INTERNATIONAL JOURNAL OF CONTEMPORARY STUDIES IN EDUCATION
VOL. 03 NO. 03 (2024), 209-217

IJCSE

https://journals.eduped.org/index.php/ijcse
E-ISSN 2963-0282
P-ISSN 2963-5993

Analysis of Mathematical Critical Thinking Ability Junior High School Students on Systems of Linear Equations in Two Variables Material

Jihan Fadilla[1*], Fitri Wulan Sari[2], Hafizah Auladina[3], Lilis Marina Angraini[4], Ebenezer Bonyah[5]

[1,2,3,4]Universitas Islam Riau, Indonesia
Jl. Kaharuddin Nst No.113, Simpang Tiga, Kec. Bukit Raya, Kota Pekanbaru, Riau 28284, Indonesia

[5] Akenten Appiah Menka University of Skills Training and Entrepreneurial Development P. O. Box 1277, Kumasi, Ghana

DOI: https://doi.org/10.56855/ijcse.v3i3.1021
Received Mei 24, 2024; Accepted September 4, 2024; Available online November 5, 2024

Abstract: The aim of this research is to understand junior high school students' mathematical critical thinking abilities when facing SPLDV problems. The approach applied is a qualitative approach in the descriptive method. Subjects were selected using a purposive sampling technique and then 3 students were selected from 31 students in class VIII-5 of SMP N 1 Tualang. The test instrument used consists of three questions. Then students' responses were categorized into high, medium and low categories and analyzed these responses using indicators of critical thinking skills in the context of mathematics. Research findings show that students in class VIII-5 at SMP N 1 Tualang have critical mathematical thinking skills and are categorized as sufficient. This can be seen in the answers to test questions which do not cover several aspects of mathematical critical thinking skills. Mathematical critical thinking abilities were measured in three categories, high (9.68%), medium category (70.98%), and low category (19.36%).

Keywords: Analysis, Critical Thinking Skills, SPLDV

1. Introduction

Mathematics is one of the compulsory subjects for junior high school students. In understanding complex mathematical material such as Systems of Linear Equations in Two Variables (SPLDV), students must have strong critical thinking skills and good learning independence. According to Early (2017), who expressed the hope that the mathematics learning process at school could equip students to think logically and critically to face challenges in everyday life. Mathematics subjects function as developers of critical, analytical, systematic and logical thinking skills. (Yolanda and Wahyuni 2020).

Razak (2017) It revealed that thinking critically in mathematics is an essential ability that involves deep understanding, evaluation and analysis in solving mathematics problems. (Hidayat, Akbar, and Bernard 2019) Critical thinking is the ability to think deeply, use reasoning to obtain relevant knowledge and be responsible for this thinking. Meanwhile, Ennis (Hapsari 2016) Describes critical thinking skills as a reflective and rational process focusing on making decisions regarding objective phenomena.

*Corresponding author: jihanfadilla@student.uir.ac.id

Effendi and Farina (2017) They explained that in the 21st century, students must master innovation skills, including creativity and critical thinking. However, many schools have not encouraged the development of students' critical thinking skills in mathematics learning, so this ability is weak. The results of research conducted by Apriliani (2020) Show that the mathematical essential thinking skills of class X students at MA Nurul Jannah NW Ampenan are in the medium category. Likewise, a study by Hasanah and Aini (2021) Shows that student achievement in mathematical critical thinking skills in SPLDV material is still unsatisfactory.

Considering the significance of critical thinking skills in mathematics, it is expected that students in Indonesia have these abilities at a high level. However, based on the results of previous studies, it can be concluded that students' critical thinking abilities are still lacking. Therefore, this research evaluated the mathematical essential thinking skills of class VIII SMP students, especially on the SPLDV topic.

2. Research Methods

The method chosen is a qualitative descriptive approach. The sample for this research consisted of students in class VIII of SMP N 1 Tualang. The study objects were selected using a purposive sampling method, which was carried out by paying attention to the evaluation results' ranking from highest to lowest. The research tool is a description test which includes SPLDV (System Of Linear Equations With Two Variables) material adapted from the progress measurement tool created by (Syifa 2019), consisting of three questions. Data were collected through tests and analysed using critical thinking ability criteria established by (Syifa 2019).

Table 1 - Indicators of Mathematical Critical Thinking Ability

Number	Indicators	Competency indicators
1	Clarification	Explain the problem situation related to spldv.
2	Analysis	Provide arguments regarding solving spldv problems based on available information.
3	Evaluation	Assess the credibility of the arguments regarding solving the split problem based on the available information.

