Based on research that has been done found that the results of the mathematical thinking habits of students show a different percentage. This is shown in Table 4.

Table 4. Results of students' mathematical thinking habits.

Habits of Mind Category	Angket Percentage
Thinking Flexibly	73.69
Thinking of Thinking	73.90
Thinking and communicating with clarity and precision	75.93

Based on the results of the graph on Figure 1 shown the results of different percentages between the results of the questionnaire in each category. These differences occur because of differences in indicators used in each category. The student's overall mathematical thinking habits are already in the good category.

Based on the categories and perindicators of mathematical thinking habits, it can be known that the mathematical thinking habits of students fall into the category of good. On the Graph it is shown that the categories are very good and the highest in the indicator speak through writing precisely when describing the description of mathematics. This shows that most students are used to writing how to solve mathematics. As for the indicator with the lowest percentage score is a conscious indicator to plan the strategy to produce the required answer information of 71.25. These results show that most students have not prepared their way in advance to solve math problems, but immediately do it. Overall for other indicators are in the good category, this means students already have a habit of thinking mathematically.

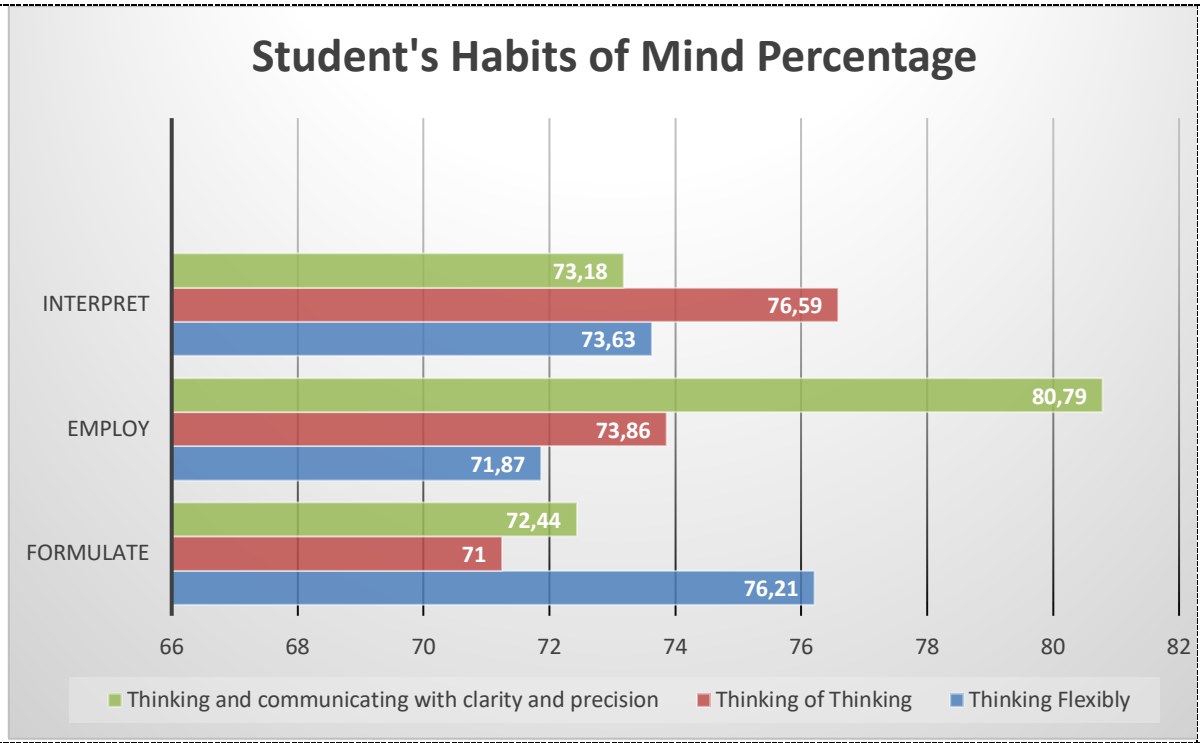

Figure 1. Student's Habits of Mind Percentage

The type of flexible thinking habit is characterized by the existence of open nature through alternative means when solving mathematical problems. Based on the data of the results of the questionnaire, it is known that in the habit of thinking mathematically flexible thinking type has a percentage of 73.69%. This type is measured through indicators accustomed to having the capacity to change minds while receiving additional data, accustomed to utilizing various problem-solving strategies and imagining various consequences, and accustomed to developing alternative choice

