PARADIKMA JURNAL PENDIDIKAN MATEMATIKA
ISSN: 1978-8002 (Print)
ISSN: 2502-7204 (Online)

The Influence of Mathematical Literacy Ability and Critical Thinking Ability on Mathematical Problem Solving Ability

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Article History:
Received : 30-04-2024
Revised : 27-05-2024
Accepted : 02-07-2024
Online : 02-07-2024

Keywords :
Mathematical Literacy Ability, Critical Thinking Ability, Mathematical Problem Solving Ability

ABSTRACT

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The aims of this research are: (1) To find out how mathematical literacy skills and critical thinking skills affect mathematical problem-solving abilities simultaneously, (2) to find out how mathematical literacy skills and critical thinking skills affect mathematical problem-solving abilities partially. This study used a quantitative research approach and was conducted at SMPS Bina Taruna Medan, SMPN 20 Medan, and SMPN 33 Medan. The subjects were students in class VII-1 across the three schools, totaling 90 students. Random sampling was employed as the sampling method. The instruments included: (1) a test of mathematical literacy skills, (2) a test of critical thinking skills, and (3) a test of mathematical problem-solving abilities. Data analysis utilized multiple linear regression. The results indicate: (1) There is a simultaneous influence of mathematical literacy skills and critical thinking skills on mathematical problem-solving abilities, (2) There is a partial influence of mathematical literacy skills and critical thinking skills on mathematical problem-solving abilities. (3) Mathematical literacy skills and critical thinking skills jointly account for 90.1% of the variance in mathematical problem-solving abilities, with the remaining 9.9% attributed to other variables.

A. INTRODUCTION

Mathematical is a fundamental problem and very important for life. Learning mathematics at school is expected to help students become more creative, flexible, collaborative, problem solving and innovative in the future. By studying mathematics, students are expected to improve mathematical literacy, critical thinking skills, and Ability to solve math problems.

Mathematical literacy as defined in PISA, is the ability to reason mathematically and formulate and apply mathematics in various situations, including the ability to describe, explain or predict phenomena/events using concepts, procedures and facts (OECD, 2018). Mathematical knowledge is not only necessary to master content, but also to use reasoning, concepts, facts, and mathematical tools to solve everyday problems. Therefore, mathematical ability is a skill needed to be able to face problems in everyday life.

Critical thinking is a higher order thinking skill. Concurring to Johnson, basic considering may be a clearly organized prepare utilized in mental exercises such as fathoming issues, making choices, inducing, analyzing theories, and carrying out logical investigate exercises (Johnson, 2014). Mathematical critical considering is one of the objectives of science learning and is defined as a basic thinking process for analyzing hypotheses and generating ideas for existing situations, with the aim of encouraging logical thinking. Critical thinking skills also enable students to formulate problems correctly, gather and evaluate relevant information, and communicate effectively with others to find solutions to complex issues. This shows that critical thinking chops are veritably important for students to train their ability to understand more complex information provided and make important decisions both in learning and in everyday life. This will allow students to socialize, solve scientific problems, and effectively solve practical problems in the future.

The capability to break fine problems is an important fine skill that scholars who study mathematics must master. The verity of this statement is that working fine problems is a skill listed in the class and mathematics

literacy objects (Hendriana et al. 2017). By learning fine problem working chops, scholars are anticipated to gain experience using the knowledge and chops they've applied. Mathematics learning points not only ameliorate scholars' chops in working problems related to computations in numerical form, but also to ameliorate scholars' chops in working problems that use mathematics contextually. The significance of problem working chops was stressed by Fauziah, who showed that problem working chops are one of the fine chops which can be classified as advanced position chops (Fauziah, 2018). Likewise, the significance of problem working chops was also stressed by Pimta, who stated that problem working chops can be answered by scholars understanding the being problems and how scholars break them an idea of what to do break the problem. Ulya, R and Hidayah (2016).

