PRISMA, 15(1), 413-422, June 2026
https://jurnal.unsur.ac.id/prisma
DOI:10.35194/jp.v15i1.6420

p-ISSN 2089 3604
e-ISSN 2614 4611

Analysis of Students' Mathematical Problem-Solving Abilities in Single Variable Linear Equations and Pythagorean Theorem Material

Meida Rosita[1,*] , Iyan Rosita Dewi Nur[2] , Kiki Nia Sania Effendi[3]
[1,2,3]Universitas Singaperbangsa Karawang, Karawang, Indonesia
*Corresponding Authors: 2410632050014@student.unsika.ac.id

Submitted: 20-05-2026	*Revised: 28-05-2026*	*Accepted: 03-06-2026*	*Published: 05-06-2026*

ABSTRACT

This study aims to analyze students' mathematical problem-solving abilities in Single Variable Linear Equations and the Pythagorean Theorem based on Polya's problem-solving stages. The study uses a descriptive qualitative approach involving 40 eighth-grade students VIII junior high school students through descriptive tests and interviews. The results of the analysis show that students' mathematical problem-solving abilities are in the moderate category for both subjects, with an average score of 74.85 for Single Variable Linear Equations and 74.67 for the Pythagorean Theorem. Students in the high category are able to go through all stages of problem solving systematically. Students in the moderate category were able to understand the problem and plan a solution strategy, but often made computational errors. Conversely, students in the low category had difficulty understanding information, constructing mathematical models, and implementing solution procedures. Overall, the results of this study confirm the need to strengthen problem-solving-based learning that emphasizes understanding concepts and solution strategies to optimally improve students' mathematical problem-solving abilities.

Keywords: mathematical problem solving; pythagorean theorem; single variable linear equations

INTRODUCTION

Mathematics plays a crucial role in the development of science and technology, so it is important for every individual to understand and master it. As one of the compulsory subjects in school, mathematics contributes greatly to the development of logical, systematic, and analytical thinking skills. The main objective of mathematics education is to develop problem-solving skills, as these skills train students to think creatively, critically, logically, and systematically (Siahaan & Surya, 2020). In addition, mathematics is a language that demands precision and accuracy in every term and symbol used (Pamungkas et al., 2018). Students need to have adequate mathematical skills to be able to face various global challenges, because mathematics is an important part of the national education curriculum (La'ia & Harefa, 2021).

Problem-solving skills are very important in mathematics learning, not only for those who will study mathematics in the future, but also for those who will apply it in other fields of study and in everyday life (Indira et al., 2019). Mathematics has many benefits in human life, so it is very important for students to learn it (Salsabila & Hidayati, 2021). Although mathematics is considered important, many students often find it difficult to solve problems that are considered complicated. As stated by (Salsabila & Hidayati, (2021) "Based on the reality in the field, students' mathematical problem-solving skills in Indonesia are still very low." Many students are only able to solve problems that require a single step to complete

(Amam, 2017). Students' inability to solve mathematical problems is often caused by difficulty understanding the information in the question, inaccuracy in modeling the problem into mathematical form, and lack of precision when completing calculations. (Utami & Wutsqa, 2017). Observations in class VIII at SMPN 1 Cikampek show that most students still have difficulty solving mathematical problems, as evidenced by the large number of students who scored below the minimum passing grade and made mistakes in the steps to solve the problems.

Single Variable Linear Equations and the Pythagorean Theorem is part of the mathematics curriculum at the junior high school level. Single Variable Linear Equations can be defined as an open sentence with one variable of degree one and connected with an equal sign (=). This concept is closely related to everyday life, such as calculations in simple economic activities, time management, and work management (Sonia et al., 2022). Single Variable Linear Equations also forms the basis for other material, such as two-variable equation systems, and is related to the concepts of lines and angles. Meanwhile, the Pythagorean Theorem is an important basic concept for various calculations in mathematics and its applications in real life. However, some studies show that students still have difficulty applying this theorem to solve problems (Yadrika et al., 2019).

