Journal ofMathematics Education
*Website:*http://usnsj.id/index.php/JME
E-mail:manajemenjme@gmail.com
p-ISSN 2528-2468; e–ISSN 2528-2026

DOI:https://doi.org/10.31327/jme.v11i1.2747

THE EFFECT OF SELF EFFICACY ON MATHEMATICAL PROBLEM-SOLVING ABILITY BASED ON NEWMAN'S STAGES

Luthfi Hanafiah Alhaidar[1], Hanifah[2], Muthiah Fildzah Noverli[3]
[1,2,3]Singaperbangsa University, Karawang

Article Info

Article history:

Received Mar 12, 2026
Revised Apr 20, 2026
Accepted Mei 26, 2026

Keywords:

Self-Efficacy
Problem Solving Skills
Newman.

ABSTRACT

Students' low ability to solve contextual mathematical problems is often influenced by affective factors, one of which is self-efficacy. This study aims to determine the effect of self-efficacy on students' mathematical problem-solving ability based on Newman's stages. The research approach used was quantitative with a causal-associative method. The sample in this study consisted of 31 students. The research instruments consisted of a self-efficacy questionnaire and a mathematical problem solving ability test. Data analysis techniques included prerequisite tests and hypothesis testing using the t-test and the coefficient of determination. The analysis results showed a significant value of 0.010 < 0.05, so it can be concluded that there is a significant influence of self-efficacy on students' mathematical problem-solving ability, namely 20.7%.

This is an open access article under theCC BYlicense.

Corresponding Author:

Luthfi Hanafiah Alhaidar
Singaperbangsa University, Karawang, Indonesia
E-mail:2210631050020@student.unsika.ac.id

How to Cite:

Alhaidar, L.H., Hanifah, &Noverli, M.F. (2026) The Effect of Self Efficacy on Mathematical Problem-Solving Ability Based on Newman's Stages. *JME:Journal of Mathematics Education*, *11*(1), 121-128

1. INTRODUCTION

Mathematical problem-solving ability is widely recognized as one of the most important higher-order thinking skills that students must develop in mathematics learning. This ability requires students to integrate previously acquired knowledge, interpret problem situations, and generate new strategies to obtain appropriate solutions (Indriani et al., 2023). In mathematics education, problem-solving is not only an instructional goal but also a fundamental means of developing students' reasoning, critical thinking, and analytical skills. In line with this perspective, the Independent Curriculum implemented in Indonesia emphasizes problem-solving as a core competency that students must master. This competency is essential because it encourages students to apply mathematical concepts and

principles to complex and contextual real-life problems, thereby strengthening their conceptual understanding and adaptive reasoning abilities (Sulistifa et al., 2025).

Despite its importance, many students still experience difficulties in mathematical problem-solving, particularly when dealing with word problems that require systematic reasoning and structured solution steps. Students often struggle to interpret problem statements, identify relevant information, and translate verbal problems into mathematical models. This phenomenon indicates that students' mathematical problem-solving ability remains relatively low and requires further attention. Empirical evidence also supports this issue. A study conducted by Irawadi et al. (2025) involving 40 students revealed that only 9 students demonstrated high mathematical problem-solving ability, while 3 students were categorized as moderate, and the majority, 28 students, were categorized as having low problem-solving ability. These findings suggest that most students still face significant challenges in solving mathematical problems effectively. Furthermore, the Programme for International Student Assessment (PISA) 2022 results also reflect similar conditions. Indonesia's mathematics score was 366, which is considerably below the OECD average score of 477 (Silvia, 2024). This gap indicates that Indonesian students still encounter considerable difficulties in solving non-routine mathematical problems that require reasoning and problem-solving skills. Therefore, improving students' mathematical problem-solving ability remains an important issue in mathematics education.

Mathematical problem-solving ability is influenced not only by cognitive factors but also by affective factors. One important affective factor that plays a significant role in learning mathematics is self-efficacy. Self-efficacy refers to an individual's belief in their ability to organize and execute the actions required to achieve specific goals (Alamsyahrir & Ie, 2022). Students with high self-efficacy tend to demonstrate greater confidence, persistence, and resilience when facing challenging tasks. Conversely, students with low self-efficacy are more likely to avoid difficult problems, give up easily, and doubt their own abilities. Previous studies have shown that self-efficacy has a strong relationship with students' cognitive performance, particularly in mathematical problem-solving. Pratiwi and Imami (2022) found that students with high self-efficacy were more persistent in exploring alternative strategies and were less likely to give up when encountering complex problems. This persistence enables students to engage more deeply in the problem-solving process and increases the likelihood of obtaining correct solutions. Therefore, self-efficacy is considered an important factor that influences students' success in mathematical problem-solving.