Literacy comes from English and refers to the ability to read and write. The ability to read and write is still the most important skill needed to carry out daily life. Because without literacy, it is difficult to advance communication between humans to a higher level. The term literacy refers to language skills which include the ability to listen, speak, read, write and think. Literacy has become a very hot topic in international discussions and is a big goal and ambition of the young generation in every country. Mathematical literacy consists of mathematical reasoning abilities, use of concepts, ability to apply procedures, ability to find facts and find mathematical tools to describe, depict and evaluate events In simple terms, mathematical literacy is a student's ability to understand mathematical concepts, use mathematics to solve life problems, including mathematical thinking, problem solving, mathematical communication, and the use of mathematics in everyday life. This process requires the ability to think mathematically, starting with identifying and understanding the problem. Mathematical literacy means being able to read, listen, write and speak and have mathematical knowledge that can be used for understanding, problem solving and communication.

The more you learn based on your discoveries and deepen the concept of the material, the more meaningful your knowledge will be. To think critically, you need to read critically so that your decisions are not wasted. Critical thinking is one of the important chops when learning mathematics. Critical thinking has numerous different terms and is defined by different experts using different expressions, but the meaning is the same. According to Purwanto, he expresses the meaning of thinking in relation to a more general framework, namely abstraction, while he expresses it in relation to a more specific framework, namely abstractions such as reactions, memories, memory, and so on. It is said that this is thought about in the arrangement or study of interrelationships. understanding and emotion. Thoughts are definitely related to various problems, whether they arise from the present, the past, or those that don't yet exist. The problem solving process is called the thinking process. Critical thinking skills are required to make holistic decisions. These skills include the ability to provide simple explanations, build basic skills, formulate, provide further explanations, and manage strategies and tactics. Based on the opinions of several experts mentioned above, the definition of critical thinking ability, namely anyone who includes analysis and evaluation of ideas and ideas in a more specific direction in order to obtain relevant knowledge about the world, can be drawn conclusions regarding the competencies that must be possessed. To get proof. Critical thinking skills are very important for analyzing problems and finding solutions.

In everyday life, humans are never free from problems ranging from simple to complex. People who are used to facing problems will find it easier to solve the same problem when faced with that problem. On the other hand, it may be difficult for people who are not used to solving problems. Nitko said that problem solving is an effort to achieve a desired goal and not necessarily knowing the right way to achieve that goal, but Sumarmo revealed that problem solving is a process to alleviate difficulties [14]. To achieve a desired goal. According to this narrative, problem solving is an effort to achieve the expected goals through basic processes and skills. According to Polya in Hudojo, there are two types of mathematics, namely problems that must be discovered and problems that must be proven. The problem found is a mathematical problem based on data, conditions and objects used to solve the problem. The problem to be proven is a mathematical problem. The solution is to use the assumptions and conclusions contained in the sentence to prove that the sentence is true. Based on the explanations of the experts above, mathematical problem solving ability is a student's ability to find ways to solve problems or develop new ideas and methods according to the problems they face in everyday life, we can conclude that.

B. RESEARCH METHODS

The aim of this research is to discover out how mathematical literacy skills and critical thinking skills impact students' mathematical problem solving abilities at the same time and partially. This investigate employments a quantitative approach, with the sort of investigate being ex-post facto, because it is research into relationships that influence each other and is not manipulated or treated with the variables and data taken

in this research after or when the incident occurs. This research is directed at testing the influence of two variables, namely, mathematical literacy abilities (X1) and critical thinking abilities (X2), on problem solving abilities (Y).

This study is conducted in three junior high schools in the city of Medan. The first is SMPS Bina Taruna Medan which is located on Jl. Marelan Raya Pasar III no. 100 Rengas Island District. Medan Marelan. The second is SMP Negeri 20 Medan which is located on Jl. Captain Rahmad Buddin Lk. 14, Terjun Kec. Medan Marelan. The third is SMP Negeri 32 Medan which is located on Jl. Marelan V No. 123, Rengas Island District. Medan Marelan. This investigation was conducted within the odd semester of the 2023/2024 scholastic year.