Studying Single Variable Linear Equations material and the Pythagorean Theorem provides great benefits in developing students' logical and systematic thinking skills. However, in reality, many students are still unable to connect these concepts effectively. Based on research (Sonia et al., 2022) Most students have difficulty understanding the context of the questions, translating the problems into mathematical models, and determining the appropriate steps to solve them.

According to (Fitri & Hasyim, 2018), There are five key competencies in mathematical ability, namely problem solving, communication, connection, and mathematical reasoning. Among these five aspects, problem solving is at the core of mathematics learning. Ruseffendi (2006) emphasizing that problem-solving skills are not only important for those who study mathematics, but also for all students in their daily lives and other fields of study. Rahmatiya dan Miatun (2020) states that mathematical problem solving emphasizes the application of valid strategies, methods, and procedures in solving problems. Mathematical problem-solving skills are considered the core of mathematics teaching because they build students' confidence in facing various problems. (La'ia & Harefa, 2021;Lubis et al., 2020)

Polya (1973) presented four stages in mathematical problem solving, namely: (1) understanding the problem, (2) planning a solution strategy, (3) implementing the plan, and (4) reviewing the solution. By following these steps, students can think more logically and systematically in solving mathematical problems. (Yuwono et al., 2018).

Based on the above description, this study aims to analyze junior high school students' mathematical problem-solving abilities in solving problems on Single Variable Linear Equations and Pythagorean Theorem material. The results of this study are expected to provide an overview of the extent of students' abilities in solving mathematical problems and serve as a reference for teachers in improving the quality of mathematics learning in schools.

RESEARCH METHODS

This study applies a qualitative approach with a descriptive method that aims to describe mathematical problem-solving abilities in Single Variable Linear Equations and Pythagorean Theorem materials. Qualitative descriptive research is conducted to determine the phenomena perceived by research subjects regarding behavior, views, and others, using various scientific techniques to describe words (Ridzkiyah & Effendi, 2021).

The population in this study included all eighth-grade students at SMPN 1 Cikampek, while the research sample was determined using purposive sampling, which resulted in 40 students as research subjects. These students were given a mathematical problem-solving test consisting of six essay questions, with three questions on Single Variable Linear Equations material and three questions on the Pythagorean Theorem. The students' answers were then analyzed in depth to identify their abilities in mathematical problem solving.

Based on the results of this analysis, students were classified into three categories of ability: high, medium, and low. This classification follows the criteria set out by Arikunto. (Setyawan et al., 2023) which can be seen in Table 1 below.

Table 1. Criteria for High, Medium, and Low Student Categories

Student Category Criteria	Description
$X \geq (M + SD)$	High
$(M - SD) < X < (M + SD)$	Medium
$X \leq (M - SD)$	Low

The research instrument, in the form of an essay test, was developed based on indicators of mathematical problem-solving ability. Three students were selected as samples. Each of these students represented groups of students with high, medium, and low mathematical problem-solving abilities. The instruments used were a mathematical problem-solving ability test sheet and an interview guide sheet.

RESULTS AND DISCUSSION

The results obtained from the students' mathematical problem-solving abilities by solving problems on the material of Single Variable Linear Equations and the Pythagorean theorem in descriptive form are as follows, while the descriptive statistics results are shown in Table 2.

Table 2. Statistical Results of Students' Mathematical Problem-Solving Ability in Single Variable Linear Equations and Pythagorean Theorem

Material	N	Minimum Value	Maximum Value	Average	Standard Deviation
Single Variable Linear Equations	40	20	100	74.85	17.88
Pythagorean Theorem	40	17	100	74.68	21.18

Students have not achieved maximum scores in mathematical problem-solving tests, as shown by the scores given in Table 2. Students obtained a maximum score of 100 in the subject of Single Variable Linear Equations, a minimum score of 20, an average of

