

The influence of *pesantren*-based students' self-concept on errors in solving basic geometry problems

Nanang Hadi Hariyanto¹, Rifda Izza¹, Adinda Beauty Afnenda¹

¹Department of Mathematics Education, Cordoba Islamic University of Banyuwangi, Indonesia

*Corresponding Author: Nanang Hadi Hariyanto; nanang@uicordoba.ac.id

Abstract:

This study aims to describe the types of errors and identify the factors causing errors in solving geometry problems from the perspective of students' self-concept. This research is a qualitative descriptive study. The subjects were students from Class A of the Mathematics Education Study Program in the 2022/2023 academic year who had received material on the geometry subtopic "basic construction justified." Data collection techniques included questionnaires, problem-solving tests, and interviews. Data analysis techniques involved data reduction, data presentation, and conclusion drawing. Data validity was ensured using triangulation through the results of tests and interviews. The results of the study indicate that (1) students with a positive self-concept made errors such as comprehension errors, process skill errors, and errors in encoding or writing the final answer. These were caused by two factors: an inability to fully understand the given information and a lack of experience in solving non-routine geometry problems. (2) Students with a negative self-concept made errors such as reading errors, comprehension errors, transformation errors, process skill errors, and errors in writing conclusions. The factors causing these errors were (a) inadequate understanding of geometry material, (b) weak prerequisite knowledge, and (c) carelessness in solving geometry problems.

Article Info:

Submitted:

01-07-2025

Revised:

02-07-2025

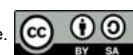
Accepted:

02-07-2025

Keywords:

error analysis, geometry, self-concept, Newman's theory

This work is licensed under CC BY-SA License.



INTRODUCTION

One of the subjects taught from elementary school through to university is mathematics. However, many students struggle to solve mathematical problems. This is evidenced by the research of Ramadhani & Hakim (2021), which found that none of the students provided correct answers to the math problems given. This indicates that numerous errors occurred during the problem-solving process. A study by Nengsih et al. (2022) concluded that errors in solving math problems are caused by a lack of understanding of the questions and a hasty approach to solving them. Failing to include units of measurement is also one of the common mistakes in solving math problems (Asriyani et al., 2020).

One of the theories that addresses mathematical errors is Newman's theory. According to Newman's theory, there are five types of errors: (1) reading errors, (2) comprehension errors, (3) transformation errors, (4) process skill errors, and (5) errors in writing conclusions. These types of errors are interrelated; for instance, if someone makes reading and comprehension errors, the transformation process will not be achieved (Phaliso, 2022). Several researchers have conducted studies related to error analysis based on Newman's theory. For example, Mahmudah (2018) explained that most student errors in solving mathematical problems were due to comprehension

errors, transformation errors, and process skill errors, which in turn led to incorrect conclusions. A study by Murtiyasa & Wulandari (2020) revealed that students made errors in understanding the problem, in transforming the problem, and in process skills, mainly because they were unable to determine the appropriate formula or perform the necessary calculations. Based on the types of errors described above, it is evident that there are certain factors that contribute to students making mistakes when solving mathematical problems.

Difficulties in learning are one of the key factors contributing to errors in solving both routine and non-routine mathematics problems. These difficulties arise from various factors. According to Utari et al. (2019), the causes of learning difficulties stem from both external and internal factors. External factors include a lack of variety in teaching methods, suboptimal use of learning media, and inadequate school facilities. Internal factors include limited knowledge or intelligence, negative attitudes toward learning mathematics, and low student motivation. Research by Septiyani & Alyani (2021) revealed that students' responses, based on the analysis of mathematics test data, were still categorized as very weak.

Based on literature studies, difficulties in solving mathematical problems are also influenced by students' self-concept. Self-concept plays an important role in integrating individual motivation and behavior, especially in learning (Farah et al., 2019). This means that a positive self-concept is expected to boost learning motivation, thereby reducing difficulties in solving mathematical problems. According to Rohmat & Lestari (2019), individuals with a high self-concept are more motivated to complete mathematics tasks effectively. Conversely, students who face learning difficulties generally exhibit a low self-concept (Khodijah & Hakim, 2024). Research conducted by Saputra et al. (2021) found that self-concept has a significant and positive influence on students' academic achievement. Self-concept contributes 52.8% to understanding mathematical concepts.

