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INFLUENCE SELF-EFFICACY ON THE MATHEMATICAL COMMUNICATION ABILITY OF STUDENTS IN MATERIAL SYSTEMS OF LINEAR EQUATIONS

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ABSTRACT
Self-Efficacy is one of the factors that can affect students' mathematical communication ability. Focus Self-Efficacy in this study, namely students' self-confidence in mathematical communication ability in written mathematics, especially material systems of linear equations. The purpose of this study is to determine the effect Self-Efficacy on the mathematical communication ability of class X MAN 2 Malang. This research approach uses a quantitative causal comparative method. The sample in this study amounted to 32 students obtained from the sampling technique simple random sampling. Obtaining data in this study is in the form of related questionnaire results Self-Efficacy consisting of 25 statement items and 4 descriptive test items to measure students' mathematical communication ability. The results of this study indicate that students' mathematical communication ability are influenced by Self-Efficacy 81.7% which is categorized as very strong and the remaining 18.3% is influenced by other factors. Thus, it can be stated that Self-Efficacy has a significant effect on the mathematical communication ability of class X MAN 2 Malang students in the material of systems of linear equations. Therefore, teachers must continue to encourage increasing student Self-Efficacy. Because with high Self-Efficacy, students' mathematical communication abilities will also be high, so that student learning outcomes will also increase.
Keywords: Self-Efficacy, Mathematical Communication Ability, Systems of Linear Equations

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PRELIMINARY

Process standards that students must master according to *National Council of Teachers of Mathematics* (NCTM), one of which is mathematical communication ability (Nasution, 2018). Mathematical communication ability are needed because students will need them in learning and solving mathematical problems in life every day. Umar in Riawati's article, (2019) states that in organizing students' mathematical thinking patterns, it is necessary to have good communication skills, both written and verbal; this needs to be done to develop students' mathematical communication ability in learning mathematics. In learning mathematics, students must be trained to give opinions on each answer or provide responses from other students' answers (Selvianie, 2014). Weak mathematical

communication ability also result in the ability to complete other mathematics, resulting in minimal learning outcomes obtained by students (Fitria & Handayani, 2020). To maximize student learning outcomes, it is also necessary to optimize the factors that influence mathematical communication, mainly student internal factors. Internal factors are student psychological factors (Mukti & Syam, 2017). One of the internal factors that exist in students is self-efficacy.

Self-efficacy is each individual's self-confidence in his ability in various conditions to face and complete the desired goals (Andinny, et al., 2022). According to Albert Bandura in Fitria & Handayani research (2020), self-efficacy is an assessment or opinion of one's ability to organize the activities needed to solve problems to achieve specific results. Self-efficacy is related to belief in one's ability to carry out the expected actions. Someone who has high self-efficacy will persist when facing difficult problems, because they believe that they are able to solve the problem. Meanwhile, someone with low self-efficacy will easily give up and be vulnerable to the pressures of heavy problems (Rachmawati, et al., 2021). Therefore, self-efficacy is a condition where students feel confident and believe they can give maximum results from the effort they have made.

One of the math materials that can support self-efficacy and students' mathematical communication ability is material on a system of linear equations (Sulastri & Sofyan, 2022), because this material on a system of linear equations can assist students in finding solutions to problems, requiring students to be able to solve descriptive questions in the form of the issues related to daily activities, which in this case can measure self-efficacy and students' mathematical communication ability (Sari, et al., 2019). In the material of systems of linear equations, students must be able to solve, starting from modeling story problems into mathematical form, from determining variables, constants, etc., looking for variable values, and proving and concluding solutions.

Based on initial observations made by researchers in class X MAN 2 Malang during fieldwork practices, researchers conducted interviews with several students, which showed that most students did not like learning mathematics because they found studying or solving a mathematical problem challenging. During the learning process, students also need more confidence and confidence when expressing opinions, and it is common for students to be silent and listen. In addition, students also refrain from solving mathematical problems, exceptionally when appointed by the teacher to explain their work to other students. Ajeng and Sutirna, (2021) also demonstrated that students' fear of learning

mathematics could result in lousy self-confidence, leading to minimal student learning outcomes.