74.85, and a standard deviation (data dispersion level) of 17.88. Students obtained a minimum score of 17 on the Pythagorean theorem material, with an average of 74.67 and a standard deviation (data dispersion level) of 21.18. The method proposed by Arikunto (Setyawan et al., 2023) enables mathematical problem solving to determine low, medium, and high categories. This method categorizes research data based on mean values and standard deviations. The percentage of students' mathematical problem-solving abilities in Single Variable Linear Equations and Pythagorean Theorem material is shown in Tables 3 and 4 as follows:

Table 3. Percentage of Students' Mathematical Problem-Solving Ability in Single Variable Linear Equations Material

Category	Value Limit	Number of Students	Percentage
High	$X \geq 88$	6	15%
Medium	49-88	29	72.5%
Low	≤ 49	5	12.5%

Table 4. Percentage of Students' Mathematical Problem-Solving Ability in the Pythagorean Theorem Material

Category	Value Limit	Number of Students	Percentage
High	$X \geq 88$	7	17.5%
Medium	52-88	27	67.5%
Low	≤ 52	6	15%

Based on Tables 3 and 4, it can be seen that the mathematical problem-solving ability of students in the category of high achievement in the subject of Single Variable Linear Equations reached 15%, meaning that 6 students obtained high scores. In the category of moderate achievement, 72.5% of students obtained scores between 49 and 88, while in the category of low achievement, 12.5% of students obtained scores below 49. The mathematical problem-solving ability of students in the Pythagorean Theorem material in the high category reached 17.5%, meaning that 7 students obtained high scores, in the medium category reached 67.5%, meaning that 27 students obtained scores between 52 and 88, and in the low category reached 15%, meaning that 6 students obtained scores below 52. The results of the percentage of mathematical problem-solving skills in the Single Variable Linear Equations and Pythagorean Theorem materials show that there are more students with moderate skills than those with high and low skills. Most students in the class were able to solve mathematical problems on the material of Single Variable Linear Equations and Pythagorean Theorem. This shows that students' mathematical problem-solving skills are sufficient in answering questions on Single Variable Linear Equations and Pythagorean Theorem.

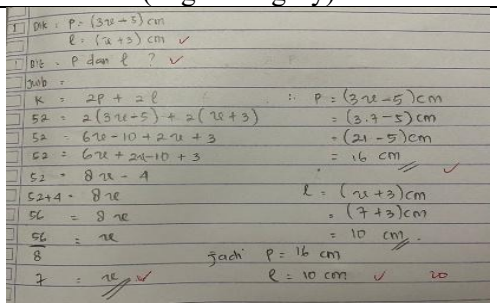
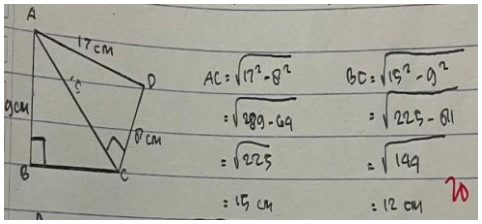
In general, students with high abilities are able to go through all stages of problem solving systematically, students with moderate abilities only partially, while students with low abilities have difficulties from the start. According to Polya, this emphasizes the importance of understanding the problem as the first step in the process of mathematical problem solving (Amaliah et al., 2021). The results of students' problem-solving abilities, categorized as high, medium, and low for both Single Variable Linear Equations and Pythagorean Theorem materials, are shown in Table 5.

Table 5. Results of Students' Mathematical Problem-Solving Skills

Categories and Subjects	Understanding the Problem	Planning the Resolution	Implementing the Plan	Double-check
High S-1	Can answer questions and explain what is known.	Having the ability to create appropriate plans and formulas.	Follow the calculation procedures correctly according to the plan.	Draw conclusions, double-check the calculations.
Medium S-10	Can answer questions and explain what is known.	Having the ability to make the right plans.	There is an error in the calculation.	Do not draw conclusions or check the calculation results.
Low S-3	Unable to understand the problem.	Unable to complete the settlement.	Unable to carry out the plan.	Does not draw conclusions and does not check the calculation results.

