SELF-ESTEEM AND HABITS OF MIND IN LEARNING MATHEMATICS: HOW TO AFFECT STUDENTS' MATHEMATICAL REPRESENTATION SKILLS?

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Abstract

Objectives: Mathematical representation is the skills to describe objects, concepts, or relationships in the real world using mathematical symbols. The low mathematical representation skills of students affects students' Self-Esteem and Habits of Mind. Self-esteem is an individual's assessment and assessment of the student's own self-worth while, Habits of mind is an aspect of student character building that tends to behave intellectually or intelligently when facing problems. The purpose of this study was to determine the effect of Self-Esteem and Habits of Mind on Mathematical Representation Skills. The type of research is quantitative, the sample is 53 students of the Pattimura University Mathematics Education Study Program. Instruments in data collection are Mathematical Representation Test questions, questionnaires containing Self-Esteem and Habits of Mind scale items. Data processing using multiple linear regression analysis. From the results of descriptive statistical analysis of Self-Esteem (X_1) and Habits of Mind (X_2). It is concluded in general that most students of the Mathematics Education at Pattimura University have good and positive Self-Esteem and Habits of Mind. Based on the calculation results using inferential statistical analysis, there is a significant influence between Self-Esteem and Habits of Mind on the skills of mathematical representation of students.

Keywords: Self-Esteem, Habits of Mind, Mathematical Representation Skills.

INTRODUCTION

Mathematics learning in higher education is frequently fraught with difficulties. Many students difficulty with understanding and implementing mathematical ideas. The low level of mathematical representations utilized in the learning process is one of the reasons contributing to the low level of mathematics learning in colleges. Mathematical representations, such as symbols, graphs, and diagrams, play an important part in assisting students in better seeing, understanding, and applying mathematical concepts (Goldin, Mathematical Representations. In Lerman, S. (eds), 2014); (Mainali, 2021); (Sabirin, 2014). Low mathematical representation can hinder students' understanding, cause difficulties in solving problems, and hinder effective mathematical communication (Samsuddin & Retnawati, 2018).

Low mathematical representation can occur due to several factors. According to (Mainali, 2021); (Goldin, Perspective on Representation in Mathematical Learning and Problem Solving, 2008)Goldin, G. A. (2008) First, teachers may not understand the importance of mathematical representations and how to use them effectively in teaching. Lack of training and knowledge of appropriate mathematical representation strategies can lead to limited teaching, relying only on verbal explanations that are difficult for students to understand. In addition, a crowded curriculum and limited time can also limit the use of mathematical representations in learning.

Students may not have sufficient opportunities to develop a deep understanding of mathematical concepts through effective visual representations. For visual representations to be effective, they must be influenced by students' self-esteem and habits of mind (Novita, Herman, Dasari, & Putra, 2022)(Andersen, 2009).

The problem of the influence of self-esteem and habits of mind on students' mathematical representation is one of the crucial issues in mathematics education. Self-Esteem is an important factor in learning mathematics, because it is part of the self-concept that involves students in self-evaluation and assessment (Nabila & Widjajanti, 2020). Students with higher Self-Esteem tend to have more positive attitudes toward math and are more likely to engage in math-related activities (Branden, 1992). On the other hand, students with lower Self-Esteem may have a negative attitude towards math and may avoid math-related activities. Habits of mind, which are the ways of thinking and problem-solving strategies that students use, also play a role in students' mathematical representations of the material. Students with strong habits of mind tend to be more successful in mathematics, as they are able to approach problems in a systematic and logical way (Lim & Selden, 2009) (Diva & Purwaningrum, 2023) (Purwasih, Sari, & Agustina, 2018) (Indriani, Yuliani, & Sugandi, 2018). Conversely, students with weaker habits of mind may struggle in mathematics and may have difficulty in representing mathematical concepts.

The Relationship between Self-Esteem and Habits of Mind in Mathematical Representation. Self-esteem and habits of mind are interrelated and can influence each other in the context of mathematical representation. Students with high self-esteem tend to have strong confidence in developing and using the habits of mind required for good mathematical representation. In contrast, students with low self-esteem may have difficulty in activating their habits of mind in the context of mathematical representation. Therefore, it is important to develop positive self-esteem and strong habits of mind in mathematics education to improve students' mathematical representation skills.