In this research, the data analysis technique used is descriptive analysis, which aims to explain the information that has been obtained. According to Miles and Huberman (Angelina and Effendi 2021)In descriptive data analysis, there are three steps: analysing, presenting, and making conclusions. The process of decomposing data is collected by grouping answers into high, medium, and low categories. After that, the score limits for each group are set, and the data is evaluated based on indicators of critical thinking skills in mathematics.

This research procedure involves several steps; these steps are the procedures followed by the researcher in completing this research. The first step researchers take is to start by compiling an introduction that includes background, problem identification, literature review, and research methods. After the researcher has prepared the introduction, the researcher then asks for criticism and expert suggestions to improve the introduction. The next step is to develop an instrument as a data collection tool. Researchers will conduct research by asking students to work on questions provided by the researcher. Then, researchers analysed the students' test results. After the researcher has studied the test results, the researcher then carries out the final stage, namely, concluding as a result of the research.

3. Research Instruments

The tool used is a written test. The researcher prepared three written test questions that matched the critical thinking ability indicators chosen as relevant data or sources in this research.

Table 2 - Research instrument questions based on indicators

Number	Indicators	Question
1	Clarification	Aldi bought two pairs of socks and three pairs of gloves for IDR 95,000, and Dimas bought one and two for IDR 55,000. When Aldi returned home, he regretted that one of the gloves he bought had a torn seam. He decided to exchange the gloves for socks and paid Rp. 5,000. But the seller said the money he paid was not enough. Is there an explanation for the lack of funds the seller mentioned?
2	Analysis	Keke bought two slices of brown bread and one slice of cheese bread, and she paid IDR 17,000, while Arsy gave her IDR 30,000 and got IDR 4,000 in exchange for one slice of chocolate bread and three slices of cheese bread. If there are two different pockets, namely: Pocket A: 8 brown bread, 7 cheese bread Pocket B: 5 brown bread, 10 cheese bread If Haura has IDR 90,000, which bag can Haura buy? Explain!
3	Evaluation	Zaki bought three T-shirts and one pair of trousers for IDR 400,000, and Tomi bought one T-shirt and two pairs of trousers for IDR 350,000. Tomi wanted to use the shopping voucher, so he had to buy 4 T-shirts and two pairs of trousers at the same shop the following week. It turns out there is currently a provision for promotions in this shop. Namely, it is a voucher worth IDR 100,000 or a 20% discount. Ultimately, Tomi used the voucher because he thought it would reduce the total purchase cost. Is Tomi's decision correct?

4. Results And Discussion

Testing was conducted on Monday, April 29, 2024, in class VIII-5 at SMP N 1 Tualang. For this research, one representative was selected for each student with high, medium, and low critical thinking abilities. The results of the group boundary criteria analysed are presented in the table below.

Table 3 - Results of Group Limit Criteria in Critical Thinking Ability

Limit	Group	Number of Students	Percentage
$X > 75{,}5$	High	3	9,68%
$21{,}9 \leq X \leq 75{,}5$	Medium	22	70,96%
$X < 21{,}9$	Low	6	19,36%

By referring to the criteria compiled by Arikunto (Risah, Sutirna, and Hakim 2021)It was found that 9.68% of students had high critical thinking skills, 70.98% of students had moderate essential skills of thinking, and 19.36% of students had low critical thinking skills that were low.

In the high category, three students are proficient in all indicators of mathematical critical thinking skills. They can explain problem situations, present arguments, and evaluate the credibility of arguments to solve SPLDV problems. However, in the medium category, the majority, namely 22 students, could only master several indicators of mathematical critical thinking abilities. Even though they can explain the clarification and analysis indicators, they still make mistakes on the evaluation indicators to solve SPLDV problems. This highlights the need for more systematic learning assessment and greater emphasis on developing problem-solving skills. In contrast, six students in the low category showed significant limitations in their mathematical critical thinking abilities. Even though they have difficulty explaining the problem and providing arguments, they still make mistakes in assessing the credibility of statements regarding the right solution to the SPLDV problem.

