The Effect of Self-efficacy and Self-esteem on Students' Mathematical Communication Skills

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ABSTRACT

This study aims to determine: (1) the description of Self-efficacy, Self-esteem, and mathematical communication skills of class, (2) the effect of Self-efficacy on students' mathematical communication skills, (3) the effect of Self-esteem on students' mathematical communication skills and (4) the effect of both Self-efficacy and Self-esteem on students' mathematical communication skills. This research is a causal-comparative research type which is also called ex post facto research with quantitative research. The research was carried out at MTsN 1 Gowa. The research used the systematic random sampling (SRS) technique and obtained a sample of 80 students from 160 students of class VII MTsN 1 Gowa. The research instruments used were self-efficacy questionnaires, self-esteem questionnaires, and mathematical communication skills test questions. The data analysis undertook by using descriptive and inferential statistics in the form of multiple linear regression analysis. This study showed that the self-efficacy level of 80 class VII students of MTsN 1 Gowa was in the medium category, where the highest score was 55 and the lowest score was 34, with an average score of 43.13. The self-esteem level of 80 class VII students of MTsN 1 Gowa is in the medium category, where the highest score is 59, and the lowest score is 38, with an average score of 49.10. The level of mathematical communication skills of 80 students of class VII MTsN 1 Gowa is in the high category where the highest score is 85, and the lowest score is 50 with an average value of students' mathematical communication skills of 63.81.

Keywords: Self Efficacy, Self Esteem, mathematical communication skills.

1. INTRODUCTION

One of the purposes of mathematics learning is to develop students' ability to convey their ideas through verbal communication, notes, symbols, tables, graphs, diagrams, and other media to clarify the situations or the problems.

Mathematical communication includes delivering explanations using verbal, writing, and visualization, such as explaining reasons and result from correction using written or spoken information and communicating mathematical ideas and solutions in written forms such as numbers and algebra symbols and visual forms like pictures, diagrams, graphs, tables, and concrete material [1]. Therefore, in the process of Math learning, students must be trained to

deliver their argumentation as well as to give responses to others' answers.

In the Regulation of the Minister of National Education Number 22 the Year 2006 about content standard, Math lessons aim to build student's abilities in the field of (1) understanding Math concept; (2) reasoning; (3) solving problems; (4) communicating ideas; (5) appreciating the uses of Math in daily life [2]. Based on those goals, Mathematical communication skill is a must-have ability for students. Consequently, to maximize students' achievement in it, we need to optimize its influential factors.

One of the influential factors in a human being is the belief that one can control a situation and deliver positive outcomes. This belief is called self-efficacy. Faith in a person about his power to conduct a task to

achieve certain results [3]. Self-efficacy is the ability to create specific tasks, including performing them in different situations [4]. Self-efficacy is a condition in which someone believes that he can control the result of the work done. Apart from self-belief, another essential thing to optimize students' learning achievement in mathematical communication is self-assessment.

General self-assessment, including positive and negative assessment, will lead to being worthy in everyday life called self-esteem. Self-esteem is a feeling of being worthy [5]. It is more basic than reputation and prestige as it mirrors the desire for power, achievement, accuracy, control and competence, self-belief to face the world, independence, and freedom. In other words, self-esteem is based on real competence, not others' opinions. Someone with high self-esteem will not be easily affected by others' judgment about his personality.

The interview with a math teacher in MTsN 1 Gowa found that 7th-grade students' achievement in mathematics subjects had a significant ratio among students. The result showed that 60% of students' score was in the low score category. We also interviewed some students and got the result that only a few students liked Math. Some students failed to estimate their self-worth in their friends' eyes. It was shown by their low self-esteem, such as they could not decide on any goals for their future. Additionally, in the learning process, they were shy to express their opinions. They chose to be silent and listened only.

Built upon the above explanation, we conducted research to develop learning material titled "The Effects of Self-Efficacy and Self-Esteem On 7th Grade Students' MTsN 1 Gowa Mathematical Communication Skills".

2. RESEARCH METHODS

The type of research method used was causal-comparative research or ex post facto. Ex post facto research aims to investigate the possible cause and effect of phenomena by observing existing effects and finding potential causal factors using specific data. This research aimed to discover the impacts of self-efficacy and self-esteem on students' mathematical communication skills. All the data used were quantitative.

The population of this research was 160 students, with 80 students as the sample. The samples were randomly chosen at the beginning of the study. Questionnaires and several tests were used to collect the data. We used a self-efficacy questionnaire, self-esteem questionnaire, and mathematical communication skill tests. Multiple Linear Regression was used to analyze the data. We used this method because it is a proper model if the model satisfies data normalization assumption and is free of classic statistical assumptions, including heteroskedasticity, autocorrelation, and multicollinearity [4]. The hypothetical thesis was tested using T-Test and F-test statistics.