One area of mathematics that particularly requires a strong self-concept is geometry. Ludbiyani (2022) found that students with a high self-concept demonstrate strong inductive reasoning skills in geometry. Previous research on students' self-concept in geometry was conducted by Sundawan & Nopriana (2019) under the title "Guided-Discovery Learning, Mathematical Representation, and Students' Self-Concept in Geometry." Their findings indicated that most students had a low self-concept in geometry learning, which led to poor performance in solving geometry problems. Therefore, this study aims to describe students' errors based on Newman's error analysis indicators in solving geometry problems, as viewed from the perspective of their self-concept.

METHOD

This study employs a descriptive research design with a qualitative approach. The purpose of this study is to describe the types of errors made by students in solving basic geometry problems, viewed from the perspective of their self-concept. The research subjects consisted of students enrolled in the Mathematics Education (*Tadris Matematika*) Study Program who had studied the subtopic "Proving Triangles Similar" during the 2024/2025 academic year at Universitas Islam Cordoba, Banyuwangi.

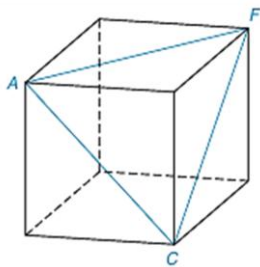
The study utilized three research instruments: a student self-concept questionnaire, a geometry problem-solving test, and an interview guide. The self-concept questionnaire was administered to classify students into two categories of self-concept, namely positive and negative. The classification criteria for self-concept categories are presented in Table 1.

Table 1. Self-Concept Categories

Questionnaire Score	Category
$0 > K \geq 147$	Negative
$147 > K \geq 245$	Positive

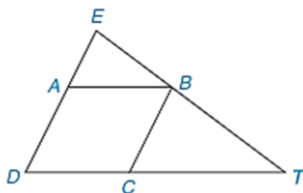
The geometry test was used to explain students' errors in solving geometry problems. The following are three basic geometry questions used in this research.

1. Draw an obtuse triangle and construct the three angle bisectors of the triangle. Will the angle bisectors intersect at a single point? Explain!
2. Observe the following figure!



A , C , and F are three vertices of a cube as shown in the figure below. What is the measure of angle ACF ?

3. Observe the following figure!



Given triangle DET and parallelogram $ABCD$ as shown in the figure below. Prove that triangle ABE is similar to triangle CBT !

Figure 1. Basic Geometry Questions

The interview guideline in this study employed a semi-structured interview method, allowing new questions to emerge based on the responses provided by the subjects. This interview was useful in supporting the data that had already been collected. To assess the validity of the data, data triangulation was used. Data triangulation was conducted through the results of test items and interviews.

The stages of this study were as follows: (1) administering a self-concept questionnaire to students. The results of the self-concept questionnaire were analyzed and classified into two categories: positive, coded as "SP", and negative, coded as "SN". (2) Based on the analysis results, one subject from each category was selected to be given a geometry test in order to analyze the errors made in solving geometry problems. The error analysis in this study was based on Newman's error analysis, which includes reading errors, comprehension errors, transformation errors, process skill errors, and encoding errors. The indicators used in this study are presented in the following Table 2.

Table 2. Indicators of Errors Based on Newman's Theory

Type of Error	Error Indicator
Reading Error	Students are able to read the problem but are not yet able to understand the meaning of the question correctly
Comprehension Error	Students do not know the information obtained from the problem
Transformation Error	Students are unable to select and determine the formula or procedure needed to construct and solve the geometry problem.
Process Skill Error	Students are unable to write the formula or procedure used to construct and solve the problem correctly

(Rohmah & Sutiarso, 2018)

(3) The subjects in each self-concept category were interviewed to support the data that had already been obtained. (4) Data triangulation was conducted. The primary instrument in this study was the researcher. The secondary instruments included a questionnaire consisting of 49 self-concept statements, 3 geometry problems, and an interview guideline that had been validated by experts.