The sample determination in this study used a cluster irregular sampling strategy which partitions the populace into several groups (clusters), so that this study randomly selected two state schools and one private school in Medan City, consisting of junior high schools. Next, Class VII from the three schools was used as the research sample. The instrument used in this research is a descriptive test. The data analysis techniques used in this research are prerequisite testing, multiple regression models, correlation analysis, and coefficient of determination. This test uses SPSS 26.0. The form of research design is as follows:

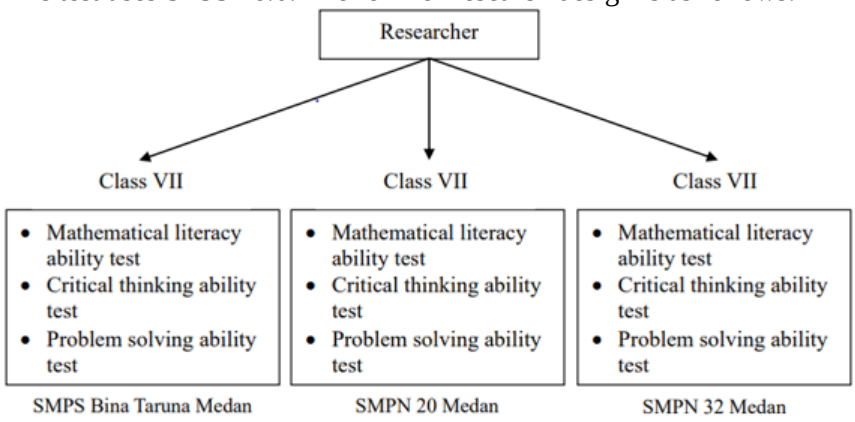

Figure 1 Study design

In Figure 1 is a research design that took a sample from class 7 and used a mathematical literacy ability test, a mathematical communication ability test, a critical thinking ability test and a problem solving ability test.

C. RESULT AND DISCUSSION

Result

The resulting data will be quantitative data. Through this research, a lot of data was obtained, including: 1) Comes about of students' mathematical literacy ability tests. 2) Comes about of students' critical thinking ability tests. 3) Comes about of students' mathematical issue solving tests. The information depicted in this inquire about incorporate the Student Mathematical Literacy Capacity Test (X1), the Student Critical Thinking Capacity Test (X2) and the Student Problem Solving Capacity Test (Y). There are 90 students at the public and private junior high school level in Medan City.

The performing data will be quantitative data. Through this exploration, a lot of data was attained, including: 1) Results of scholars' fine knowledge capability tests. 2) Test the results of scholars' critical thinking capacities. 3) test results of scholars' fine communication chops, and 4) results of tests of scholars' problem working capacities. The data described in this exploration include the Student Mathematical knowledge Capability Test (X1), the Pupil Critical Allowing Capability Test (X2), the Student Mathematical Communication Capability Test (X3), and the Pupil Problem working Capability Test (Y). There are 90 scholars at the public and private inferior high academy position in Medan City. The computation comes about are appeared within the taking after table:

Table 1 Results of Research Variable Values

Statistic	X_1	X_2	Y
Lowest Score	43,75	48,43	58,24
Highest Score	93,75	96,86	95,68
Mean	76,944	79,344	80,449
Std. Deviation	12,514	10,317	8,906

In table 1 above are the statistical results of the research variable values, where the average is X1 76.9, X2 79.3, and Y 80.4

1. Multicolinearity Test

The multicollinearity test in this study is based on the use of SPSS 26.0 and considers variance inflation factor (VIF) and collinearity tolerance using the following assumptions:

H_0 : multicollinearity doesn't do

Ha : multicollinearity occurs

The test criteria are:

- If $VIF \leq 10$ and Forbearance value ≥ 0.10 there's no multicollinearity between the autonomous factors
- If $VIF \geq 10$ and Forbearance value ≤ 0.10 there's no multicollinearity between the autonomous factors

Coefficients[a]								
Model		Unstandardized Coefficients		Standardlized Coefficients Beta	t	Sig.	Collinearity Statistics	
		B	Std. Error				Tolerance	VIF
1	(Constant)	8.550	3.357		2.547	.013		
	Mathematical literacy	.037	.054	.052	.692	.491	.282	3.549
	Critical thinking	.466	.067	.540	6.979	.000	.268	3.725
a. Dependent Variable: Problem Solving								

Figure 2 Multicollinearity Test Comes about

Figure 2 appears that there is no multicollinearity in this research data (H_0) because the VIF value is less than 10, 3.725 is greater than 10, and 2.754 is less than 10. The tolerance value is greater than 0.10, and the values 0.282 and 0.268 are all greater from 0.10. Mathematical literacy (X_1) and critical thinking (X_2) are independent variables, meaning they do not interact with each other.