3. RESULT

3.1. 7th Grade students' of MTsN GOWA mathematical communication skill description

According to the students' mathematical communication skill test, we acquired the result in the following table. The data were processed using SPSS.

Table 1. Descriptive statistic score of students' mathematical communication skill test result

Students' mathematical communication skills	
Number of samples	80
Lowest score	50
Highest score	85
Rata-rata	63,81
Standard deviation	8,832
Variance	78,002

Table 1 shows that the highest score is 85 and the lowest one is 50. The mean is 63.81, the standard deviation is 8.832, and the variance is 78.002.

By categorizing the students' mathematical communication skill test result as very low, low, middle, high, very high, we acquired the frequency and percentage as the following table:

Table 2. Frequency distribution and percentage of students' mathematical communication skill test result

Ability	Category	Frequency	Percentage %
0-34	Very Low	0	0
35-54	Low	9	11,25

55-64	Middle	29	36,25
65-84	High	41	51,25
85-100	Very High	1	1,25
Total		80	100

Table 2 describes that no students are in the very low category, while there are 9 students (11.25%) who belong to the low category, 29 students (36.25%) are in the middle category, 41 students (51.25%) are in the high category, and 1 student is in the very high category. According to the table, we can conclude that most students' mathematical communication skill test results are in the high category.

3.2. MTsN 1 Gowa 7th Grad Students' Self-Efficacy Description

Based on the self-efficacy questionnaire result processed by SPSS, we acquired the following result:

Table 3. Descriptive statistic score of self-efficacy questionnaire result

Self-Efficacy	
Number of samples	80
Lowest score	34
Highest score	55
Mean	43,13
Standard Deviation	4,832
Variance	23,351

Table 3 shows that the highest score for the self-efficacy questionnaire is 55 and the lowest one is 34. The mean is 43.13, the standard deviation is 4.832, and the variance is 23.351.

The result was then categorized as low, middle, high, as shown in the table below:

Table 4. Frequency distribution and percentage of students' self-efficacy questionnaire result

Interval	Categories	Frequency	Percentage %
$X \geq 47,96$	High	13	16,25
$38,29 \leq X < 47,96$	Middle	53	66,25
$X < 38,29$	Low	14	17,50
Total		80	100

Table 4 describes that 13 students (16.25%) are in high self-efficacy level, 53 students (66.25%) are in the middle category, and 14 students (17.50%) belong to the low self-efficacy level category. From the table, we can see that most students have a middle level of self-efficacy

The questionnaire result was categorized into the level aspect, strength aspect, and generality aspect. The following table shows the score of each category.

Table 5. Aspects' mean of MTsN 1 Gowa 7th Grade Students' self-efficacy

Aspects	Mean Score
Level	14,76
Strength	14,24
Generality	14,13

Table 5 shows that of 80 students of MTsN 1 Gowa 7th Grade self-efficacy aspects, 14.76 mean score is attained for level aspect, 14.24 for strength aspect, and 14.13 for generality aspect. We can conclude that the highest self-efficacy aspect is the level aspect.

3.3. MTsN 1 Gowa 7th Grad Students' Self-Esteem Description

Based on the self-esteem questionnaire result processed by SPSS, we acquired the following result:

Table 6. Descriptive statistic score of MTsN 1 Gowa 7th grade Self-esteem questionnaire result

Self Esteem	
Number of samples	80
Lowest score	38
Highest score	59
Mean	49,10
Standard Deviation	4,443
Variance	19,737

Table 6 shows that the highest score for the self-esteem questionnaire result is 59 and the lowest one is 38. The mean is 49.10, the standard deviation is 4.443, and the variance is 19.737.

The result was then categorized as very low, low, middle, high, very high as shown in the table below:

Table 7. Frequency distribution and percentage of students' self-efficacy questionnaire result

Interval	Categories	Frequency	Percentage %
85% < N < 100%	Very High	0	0
70% < N < 84%	High	6	7,5
55% < N < 69%	Middle	66	82,5
40% < N < 54%	Low	8	10
25% < N < 39%	Very Low	0	0
Total		80	100

Table 7 describes that 6 students (7.5%) have high self-esteem levels, 66 students (82.50%) are in the middle category, and 8 students (10%) have low self-esteem levels. No student belongs to the very high and very low self-esteem level category. From the table, we can see that most students have a middle level of self-esteem.