RESULT

The results of the self-concept questionnaire analysis from 13 students showed that 11 students had a positive self-concept, and 1 student had a negative self-concept. Two subjects from each self-concept category with the highest questionnaire scores were selected to be given geometry problems, and the results were as follows.

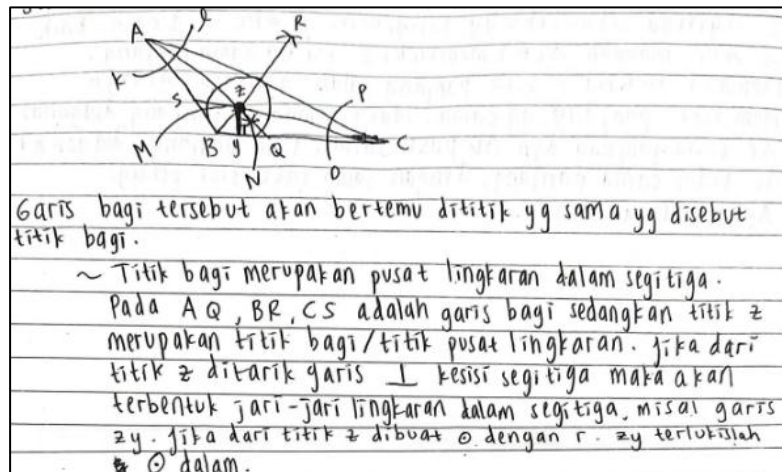


Figure 2. Answer to Question 1 by Student SP

Subject SP is one of the students whose self-concept falls into the positive category. Based on Figure 2 above, SP has shown the ability to develop a solution plan for the geometry problem. However, on the answer sheet, student SP made several errors in the solution, namely (1) a comprehension error, such as being unable to understand the question posed; this is indicated by SP's failure to write what the problem was asking. (2) a process-skill error, such as being unable to set out the procedure and method of solution; in this part, student SP could not accurately and fully explain the construction of the angle bisectors for the obtuse triangle that had been drawn. (3) an encoding error in the final answer, as student SP stated the conclusion incorrectly.

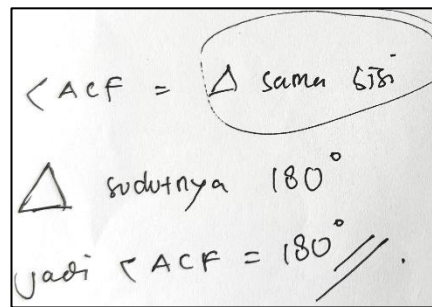


Figure 3. Answer to Question 2 by Student SP

Based on Figure 3, SP answered question 2 by stating that angle ACF is an angle of an equilateral triangle and mentioned that the sum of the interior angles in a triangle is 180° . However, in solving this question, SP made several errors: (1) a comprehension error, as SP assumed that angle ACF represents all the angles in the triangle; (2) a process-skill error, because SP did not understand that each angle in an equilateral triangle has the same measure, and thus, the correct measure of angle ACF should be obtained by dividing the total angle sum by three; and (3) an encoding error in the final answer, which resulted from the comprehension and process-skill errors, leading to an inaccurate conclusion

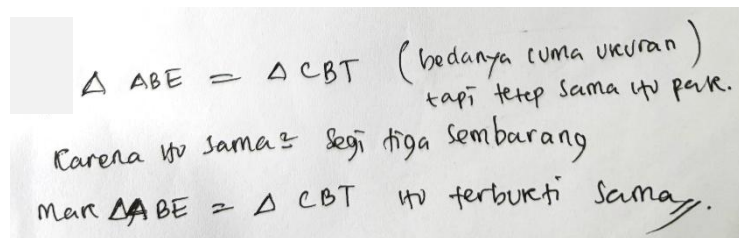


Figure 4. Answer to Question 3 by Student SP

Based on Figure 4, SP indicated that triangle ABE is similar to triangle CBT. However, the reasoning provided was incorrect, and thus SP was unable to properly prove the similarity between the two triangles. As a result, SP made errors in comprehension, process skills, and final answer writing. These errors made by student SP were also influenced by several factors, which can be observed from the interview between the researcher (R) and student SP as follows.