Some relevant studies are the results of research (Nabila & Widjajanti, 2020)on the development of Self-Esteem in mathematics learning through contextual teaching and learning approaches to get a positive effect of self-esteem on student mathematics learning outcomes. The results showed a positive correlation between self-esteem and math learning achievement. In the research (Amri & Widada, 2018)) There is also a positive direct effect of Self-esteem on mathematical understanding ability. For habits of mind in the critical thinking category and habits of mind in the creative thinking category, most of the participants were above average or could be stated as having high habits of mind. (Zhulaiha, Sunismi, & Rukmigarsari, 2021)examined the effect of mathematical disposition and self-concept on mathematical critical thinking ability. It was found that there was a simultaneous positive influence on mathematical critical thinking ability. Marsh in Mwangi (Takaria & Talakua, 2018) said that the view of the inability of the self about the hope of achieving success and confidence in learning statistics and mathematics shows a negative self-concept, so that it will have an impact on learning motivation and excessive anxiety before taking lessons. (Komariyah & Nur Laili, 2018) stated that developing the ability to think critically analytically, systematically, logically

and cooperatively has long been the focus and attention of mathematics educators in the classroom, because it is related to the nature and characteristics of mathematics science.

Overall, this study highlights the importance of considering confidence and habits of mind when teaching mathematics. By providing students with meaningful and relevant learning experiences that can help them develop positive attitudes towards mathematics and improve their problem-solving abilities, educators can help unleash their mathematical potential and improve their mathematical representation abilities. Therefore, the purpose of this study is to determine the effect of Self-Esteem and Habits of Mind on Mathematical Representation Skills.

METHODOLOGY

The design of the independent variables, (x_1), (x_2), and the dependent variable (y), respectively, indicates that this form of research is quantitative. As seen in the picture below.
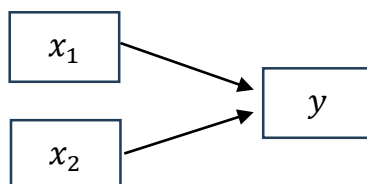
Description:

x_1 : Self-Esteem

x_2 : Habits of Mind

y : Mathematical Representation Skills

This research was conducted on students of the Pattimura University Mathematics Education Study Program in the academic year 2022/2023 which amounted to 53 students who offered analytical geometry courses. In this study, the instruments in data collection are Mathematical Representation Skills Test Questions, questionnaires containing Self-Esteem and Habits of Mind scale items that have been tested for validity and reliability. Based on the formulation of research problems with the number of two independent variables and one dependent variable, so that data collection is divided into 3 parts, namely data collection of Habits of Mind, Self Esteem and mathematical representation skills. Data on mathematical representation skills is obtained through answers to questions that refer to mathematical representation ability.

The findings of this study are calculated through the use of inferential analysis, namely Multiple Correlation Analysis and Multiple Regression Analysis. The significance of the correlation coefficient is then ascertained by computing the R value. After that, analyze the Multiple Linear Regression Test and test the meaning of regression using the F test. Based on the multiple regression, the multiple linear correlation coefficient is calculated using the SPSS version 21.0 program.

RESULT

The following explanation will clarify the various findings of data processing performed in this investigation. Starting with a simple data summary and progressing to the findings of multiple linear regression, which is the goal of this study. The preliminary data in Table 1 are as follows.

Table 1: Summary of Descriptive Statistics of the Test

Descriptive Calculation Results	Mathematical Representation	Self-esteem	Habits of Mind
Maximum	98.00	58.00	67.00
Minimum	35.00	36.00	32.00
Mean	15.87	44.85	46.302
Standard deviation	53	5.34	6.83
Sum		53	53

Based on Table 1. Above it can be seen that the data obtained the maximum value, minimum value, mean and standard deviation of each test, namely mathematical representation skills, self-esteem, and habits of mind. From the results in Table 1 it is quite clear to know, where when the mathematical representation skills test with a maximum value of 98, the results of the Habits of Mind questionnaire with a value of 67 and Self-esteem with a value of 58 were also obtained. Furthermore, the skills of mathematical representation with the lowest value of 35, also obtained the results of the Habits of Mind questionnaire with a value of 32 and Self-esteem with a value of 44.85. However, to decide on the next conclusion, it is necessary to have a statistical test. The next step is to perform the prerequisites, namely: (1) Data Normality Test; (2) Data Linearity Test; (3) Multicollinearity test; (4) Heroscedasticity test. In the data normality test using the Smirnov kolmogorof test with the results presented in Table 2 below.