The questionnaire result of the self-esteem level was categorized into power aspect, significance aspect, virtue aspect, and competence aspect. The following table shows the score of each category.

Table 8. Aspects' mean of MTsN 1 Gowa 7th Grade Students' self-esteem

Aspects	Mean Score
Power	14,74
Significance	14,54
Virtue	9,74
Competence	10,09

Table 8 shows that of 80 students of MTsN 1 Gowa 7th Grade self-esteem aspects, 14.74 mean score is obtained in power aspect, 14.54 in significance aspect, 9.74 in virtue aspect, and 10.03 in competence aspect. We can conclude that the highest self-esteem aspect is the power aspect.

3.4. The Influence of Self Efficacy and Self Esteem Simultaneously and Individually on the Mathematical Communication Ability of Class VII MTsN 1 Gowa Students

3.4.1. Simple Linear Regression

3.4.1.1. Simple Linear Regression Equation Self Efficacy (X_1) Against Mathematical Communication Ability (Y)

The simple linear regression equation in this section is used to see the relationship between the self-efficacy variable (X_1) and the mathematical communication ability variable (Y). The regression equation is as follows.

$$Y = a + bX$$

The obtained value of $a = 13.975$ and the value of $b = 1.156$, so the regression equation is $Y = 13.975 + 1.156X$. Based on this equation, it is found that the self-efficacy variable (X_1) and the mathematical communication ability variable (Y) has a positive correlation $(b = 1.156 > 0)$, which means that if the X_1 value is increased by 1 unit, the Y value will increase by 1.156 units and if the value of $X_1 = 0$ then the value of $Y = 13.975$.

3.4.1.2. Self Esteem Simple Linear Regression Equation (X_2) Against Mathematical Communication Ability (Y)

The simple linear regression equation in this section shows the relationship between the self-esteem variable (X_2) and the mathematical communication ability variable (Y). The regression equation is as follows.

$$Y = a + bX_2$$

Obtained value a = 0,847 and value b = 1,282 , so that the regression equation is $Y = 0,847 + 1,282X_2$. Based on this equation, it is found that between the self-esteem variable (X_2) and the mathematical communication ability variable (Y) has a positive correlation (b = 1,282 > 0), which means that if the value of X_2 is increased by 1 unit, then the value of Y will increase by 1,282 units and if the value $X_2 = 0$ is then the value of Y = 0,847.

3.4.2. Multiple Linear Regression

The multiple linear regression equation in this section is used to see the relationship between the self-efficacy variable (X_1) and the self-esteem variable (X_2) with the mathematical communication ability variable (Y). The regression equation is as follows.

$$Y = a + b_1 X_1 + b_2 X_2$$

Obtained value $a = 0{,}313$, $b_1 = 0{,}596$ and value $b_2 = 0{,}770$, so that the regression equation is Y = 0,313 + 0,596X_1 + 0,770X_2. Based on this equation, the following results are obtained.

1) The relationship between the self-efficacy variable (X_1) and the mathematical communication ability variable (Y) if the self-esteem variable (X_2) is constant, it is positively correlated ($b_1 = 0{,}596 > 0$), which means that if the X_1 value is increased by 1 unit, the Y value will increase by 0.596 units.

2) The relationship between the self-esteem variable (X_2) and the mathematical communication ability variable (Y) if the self-efficacy variable (X_1) is constant, it is positively correlated ($b_2 = 0{,}770$), which means that if the X2 value is increased by 1 unit, then the Y value will increase by 0.770 units.

If $X_1 = 0$ and $X_2 = 0$, then Y = 0,313 , it means that without the value of the self-efficacy variable (X_1) and the self-esteem variable (X_2), the value of the student's mathematical communication ability variable (Y) is 0.313 units.

3.4.3. Hypothesis Test

3.4.3.1 Statistical t-test (individual hypothesis test)

Individual hypothesis testing is a multiple regression coefficient hypothesis testing with only one B (B1 or B2) affecting Y. In other words, this test is conducted to determine whether self-efficacy or self-esteem individually affects students' mathematical communication skills. The criteria for testing the hypothesis use a significance value, namely if sig < 0.05, then self-efficacy or self-esteem individually affects students' mathematical communication skills and if sig. > 0.05 then self-efficacy and self-esteem do not affect students' mathematical communication skills.