Next, analyze the students' answers and interviews with three students categorized as high, medium, and low ability. The following are the answers of students categorized as high ability in both subjects, namely Single Variable Linear Equations and the Pythagorean Theorem, as shown in Table 6.

Table 6. Students' Mathematical Problem-Solving Ability Responses in the High Category

Subject	Single Variable Linear Equations (High Category)	Pythagorean Theorem (High Category)
S-1	 Figure 1. (a) Based on the answers given by undergraduate students in Figure 1. (a), it appears that students are able to solve mathematical problems well. It can be seen that these students are able to solve problems using structured problem-solving steps, starting from understanding the problem, planning the solution, solving the problem, and checking the solution.	 Figure 1. (b) Based on the answers given by undergraduate students in Figure 1. (b), it appears that students are able to understand the ideas presented in the questions and have the ability to calculate the sides of a triangle using the Pythagorean theorem. Students are able to complete the questions using the appropriate strategies and steps.

Figures 1(a) and 1(b) show the results of students' answers in the high ability category, where students are able to correctly solve mathematical problems. They solve problems skillfully, plan their solutions in a structured manner, analyze and recheck the steps

in solving mathematical problems (Yuwono et al., 2018). The following are excerpts from interviews with S1 students in the high ability category.

P *"Are there any difficulties in solving problems on the subject of Single Variable Linear Equations?"*

S-1 *:"Praise be to God, I had no trouble solving the problem. I was able to find the length and width of a square with a known perimeter."*

P *:"When studying the Pythagorean Theorem, did you have difficulty answering the questions?"*

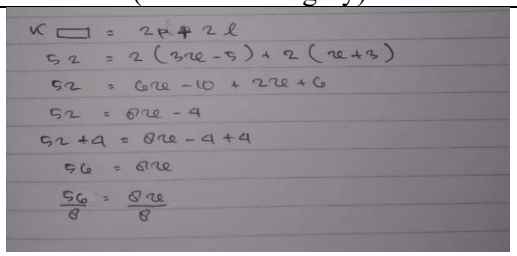
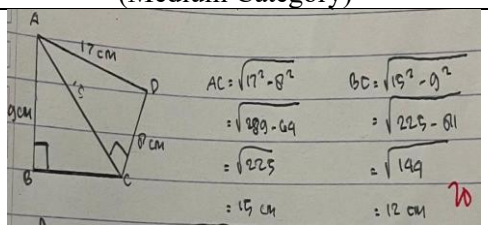
S-1 *:"No, Mom, I can solve the problem by finding the length of BC (the other side) after finding the length of AC first."*

P *: "Are there any obstacles in operating the root form?"*

S-1 *: "Nothing."*

The following are the answers of students categorized as average in both subjects, namely Linear Equations with One Variable and the Pythagorean Theorem, as shown in Table 7.

Table 7. Students' Mathematical Problem-Solving Ability Responses in the Moderate Category

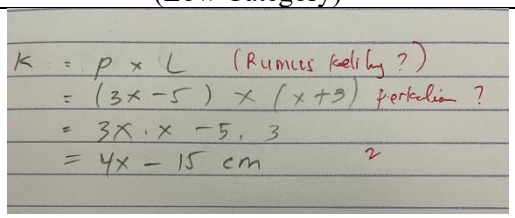
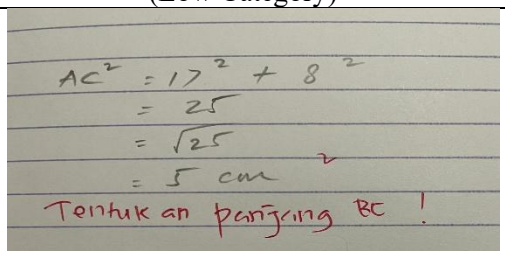
Subject	Single Variable Linear Equations (Medium Category)	Pythagorean Theorem (Medium Category)
S-10	 Figure 2. (a) Based on the answers given by student S-10 in Figure 2. (a), it appears that students are able to understand the initial concept of Single Variable Linear Equations given in the question, but their answers are incomplete. The question asks for the length and width of a rectangle, which requires students to first find the value of χ. Students have only reached the stage of finding the value of χ, and have not substituted the value of χ into the length and width stated in the question to obtain the actual measurements.	 Figure 2. (b) As shown by the answers of student S-10 in Figure 2. (b), it appears that students have a good understanding of the question, namely that there are two sides to be found. Students still have difficulty understanding the concept of which side to find, whether it is the slanted side or the other side, resulting in errors in the calculation. Figure 3 shows that students find the length of BC using addition, when they should use subtraction because they are looking for the other side of the triangle.