R : "Can you mention what was asked in the problem?"

SP : "Umm... first, I was asked to draw, Sir, then to construct. What else... oh yes, I was asked to explain whether the three angle bisectors meet at the same point. Then, in the second question, I was asked to determine the measure of angle ACF, and the last one was to prove that the two triangles are similar."

R : "Okay. Then why didn't you write that on your answer sheet?"

SP : "Hehe, I forgot, Sir."

R : "Please explain how you constructed the angle bisectors in question number 1 and what method you used to solve questions 2 and 3."

SP : "Oh, I was supposed to explain that too, Sir?"

R : "Yes."

SP : "Umm... how should I say it, Sir? I don't know how to explain it in words."

- R : "Alright then, did you write in detail on your answer sheet about the construction of the angle bisectors, how you determined the angle measure, and the proof of the two similar triangles?"
SP : "Hehe, I don't think it was detailed, Sir. But I really tried my best."

Based on the interview above, several factors contributed to student SP's errors in solving the geometry problems: (i) the student was not yet able to receive and process information effectively; and (ii) the student lacked experience in solving geometry problems, which led to a lack of accuracy during the problem-solving process.

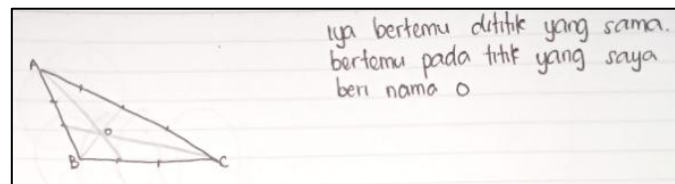


Figure 5. Answer to Question 1 by Student SN

Subject SN is a student whose self-concept falls into the negative category. In general, the answer shown in Figure 5 indicates that SN was not yet able to solve the geometry problem completely and correctly. This was due to several errors made by student SN, including: (1) a reading error, such as difficulty in identifying the given problem; (2) a comprehension error, such as the inability to determine what was being asked in the question, as shown by SN answering only two out of the four points requested; (3) a combination of comprehension and process-skill errors, resulting in the inability to select the appropriate procedure for solving the geometry problem. In Figure 2, SN only provided a drawing without describing the procedure used to answer the question, and (4) an encoding error, as SN's conclusion was incomplete.

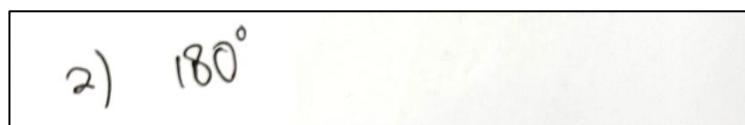


Figure 6. Answer to Question 2 by Student SN

Based on Figure 6, it is shown that SN only wrote the final answer as 180° . This final answer was incorrect. The error resulted from several mistakes made by SN in solving the geometry problem: a reading error, as SN was unable to understand the meaning of the question; a comprehension error, as SN did not include any information from the question on the answer sheet; transformation and process-skill errors, as SN did not write the formula or procedure used to solve the geometry problem; and an encoding error in the final answer, due to an inaccurate conclusion.

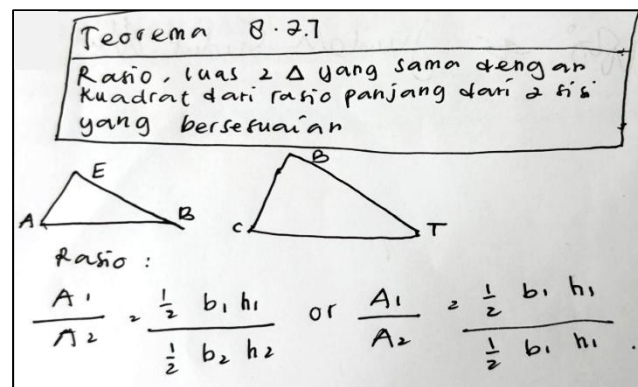


Figure 7. Answer to Question 3 by Student SN

Based on Figure 7, it is shown that SN attempted to use a theorem to demonstrate the similarity of two triangles. However, in question number 3, the solution should have begun by identifying the parallel sides of the given parallelogram and applying the theorem of corresponding angles to establish the AA (Angle-Angle) postulate, which justifies the similarity of the two triangles. Therefore, SN made errors in reading, comprehension, transformation, process skills, and final answer writing, which led to an incorrect solution to the geometry problem. The interview between the researcher (R) and student SN is presented below:

R : "What information did you get after reading the geometry problems?"