To analyze students' mathematical problem-solving processes more comprehensively, Newman's stages can be used as a diagnostic framework. Newman's error analysis consists of five stages, namely reading, comprehension, transformation, process skills, and encoding (Putri et al., 2021). The reading stage refers to students' ability to read the problem correctly, while the comprehension stage relates to understanding the meaning of the problem. The transformation stage involves converting the problem into an appropriate mathematical model. The process skills stage refers to performing mathematical procedures accurately, and the encoding stage involves expressing the final answer correctly. These stages provide a structured framework for identifying students' difficulties at each step of the problem-solving process. Previous studies indicate that students often experience the greatest difficulty at the transformation stage, where they struggle to translate problem information into mathematical representations (Noer et al., 2023). This difficulty suggests that students' errors in problem-solving are not limited to procedural mistakes but also involve conceptual and interpretational challenges.

The integration of self-efficacy with Newman's stages provides a more comprehensive perspective for understanding students' mathematical problem-solving ability. Students' success at each stage of Newman's process may be influenced by their level of self-efficacy.

For example, students with high self-efficacy are more likely to persist in understanding problem statements, attempt different transformation strategies, and carefully verify their final answers. On the other hand, students with low self-efficacy may hesitate to interpret problems, feel unsure about selecting solution strategies, and stop working before completing all stages. In this context, procedural errors may not merely reflect technical limitations but may also indicate low confidence in decision-making during problem-solving. Although previous studies have applied Newman's stages to identify students' errors, most of them focus primarily on descriptive analysis of students' difficulties. Similarly, studies examining self-efficacy in mathematics learning generally analyze its relationship with overall problem-solving ability without considering the specific stages of the problem-solving process. Thus, studies that empirically examine the influence of self-efficacy on students' success at each stage of Newman's problem-solving process remain limited.

Therefore, this study aims to examine the effect of self-efficacy on students' mathematical problem-solving ability based on Newman's stages. By integrating affective and cognitive perspectives, this study is expected to provide a more detailed understanding of how students' beliefs influence their performance at each stage of problem-solving. The findings of this study are expected to contribute to mathematics education by providing insights for teachers in designing instructional strategies that not only improve students' cognitive skills but also strengthen their self-efficacy in solving mathematical problems.

2. METHOD

This study employed a quantitative approach using a correlational design with a simple linear regression model. This design was selected to examine the relationship and the influence of students' self-efficacy on their mathematical problem-solving ability based on Newman's stages. The population of this study consisted of all 11th-grade students at MAN 1 Bekasi in the 2025/2026 academic year, totaling 96 students distributed across three classes. The sample was determined using a simple random sampling technique. Each class was assigned a number, and students were randomly selected using a random number generator. Based on this procedure, 32 students were selected as research participants.

Data were collected using two research instruments, namely a self-efficacy questionnaire and a mathematical problem-solving ability test. The self-efficacy questionnaire was developed based on three dimensions: magnitude, generality, and strength. The questionnaire consisted of 20 statements using a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5). The magnitude dimension measured students' confidence in solving problems of varying difficulty levels, the generality dimension measured students' beliefs in applying their abilities across different mathematical situations, and the strength dimension measured the persistence of students' confidence in solving mathematical problems. Before being administered, the questionnaire was validated by two mathematics education experts. The validity of each item was tested using Pearson Product Moment correlation, while the reliability of the instrument was tested using Cronbach's Alpha coefficient. The results showed that all questionnaire items were valid and the instrument was categorized as reliable.

The second instrument was a mathematical problem-solving ability test in the form of descriptive questions on the topic of equations of tangents to circles. The test consisted of four essay questions designed to measure students' abilities based on Newman's five stages: reading, comprehension, transformation, process skills, and encoding. Each item required students to demonstrate the steps of problem-solving according to these stages. Students' answers were assessed using a scoring rubric for each stage. The reading stage assessed

students' ability to identify known and asked information, the comprehension stage assessed students' understanding of the problem, the transformation stage assessed students' ability to construct mathematical models, the process skills stage assessed procedural accuracy, and the encoding stage assessed students' ability to express the final answer correctly. Each stage was scored on a scale of 0–4, so that the total score reflected students' mathematical problem-solving ability based on Newman's stages. The test instrument was also validated by experts and tested for reliability before being used in the study.