Table 2: Summary of Data Normality test Processing Results

Kategori	Respond	Significance Value	Information
Mathematical Representation	53	0.200*	Normal
Self-esteem	53	0.200*	Normal
Habits Of Mind (HOM)	53	0.060	Normal

Based on Table 2. above, As can be seen, the mathematical representation skills data is normally distributed since the significance value of 0.200 for data processing of the variable is larger than the value of $\alpha = 0.05$. As a result, H_0 is not rejected. The significance value of 0.200 for the self-esteem data is higher than the value of $\alpha = 0.05$, indicating that the distribution of the data is normally distributed and that H_0 is not rejected. The significant value of 0.060 for the self-esteem data is higher than the value of H_0, indicating that the data is normally distributed and that H_0 is not rejected. After the data is known to be normally distributed, it is continued with the linearity test. The results of the linearity test can be seen in Table 3 below.

Table 3: Summary of Data Linity Test results

Statistical Test	Y top x_1	Y top x_2
F count	1,050	0,785
F table	3,15	3,15
Sign.	0,436	0,715
Conclusion	Linear	Linear

Based on table 3. above it can be seen that the price of F at deviation from linearity of 1.050 with a significance of 0.436 then the conclusion is obtained that the significant value of F calculate 1.050 < F table 3.15 as well as the sign value of 0.436 > 0.05 then Ho is not rejected, meaning that the two data are interrelated linearly, namely mathematical representation skills and self-esteem.

For additional information, it is known that the F price at deviation from linearity is 0.785 with a F table of 3.15 and a significance value of 0.715. Based on this information, it is determined that the two data mathematical representation skills and mental habits are linearly related when the significant value of F is calculated at 0.785 < F table is 3.15 and the value of sig. 0.715 > 0.05.

Multicollinearity Test

From the test results, a VIF value of 1.944 <10 was obtained. Thus it was concluded that multicollinearity does not occur.

Heteroscedasticity Test

It was determined by the test findings that there was no heteroschedesticity since the distribution of points was random both above and below the y-axis's zero value.

After the prerequisites, namely the normality test, linearity test, Multicollinearity Test, and Heteroscedasticity test are met, then a simple regression test is carried out, namely looking at the test results about the influence of self-esteem (x_1) against mathematical representation skills (y), and the effect of habits of mind (x_2) on mathematical representation skills (y). The test results are summarized in Table 4 below.

Table 4: Summary of simple regression test results

Correlation	R value	R^2 (Determination)	Significance value
Rx_1y	0,744	0,553	0,000
Rx_2y	0,652	0,425	0,000

Based on the table above, it can be seen that the self-esteem variable is positively and significantly related to the mathematical representation skills of 0.744, this is supported by a significance value of 0.000 <0.05 and the relationship between self-esteem and mathematical representation skills is 0.744.

The R^2 value in Rx_1y is 0,553 which means that the contribution of the self-esteem variable is able to explain the variable mathematical representation skills by 55,3%. Furthermore, the habits of mind have a positive and significant relationship with mathematical representation

skills by 0,652, this is supported by a significance value of 0,000 < 0,05 and the magnitude of the relationship between habits of mind and mathematical representation skills of 0,652.

The R^2 value in Rx_2y is 0,425 which means that the contribution of the variable habits of mind is able to explain the variable mathematical representation skills of 42,2%.

In the following section is a summary of data testing followed by multiple linear regression. To see the regression equation from the test results on the effect of self-esteem (x_1) and habits of mind (x_2) to Mathematical representation skills (y) is as follows:

Table 5: Test results of determining the multiple liner regression equation

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-41.181	12.859		-3.202	.002
	Self-esteem	1.735	.390	.563	4.448	.000
	Habits of Mind	.631	.307	.260	2.055	.045

Based on the table above, it can be seen that the significance value of the effect of the variable habits of mind on mathematical representation skills is 0,045 < 0,05 with a value of b_2=0,631 larger than 0. So the regression equation obtained: $Y = -41,181 + 1,735x_1 + 0,631x_2$.