4.1. Analysis of Student Answers to Question Number 1

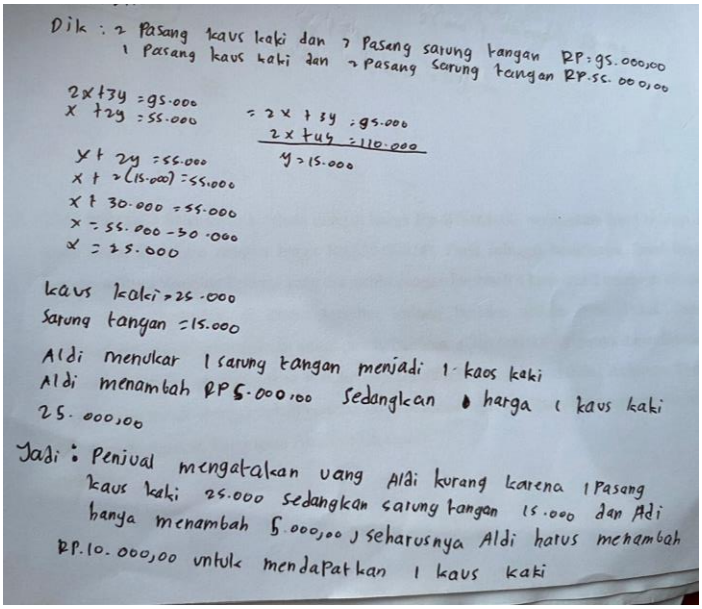

Fig. 1 - High category student answers

In Figure 1, students could fulfil the clarification indicators because they clearly explained and understood what was asked and what was known. They determined what variables were asked about in the question. As a result, the student was declared able to develop the mathematical model requested in the question. This is Arnidha's opinion. (Aprilianti Dwi Fani and Nia Sania Effendi 2021), namely, if students are able to solve problems with the correct steps, then they are able to create mathematical models.

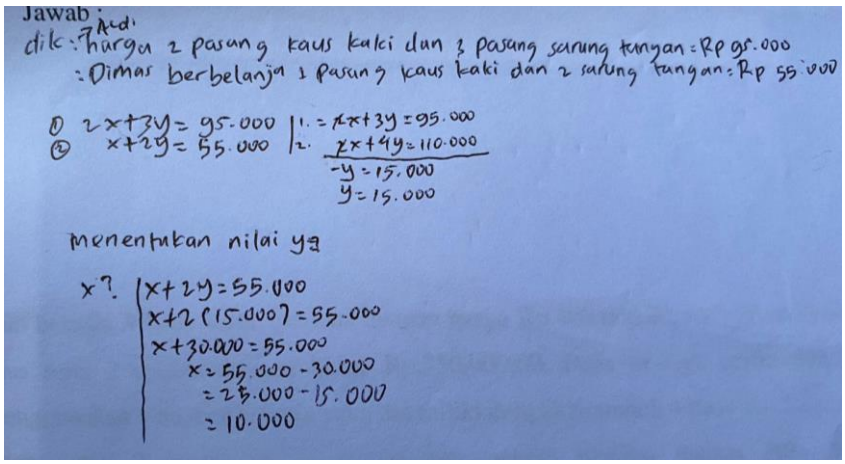

Fig. 2 - Medium category student answers

In Figure 2, the student has not been able to fulfil the clarification indicators; the student has written down what he knows but is not accurate in determining the example value of variable x. Feriyanto (2019) Shows that students' errors in determining x and y values reflect students' inability to substitute x values to produce y values or vice versa.

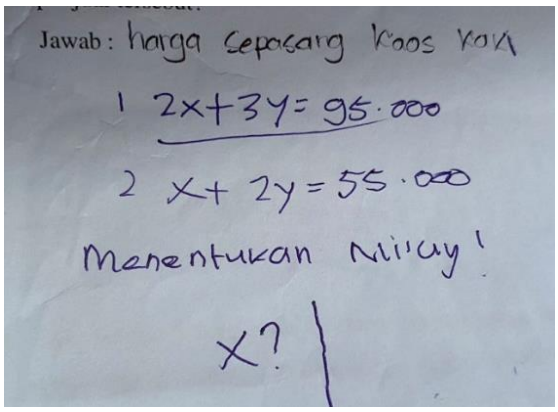

Fig. 3 – Low category student answers

In Figure 3, the student cannot fulfil the clarification indicator because he does not explain the problem in the question. The student did not work on solving the problem until he was finished, only writing down what he knew. Fazzilah, Effendi, and Marlina (2020) They explained that many students make mistakes in finding the formulas used to solve problems due to a lack of understanding of the material, lack of thoroughness and rushing to complete assignments.