In the ability to communicate mathematically, students are still said to be not optimal. It can be seen in the results of student work when completing the practice questions. The student is technically able to solve it, but the student's mathematical communication ability still need to improve. Students must still be more precise in expressing description questions in mathematical models. In addition, students also need more understanding and correct mathematical ideas in writing, which can be seen in student work that does not write work steps. For example, students directly eliminate variables from two equations without writing down which equations are used and which variables will be destroyed. At the end of the completion, students also do not conclude answers to problems that are appropriate to the questions; this is also supported by research conducted by Setiyawan, et al., (2019), which showed that in the midterm assessment of mathematics subjects, 66% of students get grades below 75.

In research conducted by Hendriana & Kadarisma, (2019), it was stated that mathematical communication ability and self-efficacy are two very important things for students to have and are related to each other. Students who are confident in their communication skills are expected to have good communication skills, and vice versa. Therefore, the researcher conducted this research to determine whether self-efficacy affects the mathematical communication ability of class X MAN 2 Malang on the material system of linear equations.

METHODS

This research was conducted at MAN 2 Malang, located in Turen - Malang. The population in this study are students class X MAN 2 Malang, totaling 153, so with simple random sampling, according to Slovin, *a* sample of 32 students was obtained. This study uses a quantitative approach with comparative causal methods. The variables in this study consist of independent variables is self-efficacy and the dependent variable is ability in mathematical communication. The data in this study is quantitative, and the data source is primary data in the form of questionnaire about self-efficacy students and the results of tests of students' mathematical communication abilities.

The instrument in this study used a questionnaire self-efficacy 25 items and four items test a linear equation system material to obtain data on mathematical communication abilities. The indicators used for the questionnaire are, level/magnitude, strength, and

generalitation. While, indicators used for test instruments are the aspects of ability to state the problem, ability to explain steps, ability to make conclusions. To make it easier to accommodate problems that arise, a grid of instruments for mastering mathematical concepts is arranged as follows:

Table 1. The Grid of Mathematical Communication Ability Instruments

Number	Indicator
1.	Students are able to express daily life events in mathematical models
2.	Students are able to describe mathematical ideas in written form
3.	Students are able to use ideas and write down steps to solve problems
4.	Students are able to evaluate mathematical ideas in solving problems and write conclusions based on the answers

After collecting the data, a validity test was carried out. A validity test was conducted to determine the quality and feasibility of the instrument based on the language, construction, and content components. This validity test uses a content validity test conducted by three instrument experts and an empirical validity test using the correlation method product moment, Which is compared to the value R_{tabel} using calculations with the help of the microsoft excel application. The instrument is said to be valid if the calculated $R_{value} \geq R_{table}$. Based on the validity test, the following results were obtained:

Table 2. Quistionnaire Validity

Item	R_{value}	R_{table}	Info	Item	R_{value}	R_{table}	Info	Item	R_{value}	R_{table}	Info
1	0.548	0.355	V	9	0.436	0.355	V	18	0.526	0.355	V
2	0.498	0.355	V	10	0.735	0.355	V	19	0.462	0.355	V
3	0.450	0.355	V	11	0.649	0.355	V	20	0.444	0.355	V
4	0.711	0.355	V	12	0.465	0.355	V	21	0.709	0.355	V
5	0.553	0.355	V	13	0.548	0.355	V	22	0.777	0.355	V
6	0.555	0.355	V	15	0.739	0.355	V	23	0.365	0.355	V
7	0.474	0.355	V	16	0.732	0.355	V	24	0.578	0.355	V
8	0.487	0.355	V	17	0.471	0.355	V	25	0.672	0.355	V

Table 3. Test Mathematical Communication Ability Validity

Item	R_{value}	R_{table}	Info
1	0.4245503	0.355	Valid
2	0.5544856		Valid
3	0.904788		Valid
4	0.8514275		Valid

Based table 2 and table 3, the results of the validity test of the self-efficacy questionnaire and the student mathematical communication ability test, for each item have a value of $R_{value} \geq R_{table}$. Therefore, it can be stated that both instruments are valid.