The data analysis technique used inferential statistics. Prior to hypothesis testing, prerequisite tests were conducted including normality and linearity tests. The normality test was conducted using the Shapiro–Wilk test, while the linearity test was conducted using ANOVA for linearity. After the prerequisite assumptions were met, hypothesis testing was performed using simple linear regression analysis to determine the effect of self-efficacy on mathematical problem-solving ability. The regression model used in this study was expressed as:

$$\mathbf{Y = a + bX}$$

where Y represents mathematical problem-solving ability based on Newman's stages, X represents students' self-efficacy, a represents the constant, and b represents the regression coefficient. The significance of the regression coefficient was tested using the t-test at a significance level of 0.05. In addition, the coefficient of determination (R^2) was calculated to determine the percentage contribution of self-efficacy to students' mathematical problem-solving ability based on Newman's stages. All statistical data analyses were performed using IBM SPSS Statistics software version 31.

3. RESULTS AND DISCUSSION

3.1 RESULTS

Classical Assumption Test

Before conducting hypothesis testing, prerequisite tests were performed to ensure that the data met the assumptions required for simple linear regression analysis. These prerequisite tests included normality and linearity tests.

Normality Test

The normality test was conducted to determine whether the self-efficacy and mathematical problem-solving ability data were normally distributed. The Shapiro–Wilk test was used because the sample size was fewer than 50 students. The data were considered normally distributed if the significance value was greater than 0.05.

Table 1. Normality Test Results (Shapiro–Wilk)

Variable	N	Mean	Std. Deviation	Sig.
Self-Efficacy	31	72.74	12.176	0.146
Mathematical Problem-Solving Ability	31	39.77	3.922	0.616

Based on Table 1, the significance value for the self-efficacy variable was 0.146 and the mathematical problem-solving ability variable was 0.616. Both values were greater than 0.05, indicating that the data for both variables were normally distributed.

Linearity Test

The linearity test was conducted to determine whether there was a linear relationship between self-efficacy and mathematical problem-solving ability. The test results were

obtained from the Deviation from Linearity value. The data were considered linear if the significance value was greater than 0.05.

Table 2. Linearity Test Results

Source	Sum of Squares	df	Mean Square	F	Sig.
Linearity	95.337	1	95.337	10.194	0.011
Deviation from Linearity	281.916	20	14.096	1.507	0.268

Based on table 2, the significance value of the Deviation from Linearity was 0.268. Since the value was greater than 0.05, it indicates that the relationship between self-efficacy and mathematical problem-solving ability was linear.

Hypothesis Testing

Hypothesis testing was conducted using simple linear regression analysis to determine the effect of self-efficacy on mathematical problem-solving ability based on Newman's stages.

Table 3. Simple Linear Regression Results

Variable	B	Std. Error	Beta	t	Sig.
Constant	29.125	3.927	—	7.416	0.000
Self-Efficacy	0.146	0.053	0.455	2.748	0.010

Based on table 3, the significance value for self-efficacy was 0.010, which was less than 0.05. These results indicate that self-efficacy significantly affected students' mathematical problem-solving ability based on Newman's stages. The regression coefficient value of 0.146 indicates a positive relationship between self-efficacy and mathematical problem-solving ability.

The regression equation in this study is:

$$\mathbf{Y = 29.125 + 0.146X}$$

This equation indicates that every one-unit increase in self-efficacy is followed by an increase of 0.146 in students' mathematical problem-solving ability.

Coefficient of Determination

The coefficient of determination test was conducted to determine the contribution of self-efficacy to mathematical problem-solving ability.

Table 4. Coefficient of Determination Results

Model	R	R Square	Adjusted R Square	Std. Error
1	0.455	0.207	0.179	3.553

Based on table 4, the R Square value was 0.207. This result indicates that self-efficacy contributed 20.7% to students' mathematical problem-solving ability based on Newman's stages, while the remaining 79.3% was influenced by other variables not examined in this study.

3.2 DISCUSSION

The results of this study indicate that self-efficacy has a positive and significant effect on students' mathematical problem-solving ability based on Newman's stages. This finding is supported by the regression analysis results showing a significance value of 0.010, which is less than the significance level of 0.05. In addition, the regression coefficient value of 0.146 indicates that higher self-efficacy is associated with higher mathematical problem-

solving ability. This result suggests that students who have strong confidence in their abilities tend to perform better when solving mathematical problems.