answers with confidence in their intuition. The highest indicator in this category is to get used to having the capacity to change minds when receiving additional data at a percentage of 76.21%. From the data can be concluded flexible thinking types of students in good categories.

Flexible thinking habits help students transform math problems into mathematical models. Students who have flexible thinking habits in good categories have the ability to change their minds when receiving additional data, so they have a variety of alternative strategy choices and ways when confronted by different types of problems. It was identified that some students are able to use formulas or ways of completion that are not taught by teachers (non-routine problems). Conversely, students who fall under the good category find it difficult to find problems that are not taught by teachers. This is detected with some students not answering non-routine questions or making many mistakes.

The next type is metacognition thinking, this type can be characterized by the student knowing his or her own capacity so that they know what to do. Based on questionnaire data it is known that the type of metacognition thinking habit has a good category with a percentage of 73.90%. This type is represented by three indicators, namely consciously to plan the strategy to produce the required answer information, accustomed to maintaining the thought of the strategy plan in the problem solving process, accustomed to evaluating yourself about what has been completed. The percentage of 76.59% is the highest percentage indicator that is accustomed to evaluating yourself about what has been completed. Therefore, it can be concluded that the metacognition thinking habit type is good and most students already have these habits. Students in this category seem to be able to describe what is known and unknown. This shows that students are able to monitor their thoughts, perceptions, decisions and behavior, so as to be able to plan what strategies to do and ultimately produce the information or answers needed. The habit of metacognition thinking makes the student understand himself, because the student consciously knows what knowledge he has and what plans he will do.

The last type in this study is the type of habit of thinking and communicating clearly and precisely. This type is characterized by students already able to not only process data, but explain what has been found at the time of processing the data. Questionnaire data shows that this type has a percentage of 75.93% and falls into the category of good. This type is measured through three indicators, namely getting used to solving mathematical problems with valid data, speaking through writing appropriately when explaining mathematical descriptions, speaking through writing in the right language to clarify mathematical problems. The highest percentage of indicators and has been well-categorized is the indicator of writing precisely when describing a mathematical description with a percentage of 80.79%. So it can be concluded that students already have a habit

of thinking and communicating clearly and precisely. Students of this category not only write data / numbers and formulas, but also students are able to describe and infer the data.

Mathematical Literacy Ability

In this study, indicators of mathematical literacy skills used are formulate, employ, and interpret. Based on research that has been done, the data shows that on each indicator of mathematical literacy ability found that there are different percentages shown in Table 5.

Table 5. Students' mathematical literacy test results.

Indicators of Mathematical Literacy Ability	Percentage
Formulate	71.59
Employ	70.90
Interpret	67.89

From Table 5 it is seen that the highest score is in the indicator formulating real problems systematically, which is 71.59%. Formulate indicators include understanding the symbolic language needed to present it mathematically, presenting situations mathematically using corresponding variables and models, and translating problems into mathematical language. On the formulate indicator, most students are already able to formulate real problems systematically. It is identified with some students understanding how to model mathematics from a given problem. However, the findings showed that most students still did not succeed on this indicator.

Furthermore, indicators using mathematics in concepts, facts, procedures, and reasoning (Employ) obtained a score of 70.90%. In more detail, indicator employ is to use concepts and facts clearly so as to implement effective problem solving strategies, can use procedures and reason with some insights to find solutions to a given problem. From the data shows most students answer the problem by writing the formula first with the correct stages of completion.