The self-efficacy variable obtained the value of sig. = 0.020 <0.05, it can be concluded that self-efficacy affects students' mathematical communication skills. This is in line with the results of research conducted by Hamidah that the higher a person's self-efficacy for his ability to formulate concepts, convey ideas, and sharpen ideas to convince others, the higher his mathematical communication skills [6]. Bandura states that self-efficacy is belief in one's ability to organize and complete the program of action needed to produce a given achievement, with a tenacity to train independence [7]. Based on this opinion, it can be said that self-efficacy greatly influences the achievement of students' mathematical communication skills.

Meanwhile, the self-esteem variable obtained the value of sig. = 0.006 <0.05, it can be concluded that self-esteem affects students' mathematical communication skills. This is supported by Lawrence's opinion [8], which states that students with high self-esteem tend to be confident in the social situations they face and confident in handling the tasks given by the teacher. In addition, students with high self-esteem will usually maintain a sense of curiosity in learning and have enthusiasm and enthusiasm when facing new challenges. Conversely, students with low self-esteem will usually avoid situations where the situation has the potential to embarrass themselves in front of others [8]. According to the research conducted by [9], there is a correlation between mathematical communication skills and self-esteem, where students with moderate self-esteem are in line with moderate mathematical communication skills. Self-esteem contains indicators to support improving the mathematical communication skills of junior high school students. Students are required to be able to communicate mathematically well in solving mathematical problems and vice versa.

3.4.3.2 F Statistical Test (simultaneous hypothesis test)

The simultaneous hypothesis test is a multiple regression coefficient hypothesis test with B1 and B2 simultaneously or jointly affecting Y. In other words, this test is conducted to determine whether self-efficacy and self-esteem simultaneously or jointly affect students' mathematical communication skills. The criteria for testing the hypothesis use a significance value, namely if sig. < 0.05 then self-efficacy and self-esteem simultaneously or together affect students' mathematical communication skills and if sig. > 0.05 then self-efficacy or self-esteem

does not affect students' mathematical communication skills.

Obtained the value of sig. = 0.000 < 0.05, it can be concluded that self-efficacy and self-esteem simultaneously or together affect students' mathematical communication skills. Thus, referring to the results of testing hypothesis 1 and hypothesis 2, the higher the level of self-efficacy and self-esteem, the higher the students' mathematical communication skills. On the other hand, the lower the level of self-efficacy and self-esteem, the lower the students' mathematical communication skills. The contribution of self-efficacy and self-esteem to the mathematical communication skills of VII MTsN 1 Gowa students is 45.6%, and other factors determine 54.4% of mathematical communication skills.

3.4.3. Multiple Coefficient of Determination (R^2)

The coefficient of multiple determination, symbolized by R2, measures the suitability of the multiple linear regression lines to data. The multiple correlation coefficient was used to measure the contribution of the Self Efficacy (X1) and Self Esteem (X2) variables to the Mathematical Communication Ability (Y) variable in relation to the multiple linear regression equation, provided that the multiple determination coefficient of = 0456, or 45.6%. So, it can be concluded that the contribution of self-efficacy (X1) and self-esteem (X2) variables to the mathematical communication ability variable (Y) is 45.6%, and other factors determine 54.4% of the mathematical communication ability variable (Y).

4. CONCLUSION

Based on the results of previous research and discussion, the conclusions obtained are

1. The mathematical communication ability test results of 80 students of class VII MTsN 1 Gowa obtained that the highest score was 85. The lowest score was 50, with an average value of students' mathematical communication skills of 63.81, a standard deviation of 8.832, and variance of 78.002, and the level of mathematical communication ability of 80 grade VII students MTsN 1 Gowa are in the high category.

2. The results of the self-efficacy questionnaire from 80 grade VII students of MTsN 1 Gowa obtained the highest score of 55 and the lowest score of 34 with an average score of 43.13, a

standard deviation of 4.832 and variance of 23.351, and a self-efficacy level of 80 grade VII students of MTsN 1 Gowa are in the medium category.

3. The results of the self-esteem questionnaire of 80 grade VII students of MTsN 1 Gowa obtained the highest score of 59 and the lowest score of 38 with an average score of 49.10, the standard deviation of 4.443, and variance of 19.737, and the self-esteem level of 80 students of grade VII MTsN 1 Gowa is in the medium category.

4. Based on individual hypothesis testing, the sig. = 0.020 < 0.05, it can be concluded that self-efficacy affects students' mathematical communication skills.

5. Based on individual hypothesis testing, the sig. = 0.006 <0.05, it can be concluded that self-esteem affects students' mathematical communication skills.

6. Based on the simultaneous hypothesis testing, the sig value is obtained. = 0.000 < 0.05, it can be concluded that self-efficacy and self-esteem simultaneously or together affect students' mathematical communication skills.

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