Figures 2. (a) and 2. (b) show the results of students' answers in the moderate ability category, where students are able to solve mathematical problems by making appropriate plans but make mistakes in their calculations. In line with the research results (Amaliah et al., 2021) that students experience difficulties in problem solving due to errors in working out problems and the calculation or computation process. The following are excerpts from interviews with S-10 in the moderate ability category.

P *:"Are there any difficulties in solving Single Variable Linear Equations?"*
S-10 *:"Yes, I understand what you are asking, but I don't know how to calculate the value of x."*
P *:"If it's about the Pythagorean Theorem, do you find it difficult to answer and solve the problems?"*
S-10 *:"Alhamdulillah,,,I can solve the problem, but I forgot to use the square root at the end when finding the length of BC (the other side)."*
P *:"So you made a mistake in your calculations?"*
S-10 *:"Yes Mrs, I wasn't careful enough.*"

The following are the answers of students categorized as having low ability in both subjects, namely Single Variable Linear Equations and the Pythagorean Theorem, as shown in Table 8.

Table 8. Students' Mathematical Problem-Solving Ability Responses in the Low Category

Subjek	Single Variable Linear Equations (Low Category)	Pythagorean Theorem (Low Category)
S-3	 Figure 3. (a) Based on the answers of S-3 students in Figure 3. (a), it appears that students do not yet understand the formula for the perimeter of a square and multiplication in algebraic form, so they are not yet able to solve problems properly.	 Figure 3. (b) Based on Figure 3. (b), it can be seen that S-3 students are able to write down what they want to convey, which is to find a side. There are exponents and roots in the students' answers, but they do not explain how the exponent two and square root are used in the formula. The correct explanation is that it must show that the perpendicular sides, for example a and b, are squared, then added together, and the result is equal to the square of the sloping side c with the help of an illustration in a right-angled triangle. The student's answer only mentions the elements of the formula (the square and the square root) without explaining the relationship and sequence of use in the.

Figures 3. (a) and 3. (b) show the results of students' answers in the low ability category, namely students who cannot understand the problem, cannot complete the solution, and cannot implement the plan. (Annisa & Kartini, 2021) that students are wrong if they cannot formulate the appropriate formula. S-3 did not understand the problem in the question, S-3 did not implement a solution and did not draw a conclusion. (Faiz & Nur, 2023). The following are excerpts from interviews with S-3 students in the low ability category.

P :"Are there any difficulties in solving Single Variable Linear Equations?"
S-3 : "Yes, Mrs, I forgot again. I'm confused about how to do it."
P :"What confuses you?"
S-3 :"I don't remember the formula for the perimeter of a rectangle."
P :"If it's about the Pythagorean Theorem, do you find it difficult to answer and solve the problems?"
S-3 :"Yes,Mrs. I forgot the formula."
P :"How to calculate or operate with roots, are there any difficulties?"
S-3 :"I can calculate square roots."

Based on the analysis of student responses and interviews, it can be seen that students who have high proficiency in Single Variable Linear Equations also have high proficiency in the Pythagorean Theorem, and are able to correctly perform the steps of mathematical problem solving. Conversely, students with low proficiency in the subject of Linear Equations with One Variable also have low proficiency in the subject of the Pythagorean Theorem.

The results of the analysis of students in the high, medium, and low categories show that students are less able to evaluate solutions based on their interpretations. These results are supported by the findings of research conducted by (Salsabila & Hidayati, 2021), students did not double-check their results because their solutions were incomplete and did not include conclusions.