SN : "Umm, I didn't quite understand the first question because it only asked to draw. Then, in the second question, there was a triangle in a cube, and in the third question, triangle DET and parallelogram ABCD were given."

R : "Can you mention what was being asked in each geometry question?"

SN : "For question 1, it asked whether the three angle bisectors meet at one point, Sir. Question 2 asked for the measure of angle ACF, and question 3 asked to prove similar triangles."

R : "Okay. Then why didn't you write that on your answer sheet?"

SN : "It's okay, Sir. I'm used to doing it that way when answering questions."

R : "As for the procedures, such as constructing the angle bisectors and solving question 2, why didn't you write them down? Was it because you didn't know the procedure, or something else?"

SN : "I do know, Sir, but I kind of forgot the procedure, so I didn't write it down."

Based on the interview results above, several factors contributed to student SN's errors in solving the geometry problems. The first factor is that SN lacked a thorough understanding of the material. Second, SN demonstrated weak prerequisite skills. Third, negligence or carelessness in solving geometry problems led to incomplete and incorrect solutions.

Based on the analysis above, students with a positive self-concept tend to make fewer errors in solving geometry problems compared to those with a negative self-concept. A study by Astuti & Hikmah (2021) explained that self-concept has a significant influence on an individual's understanding of mathematical concepts. After being analyzed using Newman's error indicators, students with a positive self-concept were found to make comprehension errors, process skill errors, and final answer errors. This aligns with Alhassora et al. (2017), who stated in their research that most mathematical problem-solving errors fall into the categories of comprehension, process skills,

and encoding. These may be caused by factors such as an inability to fully grasp the problem and a lack of experience in solving geometry problems.

On the other hand, students with a negative self-concept made reading errors, comprehension errors, transformation errors, process skill errors, and encoding or final answer errors. Research by Haryanto & Pujiastuti (2021) found that a lack of understanding of mathematical problems is a primary factor leading to errors. According to a study by C. Rr Chusnul et al. (2017), transformation errors occur when students are unable or confused about choosing the appropriate formulas, theorems, or definitions to use in solving geometry problems. These errors are also influenced by several factors, such as insufficient understanding of the material, weak prerequisite knowledge, and carelessness in solving geometry questions.

The findings also indicate that self-concept influences how individuals approach and solve mathematical problems. In this study, students with a positive self-concept were more likely to produce correct answers when solving geometry problems compared to students with a negative self-concept. This is due to the fewer errors made by students with a positive self-concept. Supporting this, research by Reski et al. (2017) also stated that a negative self-concept can negatively affect mathematics learning outcomes.

DISCUSSION

The findings of this study indicate that students' self-concept significantly influences their ability to solve geometry problems, particularly when analyzed through Newman's error analysis. Students with a positive self-concept tend to exhibit higher self-confidence in understanding and approaching problems, although they still make errors, such as comprehension errors, process skill errors, and encoding errors in the final answer. This supports the findings of Astuti & Hikmah (2021), which state that self-concept has a significant effect on one's understanding of mathematical concepts.

The errors made by students in the positive self-concept category were generally technical in nature and often related to a lack of experience or inaccuracy during the problem-solving process. These students tended to demonstrate initiative in planning solution strategies, even if they did not always express the procedures in detail. This aligns with the study by Alhassora et al. (2017), which found that errors in mathematics, particularly in geometry-based problems, are commonly found in comprehension, process skills, and encoding.

In contrast, students with a negative self-concept tended to make nearly all types of errors outlined in Newman's theory, including reading and transformation errors. These findings suggest that a negative self-concept can undermine students' motivation, focus, and confidence in interpreting problem information and constructing logical steps toward a solution. Interview results revealed signs of doubt, carelessness, and a lack of effort in articulating relevant information and procedures. This supports the findings of Haryanto & Pujiastuti (2021), who emphasized that a lack of understanding of mathematical problems is a major cause of error.