The positive influence of self-efficacy on mathematical problem-solving ability can be explained theoretically. Students with high self-efficacy tend to be more confident, persistent, and motivated when facing complex problems. In the context of Newman's stages, students with high self-efficacy are more likely to carefully read the problem at the reading stage, understand the meaning of the problem at the comprehension stage, and confidently transform the problem into a mathematical model at the transformation stage. Furthermore, students with high self-efficacy tend to perform procedural calculations more carefully at the process skills stage and provide correct final answers at the encoding stage. Conversely, students with low self-efficacy often hesitate, experience anxiety, and give up more easily before completing all stages of problem-solving.

This finding is consistent with Bandura's theory, which states that self-efficacy influences individuals' choices, effort, persistence, and resilience when facing difficult tasks (Suartini et al., 2023). Students who believe in their abilities tend to exert greater effort and persist longer in solving mathematical problems. Consequently, they are more likely to succeed in completing each stage of Newman's problem-solving process. This shows that self-efficacy plays an important role not only in students' motivation but also in their cognitive performance.

The results of this study are also in line with previous research. Agumuharam and Soro (2021) found a significant relationship between self-efficacy and mathematical problem-solving ability, indicated by a significance value of 0.0002. Similarly, Luhinar and Nugraheni (2024) reported that self-efficacy was a strong predictor of problem-solving ability, contributing 56.4% to students' performance. These findings reinforce that self-efficacy is an important factor influencing students' success in solving mathematical problems.

Although self-efficacy contributed 20.7% to mathematical problem-solving ability, this value indicates a moderate contribution. This suggests that students' success in solving mathematical problems is influenced not only by self-efficacy but also by other factors. Mathematical problem-solving ability is a complex skill that involves cognitive, affective, and metacognitive components. Therefore, other variables such as learning motivation, mathematical anxiety, prior knowledge, and conceptual understanding may also influence students' performance.

The findings of this study have important implications for mathematics learning. Teachers should not only focus on improving students' cognitive abilities but also pay attention to affective factors, particularly self-efficacy. Learning strategies that provide opportunities for students to experience success, engage in collaborative learning, and receive positive feedback can help improve students' self-efficacy. When students' self-efficacy increases, their confidence in solving mathematical problems also improves, which ultimately enhances their mathematical problem-solving ability.

Overall, this study confirms that self-efficacy plays a significant role in students' mathematical problem-solving ability based on Newman's stages. By integrating affective and cognitive perspectives, this study provides a more comprehensive understanding of how students' beliefs influence their success at each stage of mathematical problem-solving. These findings contribute to mathematics education by emphasizing the importance of strengthening students' self-efficacy to improve their mathematical problem-solving ability.

4. CONCLUSION

This study concludes that self-efficacy has a positive and significant effect on students' mathematical problem-solving ability based on Newman's stages. Students with higher self-efficacy tend to demonstrate better performance in solving mathematical problems through the stages of reading, comprehension, transformation, process skills, and encoding. The contribution of self-efficacy to students' mathematical problem-solving ability was 20.7%, indicating that self-efficacy plays an important role in supporting students' success in solving mathematical problems.

These findings imply that improving students' self-efficacy can enhance their ability to solve mathematical problems systematically. Therefore, mathematics teachers are encouraged to design learning activities that foster students' confidence, persistence, and engagement in problem-solving. Strategies such as providing meaningful problem-solving tasks, offering constructive feedback, and encouraging collaborative learning may help strengthen students' self-efficacy.

This study contributes to mathematics education by integrating affective factors, particularly self-efficacy, with cognitive processes in Newman's problem-solving stages. The findings provide a more comprehensive understanding of how students' beliefs influence their performance at each stage of mathematical problem-solving. However, this study was limited to examining self-efficacy as a predictor variable. Future research is recommended to investigate other factors such as learning motivation, mathematical anxiety, and prior knowledge that may influence students' mathematical problem-solving ability.

ACKNOWLEDGEMENTS

The authors express their gratitude to Hanifah, S.Si., M.Pd., and Muthiah Fildzah Noverli, M.Pd., as research supervisors for their guidance and valuable suggestions during the completion of this study. The authors also thank MAN 1 Bekasi for granting permission and facilitating the data collection process. Appreciation is also extended to all students of class XI who participated in this research.