The interview results supported the test data, showing that students with high abilities had good problem-solving skills, while students with moderate and low abilities needed more guidance in understanding the context of the questions and the strategies for solving them. These differences in ability were influenced by the students' level of problem-solving skills and accuracy.

CONCLUSION

The results show that students' mathematical problem-solving abilities in the subjects of Single Variable Linear Equations and Pythagoras' Theorem are in the moderate category. The distribution of student achievement in both subjects is relatively similar, indicating consistency in problem-solving abilities across mathematical topics. Students in the high category are able to complete all stages of problem solving according to Polya, from understanding the problem to rechecking the solution. Students in the moderate category demonstrate an understanding of the context of the problem and are able to devise a solution strategy, but still make computational errors and do not complete the solution steps thoroughly. Meanwhile, students in the low category experience difficulties in almost all stages, especially in understanding information, choosing a strategy, and completing the calculation procedure. Overall, the mathematical problem-solving abilities of eighth-grade students at SMPN 1 Cikampek are moderate.

These findings were reinforced through interviews, which confirmed that differences in student abilities were influenced by mastery of basic concepts, accuracy, and procedural understanding. In general, students' mathematical problem-solving abilities need to be improved through learning that emphasizes deepening concepts, modeling problem-solving

strategies, and practicing result verification. Thus, improving the quality of problem-solving-based learning is an important step toward achieving optimal mathematics learning objectives.

REFERENCES

Amaliah, F., Sutirna, & Zulkarnaen, R. (2021). Analisis kemampuan pemecahan masalah matematis siswa pada materi segiempat dan segitiga. *AKSOIMA: Jurnal Matematika Dan Pendidikan Matematka*, *12*(1), 10–20.

Amam, A. (2017). Penilaian Kemampuan Pemecahan Masalah Matematis Siswa Smp. *Teorema*, *2*(1), 39. https://doi.org/10.25157/.v2i1.765

Annisa, R., & Kartini, K. (2021). Analisis Kesalahan Siswa dalam Menyelesaikan Soal Logaritma Menggunakan Tahapan Kesalahan Newman. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *5*(1), 522–532. https://doi.org/10.31004/cendekia.v5i1.507

Faiz, & Nur, I. R. D. (2023). Analisis Kemampuan Pemecahan Masalah Matematis Siswa Pada Materi Aritmetika Sosial. *Biormatika : Jurnal Ilmiah Fakultas Keguruan Dan Ilmu Pendidikan*, *9*(2), 98–105. https://doi.org/10.35569/biormatika.v9i2.1649

Fitri, L., & Hasyim, M. (2018). Pengaruh Kemampuan Disposisi Matematis, Koneksi Matematis, Dan Penalaran Matematis Terhadap Kemampuan Pemecahan Masalah Matematika. *JP2M (Jurnal Pendidikan Dan Pembelajaran Matematika)*, *4*(1), 47. https://doi.org/10.29100/jp2m.v4i1.1778

Indira, T., Zulkardi, Z., & Sanova, Y. (2019). Peningkatan Kemampuan Pemecahan Masalah pada Materi Persamaan Garis Singgung Lingkaran melalui Pembelajaran Discovery Learning. *Edumatika: Jurnal Riset Pendidikan Matematika*, *2*(2), 69. https://doi.org/10.32939/ejrpm.v2i2.343

La'ia, H. T., & Harefa, D. (2021). Hubungan Kemampuan Pemecahan Masalah Matematis dengan Kemampuan Komunikasi Matematik Siswa. *Aksara: Jurnal Ilmu Pendidikan Nonformal*, *7*(2), 463. https://doi.org/10.37905/aksara.7.2.463-474.2021

Lubis, W. A., Ariswoyo, S., & Syahputra, E. (2020). Kemampuan Pemecahan Masalah Matematika Melalui Pendekatan Pendidikan Matematika Realistik dan Pendekatan Penemuan Terbimbing Berbantuan Autograph. *Edumatika: Jurnal Riset Pendidikan Matematika*, *3*(1), 1. https://doi.org/10.32939/ejrpm.v3i1.483