4.2. Analysis of Student Answers to Question Number 2

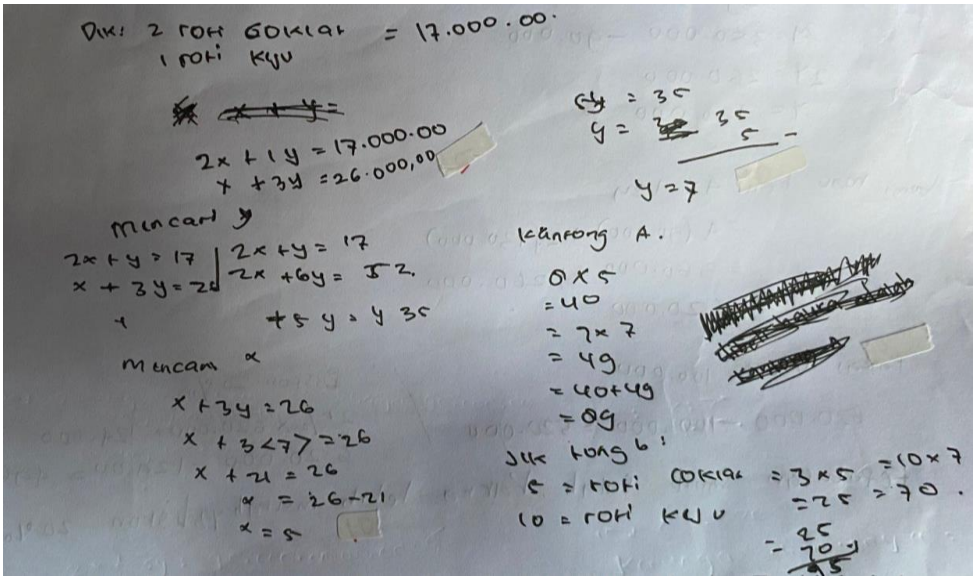

Fig. 4 - High category student answers

In Figure 4, the student could not reach the analysis criteria because he did not present reasons for solving the problem in the question. Students have recorded what they know to determine the x and y values but have not provided conclusions from solving the problems they have worked on. According to Suratih and Pujiastuti, errors in the closing part of the answer can include unclear conclusions and errors in concluding information. (Suningsih and Istiani 2021).

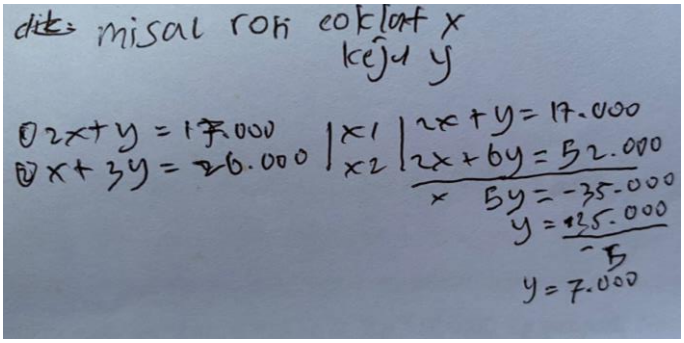

Fig. 5 - Medium category student answers

In Figure 5, the student has not reached the analysis criteria because he does not present reasons for solving the problem in the question. The student did not write down the solution to the problem until the end; he only wrote the example, made a mathematical model, and determined the value of the y variable. (Mutia, Effendi, and Sutirna 2021) Explained even though the student had not wholly succeeded in solving the question well, the student was ready to try to answer it.

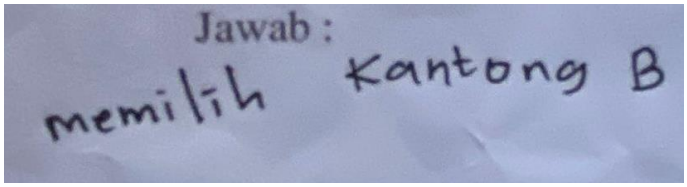

Fig. 6 – Low category student answers

In Figure 6, the student could not reach the analysis criteria because he did not present reasons for solving the problem in the question. The student only wrote his argument without writing the solution entirely and correctly. (Daniarti, Sugiatno, and Nursangaji 2015) They stated that students in the low category could not apply their knowledge and understanding to solve problems.