Moreover, these results reinforce the findings of Chusnul et al. (2017), who reported that transformation errors often arise from students' inability or confusion in selecting appropriate formulas, theorems, or definitions to solve geometry problems. Students with a negative self-concept also typically lacked mastery of prerequisite knowledge, such as basic concepts of triangles, angle bisectors, and properties of geometric figures, which are fundamental to solving geometry problems.

Therefore, it can be concluded that self-concept is an important affective factor in mathematics learning, particularly in geometry. Students with a positive self-concept tend to perform better in solving problems, while those with a negative self-concept often encounter difficulties across multiple

cognitive stages, from understanding the problem to formulating a complete and accurate solution. Consequently, strengthening students' self-concept should be a focus in mathematics instruction to reduce errors and enhance students' conceptual understanding.

CONCLUSION

There is a clear distinction between the types of errors made by students with positive and negative self-concepts in solving geometry problems. Students with a positive self-concept tend to make comprehension errors, process skill errors, encoding errors, or errors in writing the final answer. These errors are primarily caused by the students' inability to fully process the given information and their limited experience in solving geometry problems. On the other hand, students with a negative self-concept make a broader range of errors, including reading errors, comprehension errors, transformation errors, process skill errors, and final answer writing errors. The factors contributing to these errors include a lack of understanding of the geometry material presented in the test, limited mastery of prerequisite knowledge, and carelessness during the problem-solving process.

The findings of this study can serve as a comparison and reference for future research related to errors in solving geometry problems, particularly from the perspective of students' self-concept. It is expected that future studies will explore this topic more comprehensively and contribute to developing effective solutions for minimizing students' errors in solving geometry problems.

ACKNOWLEDGEMENT

The authors are thankful to the reviewer, whose comments led to substantial improvements in the paper. The first author and the fourth author are thankful to the lecturers at the Cordoba Islamic University of Banyuwangi.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest, financial or otherwise, that could have influenced the outcomes of this research. This study was conducted independently and was not funded by any external organization or institution.

REFERENCES

- Alhassora, N. S. A., Abu, M. S., & Abdullah, A. H. (2017). Newman Error Analysis on Evaluating and Creating Thinking Skills. *Man In India*, 97(19), 413–427.
- Asriyani, R. Y., Handayani, I., & Hadi, W. (2020). Students' Errors in Mathematical Problem-Solving Ability on the Triangular and Quadrilateral Materials at Junior High Schools (SMP) Jakarta. *Desimal: Jurnal Matematika*, 3(2), 125–136. <https://doi.org/10.24042/djm.v3i2.5728>
- Astuti, L. S., & Hikmah, R. (2021). Pemahaman Konsep Matematika Ditinjau dari Konsep Diri dan Minat Belajar Siswa SMP Swasta Tangerang. *Jurnal Equation: Teori Dan Penelitian Pendidikan Matematika*, 4(1), 24–34. <https://doi.org/10.29300/equation.v4i1.3916>
- C. Chusnul, R., Mardiyana, & S. Retno, D. (2017). Errors Analysis of Problem Solving Using The Newman Stage After Applying Cooperative Learning of TTW type. *AIP Conference Proceedings*, 1913(1), 1–7. <https://doi.org/10.1063/1.5016662>