Then for the indicator interpreting the solution of a mathematical process (Interpret) obtained a score of 67.89%. Interpret indicators include reflecting the process of completion, communicating conclusions appropriately, and interpreting in written form to interpret the results of calculations that have been obtained. This ability is shown by students when faced with problems able to understand the context of numbers and explain the descriptions that have been found in the calculation process. In this study it was found that most students have not rewed what they have found, students only write how to solve numbers without interpreting them.

The overall average of mathematical literacy ability is 70.05 and is still in the good category. However, the ability of mathematical literacy in indicators to interpret the solution of a mathematical process (interpret) is still relatively low when compared to indicators formulating real problems systematically (formulate) and using mathematics in concepts, facts, procedures, and

reasoning (Employ). So most students need to be trained in working on problems that not only apply mathematical formulas, but hone students' ability to understand concepts, facts, procedures, and reasoning.

The correlation between Student's Habits of Mind and Mathematical Literacy Ability

Furthermore, the data that has been obtained in this study is analyzed using product moment correlation tests. Before the correlation test, it is necessary to perform a prerequisite test, namely the normality test and linearity test. The results of the analysis using SPSS version 23 obtained the significance value of sig mathematical literacy test. (2-tailed) is 0.167 > 0.05 and the value of the significance of mathematical thinking habits is Sig (2-tailed) which is 0.20 > 0.05. Based on these results, the students' mathematical literacy skills and students' mathematical thinking habits are normal, while for linearity tests obtained sig values. in the Deviation fromLinearity line which is 0.067 > 0.05 so that it can be concluded that there is a linear relationship between variables.

Table 6. Normality Test

Tests of Normality

	Kolmogorov-Smirnov[a]			*Shapiro-Wilk*		
	Statistic	*df*	*Sig.*	*Statistic*	*df*	*Sig.*
Mathematical Literacy Ability	,075	110	,167	,981	110	,111
Habits of Mind	,064	110	,200*	,989	110	,518

Table 7. Linearity Test

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
MLA * HOM	Between Groups	(Combined)	1850,668	24	77,111	7,481	,000
		Linearity	1474,856	1	1474,856	143,091	,000
		Deviation from Linearity	375,813	23	16,340	1,585	,067
	Within Groups		876,104	85	10,307		
	Total		2726,773	109			

The prerequisite test has been met, then the product moment crelation test is carried out using the SPSS application version 23. From the results of the correlation test obtained a correlation coefficient value of 0.735. Based on calculations using SPSS obtained sig values of

0.000 < 0.05, so that significant correlation coefficient values are known. This means that the habit of mathematical thinking has a positive correlation to the ability of mathematical literacy. The better the habit of mathematical thinking will be followed by the better the ability of mathematical literacy.

Table 8. Coefficient of Correlation

Correlations			
		KLM	KBM
MLA	Pearson Correlation	1	,735**
	Sig. (2-tailed)		,000
	N	110	110
HOM	Pearson Correlation	,735**	1
	Sig. (2-tailed)	,000	
	N	110	110

**. Correlation is significant at the 0.01 level (2-tailed).

The magnitude of the relationship of mathematical thinking habits to the ability of mathematical literacy can be seen in the value of the coefficient of determination (R2) which is 54.1%. This means that 54.1% of the variation in mathematical literacy ability variables can be explained by mathematical thinking habit variables or it can be said that mathematical thinking habits have an influence on mathematical literacy ability by 54.1%, the remaining 45.9% is explained by variables other than mathematical thinking habits.

Table 9. Coefficient of determination

Measures of Association				
	R	R Squared	Eta	Eta Squared
KLM * KBM	,735	,541	,824	,679

Here is a description of the relationship of mathematical thinking habits and mathematical literacy skills.