2. Multiple Linear Regression Analysis

To test this thesis statistically, we used a multiple direct regression model and looked at the significance of the portions. Table 3 displays the findings of assessments of fine knowledge, problem working, critical thinking, and fine communication calculated using SPSS 26.0.

Coefficients[a]						
Model		Unstandardized Coefficients		Standardlized Coefficients Beta	t	Sig.
		B	Std. Error			
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	Mathematical literacy	.037	.054	.052	.692	.491
	Critical thinking	.466	.067	.540	6.979	.000
a. Dependent Variable: Problem Solving						

Figure 3 Results of Multiple Regression Measure Calculation

From figure 3 it can be seen that the multiple linear regression demonstrate condition is: $\check{Y} = 8.550 + 0.037X1 + 0.466X2$. From this equation, it means that if mathematical literacy skills (X1) increase by one unit and critical thinking skills and mathematical communication skills are constant then students' problem solving abilities (Y) will increase by 0.037 with students' critical thinking abilities being 8.550. Likewise, if critical thinking skills (X2) increase by one unit and mathematical literacy skills and mathematical communication skills are constant, students' problem solving abilities (Y) will increase by 0.466 with students' literacy skills at 8.550.

Discussion

Mathematical literacy abilities tests, critical thinking ability tests and student problem solving capacity tests have been distributed to 90 students taken from 3 junior high schools in the city of Medan, namely SMPS Bina Taruna Medan, SMPN 20 Medan and SMPN 32 Medan. Based on the investigate comes about, it was

concluded that there was a positive and noteworthy impact between the factors of critical thinking capacity and literacy capacity on students' concurrent problem solving capacities. In line with the results of this research, according to (Hendriana, 2018) mathematical abilities are needed by every student in facing challenges in the current era of globalization and information.

All these mathematical abilities are also stated in writing in the objectives of mathematics subjects in primary and secondary education listed in the KTSP and refined in the 2013 curriculum. Likewise, according to (Laia, 2019) problem solving abilities help students think analytically in making decisions in life. everyday life and helps improve other mathematical abilities such as mathematical literacy skills and critical thinking skills in dealing with new situations.

D. CONCLUSION AND SUGGESTIONS

Based on the comes about of the investigate information examination portrayed within the past area, a few conclusions were gotten relating to numerical proficiency capacities and basic considering capacities on issue fathoming abilities as takes after: There's an impact of numerical proficiency capacities and basic considering capacities on the issue tackling capacities of course VII junior high school understudies in Synchronous territory. There's a fractional impact of scientific proficiency aptitudes, basic considering abilities and numerical communication abilities on the issue understanding capacities of lesson VII junior tall school understudies in Medan.

The level of near relationship between mathematical literacy abilities and critical thinking abilities on the issue fathoming capacities of course VII middle school students in Medan simultaneously is very strong, namely 0.905 and the determinant coefficient (R2) is 0.901, this shows that mathematical literacy skills and thinking skills critical influence of 90.1% on simultaneous problem solving abilities. Meanwhile, 9.9% is determined by other variables.

It is hoped that support from related institutions will focus the influence on achieving learning not only from interesting learning models but also from within students so that they gain knowledge, attitudes and skills that are useful for them.

ACKNOWLEDGEMENT

On this event the creator would like to specific his most profound appreciation and appreciation to all parties who have made a difference the creator: Prof. Dr. Edi Syahputra, M.Pd. as administrator I and Dr. Pardomuan Sitompul, M.Si. as administrator II and Prof. Dr. Bornok Sinaga, M.Pd, Head of the Mathematics Education Postgraduate Study Program.

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