After knowing the value of the multiple linear regression equation above, we will calculate the correlation coefficient which will be summarized in the following table 5.

Table 6: Summary of Multiple Linear Regression Test Results

Koefisien (R)	% R	F table	F count	Sig Level.	Conclusion
0,588	58,8	3,15	35.711	0,000	$F_{hitung} > F_{table}$ 35,711 > 3,15

Based on table 6 above, it can be seen that the correlation coefficient value obtained is 0.588, this can determine how strong the relationship between self-esteem and habits of mind with students' mathematical representation skills. The correlation between students' self-esteem and mental habits and their mathematical representation skills in the Pattimura University Mathematics Education Study Program during the 2022/2023 academic year falls into the strong relationship category overall.

Specifically, self-esteem and mental habits account for 58.8% of the influence on mathematical representation skills, meaning that other factors influence the remaining 41.2%. Additionally, it is known from data processing using multiple linear regression test analysis that the calculated F value of 35.711 and the F table value of 3.15 show the significant value for the effect of self-esteem and mathematical Habits Of Mind simultaneously on mathematical representation skills, indicating that there is an effect of both..

The results of this study are also relevant to several other studies, namely the results of research (Rahmatina, Fahradina, & Hanum, Pengaruh Habits Of Mind dan Self Concept terhadap Berpikir Kritis Matematis, 2022) examining the effect of Habits Of Mind and Self Concept on Mathematical Critical Thinking which shows a simultaneous positive effect on mathematical critical ability.

But of course, there are still some students who have good scores on mathematical representation skills but one of their Self-Esteem and Habits of Mind is still lacking. These findings are in line with the results of research (Purwasih, Sari, & Agustina, 2018) which analyzed the mathematical literacy skills and Mathematical Habits of Mind of Junior High School students on Flat-Sided Spatial Buildings material classifying 6 levels of students' mathematical literacy skills, finding that level 3 is classified as moderate and at level 4 is low while students' Mathematical Habits of Mind are classified as strong. ((Nopriana, Herman, & Martadiputra, 2023) through her research on Prospective van Hiele Geometry of Mathematical Thinking and Habits of Mind teachers through Description of Hard Skills and Soft Skills by Gender also confirmed that the ability of prospective mathematics teachers to think geometrically prospective mathematics teachers have developed to the stage of analysis and deduction. In addition, male prospective mathematics teachers reached the highest level of geometric thinking. Overall in terms of indicators, prospective mathematics teachers' habits of mind were in the strong category.

Male mathematics teacher candidates have more positive habits of mind than female mathematics teacher candidates. women have more positive habits of mind than male mathematics teacher candidates. Therefore, Habits of Mind of prospective Mathematics teacher students affect Mathematical representation. (Fatra, Sihombing, Aprilia, & Nur Atiqoh, 2022) also concluded that the better the habits of mind, it directly affects the level of students' mathematical generalization ability so that it also affects their thinking process.

CONCLUSIONS AND RECOMMENDATIONS

From the results of the Descriptive Analysis of Self-Esteem (x_1) and Habits Of Mind (x_2) it can be concluded in general that most students of the Pattimura University Mathematics Education Study Program have good or positive Self-Esteem (x_1) and Habits Of Mind (x_2). Based on the results of descriptive analysis of the three variables, Self-Esteem and Habits of Mind are directly proportional to mathematical representation skills, where the three variables can be classified in the good category which indicates an influence between the two independent variables and one dependent variable. Based on the results of calculations using inferential statistical analysis, there is a significant influence between Self-Esteem and Habits of Mind on the Mathematical Representation Skills of students of the Pattimura University Mathematics Education Study Program in the 2022/2023 academic year.

The results of the calculation of the correlation coefficient of 0.588 which can determine how strong the relationship between Self-Esteem and Habits of Mind on Mathematical Representation skills. The skills of Mathematical Representation students in the Mathematics Education Study Program in the 2022/2023 academic year are generally correlated with Self-Esteem and Habits of Mind at a strong level, with a significant percentage of 58.8%, meaning 41.2% is influenced by other factors.

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