Meanwhile, reliability test with the method alpha Cronbach under the condition $R \geq 0.70$ (Yusup, 2018). The following are the results of the instrument reliability test using SPSS:

Table 4. Quistionnaire Reliability

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.911	.907	25

Table 5. Test Mathematical Communication Ability Reliability

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.746	.816	4

Based on table 4 and table 5, the results of the reliability test of the self-efficacy questionnaire and the student mathematical communication ability test instrument showed that the Cronbach alpha value was ≥ 0.70. Therefore, it can be stated that both instruments are reliable.

After all the tests have been carried out, it is continued with descriptive statistical analysis by finding the mean, standard deviation, frequency table of self-efficacy, and mathematical communication ability of class X MAN 2 Malang. The researcher conducted prerequisite tests, including normality, linearity, and heteroscedasticity tests, followed by hypothesis testing to determine the correlation coefficient, determination, and simple linear regression equation.

RESULT AND DISCUSSION

The research data was obtained from filling out the questionnaire self-efficacy and testing the mathematical communication ability of class X MAN 2 Malang as many as 32 students. The hypothesis in this research is Ho which states "there is no influence of Self-Efficacy on the mathematical communication ability" and Ha which reads "There is an influence of Self-Efficacy on the mathematical communication ability". The results of the analysis of each research variable are as follows:

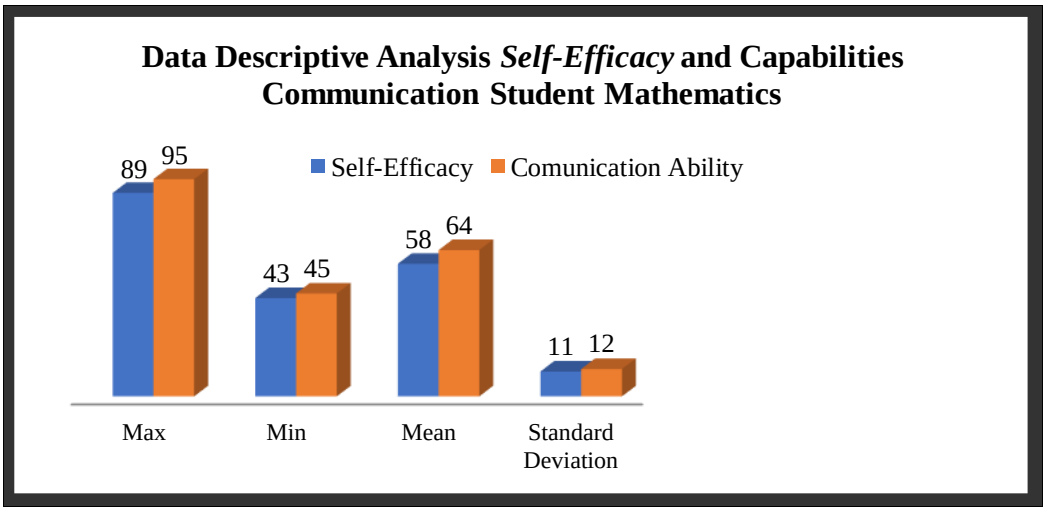


Figure 1. Result of Descriptive Data Analysis

Based on Figure 1, the highest score for self-efficacy obtained from 32 students of class X MAN 2 Malang was 89, while the lowest score was 43. The average score for self-efficacy students is 58.00, and the standard deviation is 10.860. Then, the highest score on the test of mathematical communication ability was 95, while the lowest score was 45. The average score of students' mathematical communication ability was 63.91, and the standard deviation was 11.963. Then score self-efficacy and the mathematical communication ability of class X MAN 2 Malang are categorized using the average value $(\bar{x})$ and standard deviation (SD), until the following categories are obtained: 1) high category when $X \geq (\bar{x} + SD)$, 2) medium category when $(\bar{x} - SD) \leq X < (\bar{x} + SD)$, and 3) high category when $X < (\bar{x} - SD)$ Ilmi, et al., (2022), to obtain the following frequencies and percentages:

Table 6. Frequency and Precentage of Result Self-Efficacy of Class X MAN 2 Malang

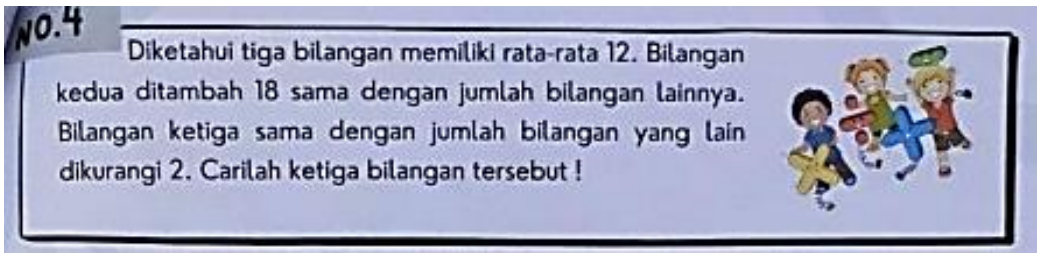
Interval	Category	F	%
$25 - 50$	Low	9	28,125
$51 - 75$	Medium	20	62,5
$76 - 100$	High	3	9,375
Total		32	100

Table 7. Frequency and Precentage of Mathematical Communication Ability of Class X MAN 2 Malang

Interval	Category	F	%
$X < 52$	Low	7	21,875
$52 \leq X < 76$	Medium	22	68,75
$X \geq 76$	High	3	9,375
Total		32	100

Based on table 6 and table 7, it is found that the percentage is the highest level of self-efficacy, and the mathematical communication ability of class X MAN 2 Malang are in the medium category. Students with high self-efficacy are more enthusiastic and keep carrying out tasks directly, even though the task is complex. The student believes that he can complete the questions or assignments given. As for students with low self-efficacy, more people are confident in their abilities and will avoid tasks that are considered problematic.

The following is one of the test questions for students' mathematical communication ability.



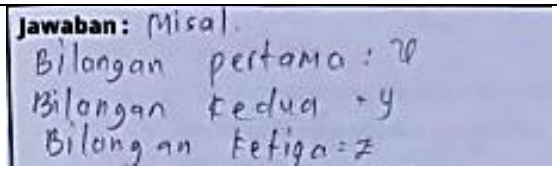
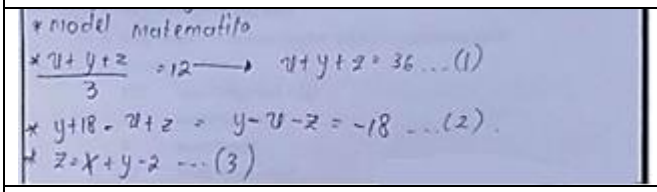
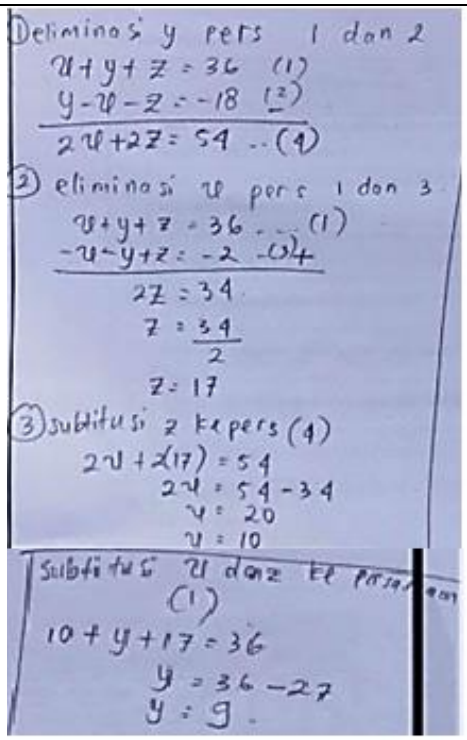
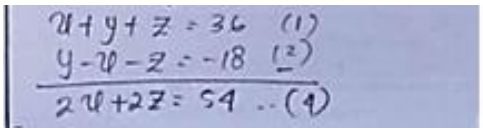
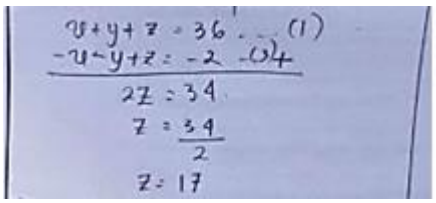
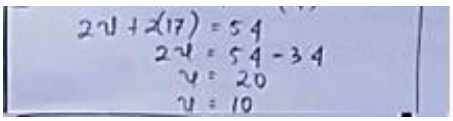
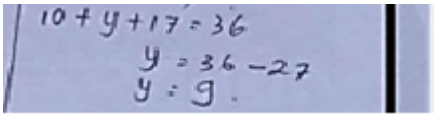
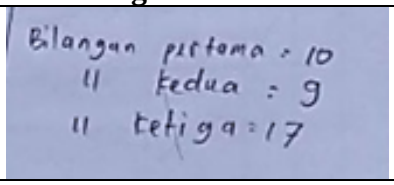
English Version