REFERENCES

Agumuharram, FN, & Soro, S. (2021). Self-Efficacy and Problem-Solving Ability of Grade X High School Students. Jurnal Cendekia: Jurnal Pendidikan Matematika, 05(03), 2352–2361. https://doi.org/10.31004/cendekia.v5i3.862

Alamsyahrir, D., & Ie, M. (2022). Technopreneurial Intention: The Role of Self-Efficacy, Entrepreneurship Education, and Relationship Support. Maranatha Journal of Management, 21, 135–144. https://doi.org/10.28932/jmm.v21i2.4532

Banjarnahor, RM, Effendy, F., & Payana, SD (2025). Classical Assumption Test in the Analysis of Factors Influencing Literacy Rates in Central Java Province. Trigonometry: Journal of Mathematics and Natural Sciences, 6(4), 91–100. Classical Assumption Test in the Analysis of Factors Influencing Literacy Rates in Central Java Province

Dilla, N., Parimita, W., & Suherdi. (2023). The Influence of Work Motivation and Organizational Justice on Organizational Citizenship Behavior of PT Rickindo Employees. Sibatik Journal: Scientific Journal of Social, Economic, Cultural, Technology, and Education, 2(2), 409–428. https://doi.org/10.54443/sibatik.v2i2.567

Hidayat, I., & Khotimah, K. (2022). The Effect of Profitability and Company Size on the Value of Chemical Sub-Sector Companies Listed on the Stock Exchange for the 2018-2020 Period. Jurnal Ilmiah Akuntansi Kesatuan, 10(1), 1–8.

https://jurnal.ibik.ac.id/index.php/jiakes/article/view/1175

Indriani, R., Rambe, KB, & Wandini, RR (2023). The Influence of Polya's Theory on Students' Mathematical Problem-Solving Ability. Tambusai Journal of Education, 7, 32182–32186. https://doi.org/10.31004/jptam.v7i3.12259

Irawadi, AA, Sripatmi, Junaidi, & Baidowi. (2025). Students' Mathematical Problem-Solving Ability Reviewed from Self-Confidence and Mathematics Anxiety. Journal of Classroom Action Research, 7(1). https://doi.org/10.29303/jcar.v7i1.10081

Luhinar, W., & Nugraheni, N. (2024). The Influence of Learning Motivation, Self-Efficacy, and Mathematics Anxiety on Mathematics Problem-Solving Ability. Elementary School Teachers' Journal, 7(1), 1–13. https://doi.org/10.15294/22654p11

Noer, SF, Sugandi, AI, & Amelia, R. (2023). Error Analysis in Problem-Solving Questions of 11th Grade High School Students on Arithmetic Sequences and Series Reviewed from Newman's Theory. Journal of Innovative Mathematics Learning, 6(4), 1369–1378. https://doi.org/10.22460/jpmi.v6i4.17677

Prasmono, ASP, & Ahdika, A. (2023). Multiple Regression Analysis on Factors Affecting the Physical Performance of Road and Bridge Preservation in South Sumatra Province. UII Journal, 1(1), 47–56. https://doi.org/10.20885/esds.vol1.iss.1.art6

Pratiwi, AF, & Imami, AI (2022). Analysis of self-efficacy in mathematics learning for junior high school students. Introduction Mathematics is one of the subjects that has an important role in the development of human thinking power. According to Santiana, et al (2020), mathematics is a universal science. AKSIOMA: Journal of Mathematics and Mathematics Education, 13(3), 403–410. https://doi.org/10.26877/aks.v13i3.13973

Putri, DA, Winarni, R., & Surya, A. (2021). Analysis of Learning Difficulties in Mathematical Problem Solving Based on the Newman Procedure in Fifth Grade Elementary School Students. Didaktika Dwija Indria, 9(3), 59–64. https://jurnal.uns.ac.id/JDDI/article/view/49193

Silvia, R. (2024). The Influence of Work-Life Balance and Work Motivation on Teacher Performance: A Study at SDN Suryakencana CBM, Sukabumi City [Indonesian University of Education]. http://repository.upi.edu/id/eprint/126238

Suartini, K., Ardiansyahroni, Nyaman, Riyadi, & Sarifah, I. (2023). Meta-Analysis: The Relationship Between Self-Efficacy and Academic Achievement. Journal of Social Sciences and Education (JISIP), 7(3), 2475–2480. https://garuda.kemdiktisaintek.go.id/documents/detail/3602249

Sulistifa, A., Purnomo, E.A., & Prihaswati, M. (2025). Systematic Literature Review: Mathematical Problem Solving Ability in HOTS. Journal of Mathematics Education and Mathematics Education, 8(3), 749–759. https://doi.org/10.30605/proximal.v8i3.5836

Ulum, ABB, Kuswara, GA, Aditya, M., F, MZ, Hidayat, Baihaqi, F., & Zulkarnaen, I. (2024). Student Satisfaction with the Library of Bhayangkara University, Jakarta Raya Using the Prerequisite Test Method Based on SPSS Software. Humanitis: Journal of Humanities, Social and Business, 2(7), 719–727. https://humanisa.my.id/index.php/hms/article/view/193