- Farah, M., Suharsono, Y., & Prasetyaningrum, S. (2019). Konsep diri dengan regulasi diri dalam belajar pada siswa SMA. *Jurnal Ilmiah Psikologi Terapan*, 7(2), 171–183. <https://doi.org/10.22219/jipt.v7i2.8243>
- Haryanto, C., & Pujiastuti, E. (2021). Analisis Kesalahan Siswa dalam Menyelesaikan Soal Open Ended Berdasarkan Prosedur Newman pada Pembelajaran Model Treffinger. *PRISMA, Prosiding Seminar Nasional Matematika*, 4(1), 103–110. <https://journal.unnes.ac.id/sju/index.php/prisma/article/view/44983>
- Khodijah, S., & Hakim, A. R. (2024). Pengaruh Konsep Diri Terhadap Kemampuan Pemahaman Konsep Matematika Siswa. *APOTEMA: Jurnal Program Studi Pendidikan Matematika*, 10(01), 56–64.
- Ludbiyani, A. D. (2022). Analisis Penalaran Induktif Siswa Kelas VIII SMP Islam Fatahillah Dalam Menyelesaikan Masalah Pola Geometris Ditinjau Dari Self-Concept. *University of Islam Malang*, 1(1), 1–12.
- Mahmudah, W. (2018). Analisis Kesalahan Siswa dalam Menyelesaikan Soal Matematika Bertipe HOTS Berdasarkan Teori Newman. *Jurnal UJMC: Unisda Journal of Mathematics and Computer Science*, 4(1), 49–56.
- Murtiyasa, B., & Wulandari, V. (2020). Analisis Kesalahan Siswa Materi Bilangan Pecahan Berdasarkan Teori Newman. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 9(3), 713–726. <https://doi.org/10.24127/ajpm.v9i3.2795>
- Nengsih, L. W., Yulianti, R., & Kamariah, K. (2022). Analisis Kesalahan Newman Mahasiswa Dalam Menyelesaikan Soal Lingkaran Berdasarkan Gaya Kognitif. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 11(3), 2406–2417. <https://doi.org/10.24127/ajpm.v11i3.5155>
- Phaliso, L. (2022). *Exploring The Errors Committed by Grade 11 Learners in Euclidean Gometry Problem-Solving* (Issue 1). University of South Africa.
- Ramadhani, D. A., & Hakim, D. L. (2021). Kemampuan Problem-Solving Matematis Siswa SMA dalam Menyelesaikan Permasalahan Materi Fungsi. *JPMI: Jurnal Pembelajaran Matematika Inovatif*, 4(5), 1113–1122. <https://doi.org/10.22460/jpmi.v4i5.1113-1122>
- Reski, N., Taufik, & Ildil. (2017). Konsep Diri Dan Kedisiplinan Belajar Siswa. *Jurnal Education: Jurnal Pendidikan Indonesia*, 3(2), 85–91. <https://jurnal.iicet.org/index.php/j-edu/article/viewFile/184/210>
- Rohmah, M., & Sutiarto, S. (2018). Analysis Problem Solving in Mathematical Using Theory Newman. *Eurasia Journal of Mathematics, Science and Technology Education*, 14(2), 671–681. <https://doi.org/10.12973/ejmste/80630>
- Rohmat, A. N., & Lestari, W. (2019). Pengaruh Konsep Diri dan Percaya Diri terhadap Kemampuan Kemampuan Berpikir Kritis Matematis. *JKPM: Jurnal Kajian Pendidikan Matematika*, 5(1), 73–84. <https://doi.org/10.30998/jkpm.v5i1.5173>
- Saputra, R. A., Hariyadi, A., & Sarjono. (2021). Pengaruh Konsep Diri dan Reward Terhadap Prestasi Belajar Siswa Pada Mata Pelajaran Pendidikan Kewirausahaan. *Jurnal Education*, 7(3), 1046–1053. <https://doi.org/10.31949/educatio.v7i3.1337>
- Septiyani, N. O., & Alyani, F. (2021). Analisis Konsep Diri terhadap Kemampuan Pemahaman Matematis Siswa di SMA. *Vygotsky*, 3(2), 133–144. <https://doi.org/10.30736/voj.v3i2.413>
- Sundawan, M. D., & Nopriana, T. (2019). Guided-Discovery Learning, Representasi Matematis dan Konsep Diri Mahasiswa pada Materi Geometri. *JNPM: Jurnal Nasional Pendidikan Matematika*, 3(1), 123–133. <https://doi.org/10.33603/jnpm.v3i1.1868>
- Utari, D. R., Wardana, M. Y. S., & Damayani, A. T. (2019). Analisis Kesulitan Belajar Matematika dalam Menyelesaikan Soal Cerita. *Jurnal Ilmiah Sekolah Dasar*, 3(4), 534–540. <https://doi.org/10.31943/mathline.v5i2.162>