No. 4

It is known that three numbers have a mean of 12. The second number plus 18 is equal to the sum of the other numbers. The third number is equal to the sum of the other numbers minus 2. Find these three numbers!

Figure 2. Test questions of Students' Mathematical Communication Ability

Table 8. Test Results of Students' Mathematical Communication Ability

Indonesian version	**English Version**
Stage of determining the problems	
	Answer: example First number = x Second number = y Thrid number = z
Stage of creating a mathematical model	
	* Mathematical model * $\frac{x+y+z}{3} = 12 \rightarrow x+y+z = 36 \ldots (1)$ * $y+18 = x+z \rightarrow y-x-z = -18 \ldots (2)$ * $z = x+y-2 \ldots (3)$
Stage of writing the steps to steps solve	
	1. Eliminate y in equation 1 and 2  2. Eliminate x in equation 1 and 3  3. Substitution z value into equation 4  4. Substitution x and z value into equation 1 
Stage of concluding answer	
	First number : 10 Second number : 9 Third number : 17

This can be seen in table 8 which shows that students with high mathematical communication ability can solve the questions well and correctly, even though they feel the questions they are working on are difficult, while students with low mathematical communication ability cannot solve the questions because they find them difficult and does not believe that he is able to do difficult problems.

This is in line with research conducted by Alifia & Rakhmawati, (2018), Oktariani, (2018), and Revita, (2019) which states that students with self-efficacy have a high level of calm when faced with tasks and confidence in facing charges that are considered problematic. At the same time, students with self-efficacy and low self-doubt about their abilities think of many things that are more difficult than the correct answer.

Then, this data acquisition is tested for normality with SPSS assistance. Based on the normality test, it was found that the value was significant for self-efficacy to mathematical communication ability obtained $0{,}099 \geq 0{,}05$, can be seen the table 9:

Table 9. Normality Test

		Self Efficacy	Communication Ability	Unstandardized Residual
N		32	32	32
Normal Parameters[a,b]	Mean	58.00	63.91	.0000000
	Std. Deviation	10.860	11.963	5.12000733
Most Extreme Differences	Absolute	.146	.151	.142
	Positive	.146	.151	.086
	Negative	-.084	-.091	-.142
Test Statistic		.146	.151	.142
Asymp. Sig. (2-tailed)		.082[c]	.061[c]	.099[c]

Based the table normality, that the data can be said to be normally distributed. Then the SPSS-assisted linearity test was carried out, which accepted that the significant value of the data for self-efficacy to the mathematical communication ability is $0{,}57$. Because $0{,}57 \geq 0{,}05$ then the data includes linear.