Table 10. The relationship of mathematical thinking habits and mathematical literacy skills

Habits of Mind Category	Indicator of Mathematical Literacy Ability		
	Formulate	**Employ**	**Interpret**
Thinking Flexibly	Get used to having the capacity to change minds when receiving additional data.	Get used to utilizing various problem-solving strategies and imagining various consequences.	Get used to developing alternative choice answers with confidence in his intuition.
Thinking of thinking	Consciously plan the strategy to produce the required answer information.	Get used to maintaining a strategy plan mind in the problem-solving process.	Get used to evaluating yourself about what has been completed

Thinking and Communicating with Clarity and Precision	Get used to solving math problems with valid data.	Speaking through writing appropriately when describing mathematical descriptions.	Speak in the right language to clarify math problems.

a. Thinking flexibly with indicator mathematical literacy ability

Students who are accustomed to flexible thinking will solve problems by having the capacity to change their minds while receiving additional data. This habit will help students not only focus on previously received data to formulate mathematical problems systematically (formulate). The real problem that has been formulated is then processed carefully in order to find a solution.

This habit will lead students in utilizing various problem-solving strategies and imagining various consequences. This will help students to use mathematics in concepts, facts, procedures, and reasoning (employ). Mathematical thinking goes beyond rote memorization and application of formulas; it involves engaging in a variety of problem-solving strategies and imagining the potential outcomes or consequences. The development of mathematical thinking habits is instrumental in empowering students to utilize mathematics effectively. It transforms the learning experience from a focus on memorization and application to a dynamic process of exploration, problem-solving, and creative reasoning. This not only prepares students for success in their mathematical studies but also equips them with valuable skills for addressing challenges in various aspects of life and future careers.

Next is the habit of flexible thinking makes students accustomed to developing alternative choice answers with confidence in their intuition. Students who have this habit will help him to interpret the solution of the process of a mathematical process (interpret). When students get used to having alternative options of answers, students will interpret the answers with maximum results according to their intuition.

b. Thinking of Thinking with indicatof mathematical literacy ability

Students who have a habit of thinking metacognition will be accustomed to consciously planning strategies to produce the required information. If students consciously face math problems, students will be easy to formulate problems (formulate) through the knowledge they have.

Furthermore students who are accustomed to thinking metacognition will maintain a thought of strategy plans in the problem-solving process. This will make it easier for students to use mathematics in concepts, facts, procedures, and reasoning (employ). When a strategy plan is maintained, the goal will be achieved by a mature process.

Metacognition thinking habits will help students in interpreting the solution of the mathematical process (interpret). This is because students will get used to evaluating themselves about what has been completed. After the strategy has been implemented, an important evaluation is carried out so that the results obtained become appropriate goals.

c. Thinking and Communicating with Clarity and Precision with indicator mathematical literacy ability

The habit of thinking and communicating clearly and carefully makes students accustomed to formulating mathematics clearly. This will support students in formulating mathematics systematically (formulate). If the math problem has been formulated clearly and systematically this will facilitate students in the next step.

Next is that students who have this habit of thinking will get used to supporting their statements with explanations, comparisons, and evidence. These habits will make it easier for students to use mathematics in concepts, facts, procedures, and reasoning (employ).

The essence of communication is a thought or the result of a process. When students are accustomed to thinking and communicating clearly and carefully students will be able to interpret the solutions of the mathematical process (interpret). This is because students who have this habit of thinking will speak clearly when explaining the description of mathematics.

Based on this research shown that there is a positive relationship between mathematical thinking habits and mathematical literacy skills. Students who already have good mathematical thinking habits are able to respond with awareness and strategies to get the right solution so as to improve the quality of mathematical literacy in understanding the role and usefulness of mathematics in solving problems in everyday life.

CONCLUSION

Based on the description above, students' mathematical literacy skills are in the good category with an average score of 70.05. Students' mathematical thinking habits are in the good category with a percentage score of 75.25%. The habit of mathematical thinking has a significant positive relationship with the ability of mathematical literacy shown by a correlation coefficient of 0.735. This means that the better the habit of mathematical thinking, it will be followed by the better mathematical literacy ability. While the magnitude of the influence of mathematical thinking habits on mathematical literacy ability is 54.1%. In conclusion, while mathematical literacy and habits of mind offer significant benefits, their limitations highlight the need for a balanced and nuanced approach to education. Recognizing both the strengths and challenges can inform more effective teaching strategies.

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