Pamungkas, A. S., Mentari, N., & Nindiasari, H. (2018). Analisis Kemampuan Berpikir Reflektif Siswa SMP Berdasarkan Gaya Belajar. *NUMERICAL: Jurnal Matematika Dan Pendidikan Matematika*, *2*(1), 31–42. https://doi.org/10.25217/numerical.v2i1.209

Polya, G. (1973). *How to solve it: A new aspect of mathematical method. Princeton University Press.*

Rahmatiya, R., & Miatun, A. (2020). Analisis kemampuan pemecahan masalah matematis ditinjau dari resiliensi matematis siswa SMP. *Teorema: Teori Dan Riset Matematika*, *5*(2), 187-202.

Ridzkiyah, N., & Effendi, K. N. S. (2021). ANALISIS KEMAMPUAN LITERASI MATEMATIS SISWA SMA DALAM MENYELESAIKAN SOAL PROGRAM FOR INTERNATIONAL STUDENT ASSESSMENT (PISA). *Jurnal Ilmiah Pendidikan Matematika*, *6*(1), 1–13.

Ruseffendi, E. T. (2006). Pengantar Kepada Membantu Guru Mengembangkan Kompetensinya dalam Pengajaran Matematika untuk Meningkatkan CBSA. Bandung: Tarsito. Retrieved from http://onesearch.id/Record/IOS3107.10571

Salsabila, I., & Hidayati. (2021). Analisis Kemampuan Siswa Dalam Menyelesaikan Soal

Matematika Tipe Higher Order Thinking Skills (Hots). *Jurnal Pendidikan DEWANTARA: Media Komunikasi, Kreasi Dan Inovasi Ilmiah Pendidikan*, *6*(1), 94–107. https://doi.org/10.55933/jpd.v10i1.643

Setyawan, F., Firdaus, M. N., Matematika, P., & Dahlan, U. A. (2023). ANALISIS KEMAMPUAN BERPIKIR KRITIS DALAM MENYELESAIKAN MASALAH MATEMATIKA DITINJAU DARI KEMANDIRIAN BELAJAR. *Didaktis: Jurnal Pendidikan Dan Ilmu Pengetahuan*, *23*(1), 1–11.

Siahaan, E., & Surya, E. (2020). Analisis pengaruh kemampuan pemecahan masalah siswa dalam pelajaran matematika. *Medan: Program Studi Pendidikan Matematikam, FMIPA UNIMED*, *1*(2), 8.

Sonia, E., Nurjaman, A., & Hutajulu, M. (2022). Analisis kemampuan pemecahan masalah matematis dalam menyelesaikan soal cerita materi persamaan linear satu variabel pada siswa SMP. *Jurnal Pembelajaran Matematika Inovatif*, *5*(4), 1087–1094. https://doi.org/10.22460/jpmi.v5i4.1087-1094

Utami, R. W., & Wutsqa, D. U. (2017). Analisis kemampuan pemecahan masalah matematika dan self-efficacy siswa SMP negeri di Kabupaten Ciamis. *Jurnal Riset Pendidikan Matematika*, *4*(2), 166–175. https://doi.org/10.21831/jrpm.v4i2.14897

Yadrika, G., Amelia, S., & Roza, Y. (2019). Analisis Kesalahan Siswa SMP dalam Menyelesaikan Soalpada Materi Teorema Pythagoras dan Lingkaran. *JPPM (Jurnal Penelitian Dan Pembelajaran Matematika)*, *12*(2), 195–212.

Yuwono, T., Supanggih, M., & Ferdiani, R. D. (2018). Analisis Kemampuan Pemecahan Masalah Matematika dalam Menyelesaikan Soal Cerita Berdasarkan Prosedur Polya. *Jurnal Tadris Matematika*, *1*(2), 137–144. https://doi.org/10.21274/jtm.2018.1.2.137-144