Table 10. Linearity Test

		Sum of Squares	df	Mean Square	F	Sig.
Between Groups	(Combined)	4286.719	20	214.336	15.718	.000
	Linearity	3624.070	1	3624.070	265.765	.000

		Sum of Squares	df	Mean Square	F	Sig.
	Deviation from Linearity	662.649	19	34.876	2.558	.057
Within Groups		150.000	11	13.636		
Total		4436.719	31			

Then a heteroscedasticity test was carried out, which showed that the value was significant at self-efficacy on mathematical communication ability is $0{,}061$. Because $0{,}061 \geq 0{,}05$ then the data does not occur heteroscedasticity constraints.

And then hypothesis test is determining the correlation values and the regression equation values.

Table 11. Correlation Coefficient

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.904	0.817	0.811	5.205

Based on the SPSS calculations in table 11, correlation coefficient values are obtained (r) as significant at 0.904, while the coefficient of determination (r^2) is substantial at 0.817. In this case, we have stated that the correlation between self-efficacy and the mathematical communication ability of class X MAN 2 Malang in the solid category with a percentage of 81.7% and 18.3% influenced by other factors. Other factors affecting students' communication skills include learning interests, motivation, and environment (Faridah, et al., 2019). The results of this study agree with Purwandari & Maya, (2020), that self-efficacy has a positive effect of 19.1% on students' mathematical communication ability, while other factors influence 80.9%, and Nurhanurawati, et al., (2021) state that communication abilities are affected by 63.1% self-efficacy.

Table 12. Regression Equation Coefficient

Model	B	Std. Error	Beta	T	Sig.
(Constant)	6.160	5.077		1.213	0.234
Self-Efficacy	0.996	0.086	0.904	11.567	0.000

After obtaining the correlation value, then determine the regression value. Based on SPSS calculations in table 12, values $a = 6.160$ and $b = 0.996$. Thus, the regression line equation is formed as follows:

$$Y = a + bX$$

$$Y = 6{,}160 + 0{,}996X$$

This equation explains that a constant value of 6,160 means self-efficacy positively influences students' mathematical communication ability. Until Self-Efficacy has increased by one unit, the students' mathematical communication ability has increased by 0,996. So there is an intermediate effect of self-efficacy on the mathematical communication ability of class X MAN 2 Malang on the material system of linear equations. In this case, he agrees with research of Rahmi, et al., (2017), Andinny, et al., (2022), and Rahayu (2021) which gives the result that there is a significant effect between self-efficacy on students' mathematical communication ability.

Self-efficacy can describe the abilities of students. However, this makes a minimal contribution to students' mathematical communication ability because other factors can influence it. Other factors affecting students' communication skills include learning interests, motivation, and environment (Faridah, et al., 2019).

The results of this study contradict research conducted by Sunarti, R, Zubaidah, and Ijuddin (2020) which shows that Self-Efficacy does not affect students' mathematical communication ability. This contradiction occurs because the researcher assumes due to differences in material. After all, in each mathematic materials, students' abilities and beliefs in dealing with this material different (Putri, 2014). Regarding systems of linear equations, students with Self-Efficacy and higher levels more easily communicate mathematical ideas in solving system problems of linear equations. In contrast, students with low Self-Efficacy students consider the material for a system of linear equations to be complex material, so students easily give up on the problem (Imaroh, et al., 2021) and (Sari, et al., 2019).

CONCLUSION

Based on existing research, Self-Efficacy has a positive effect of 81.7% on students' mathematical communication ability, so Self-Efficacy significantly affects the mathematical communication ability of class X MAN 2 Malang on the material system of linear equations. Therefore, teachers must continue to encourage increasing student self-efficacy. Because with high self-efficacy, students' mathematical communication abilities will also be high, so that student learning outcomes will also increase.

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