4.3. Analysis of Student Answers to Question Number 3

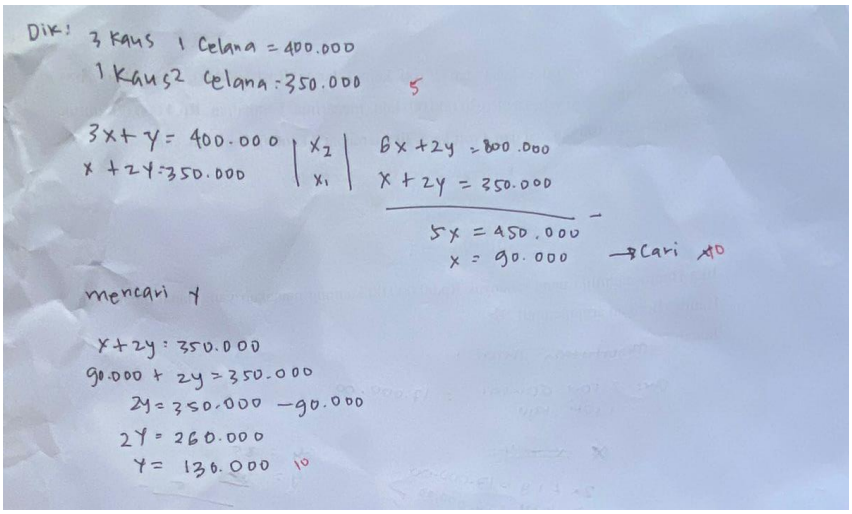

Fig. 7 - High category student answers

In Figure 7, the student has not been able to reach the assessment criteria because he cannot determine the argument's confidence regarding the solution to the problem. The student did not write down the solution to the problem until the end; he only wrote the example, made a mathematical model, and determined the values of the variables x and y. The student did not conclude the solutions that had been made. (Daniarti et al.

2015) Stated that students in the high category could conclude accurately, but some still made mistakes in concluding.

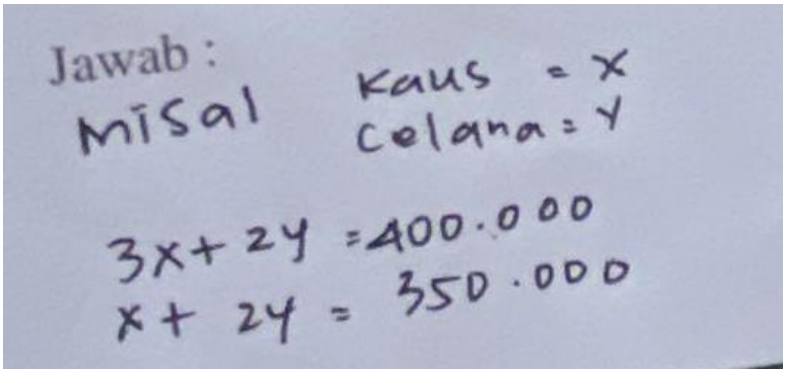

Fig. 8 - Medium category student answers

In Figure 8, the student cannot reach the assessment criteria because he cannot determine the confidence of his argument regarding the solution to the problem. The student only wrote down his mathematical examples and models but did not continue with the solution until the end. This is in line with Suliani and Ahmad's opinion. (2021) Who stated that currently, many students face difficulties when solving mathematics problems because they consider it a complex subject.

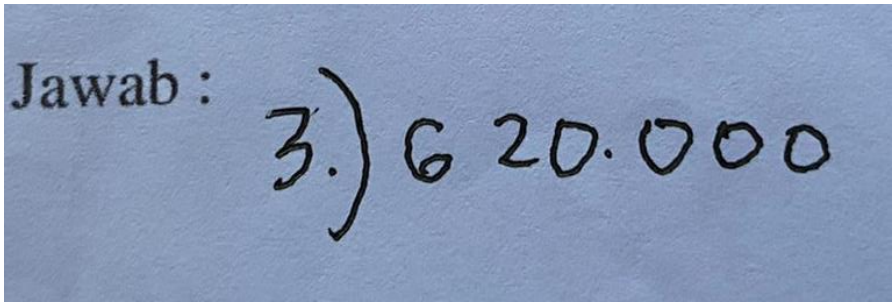

Fig. 6 – Low category student answers

In Figure 9, the student was unable to reach the assessment criteria on this question because he could not determine the argument's confidence regarding the solution to the question. The student did not write down the steps to solve the problem correctly but just wrote down the results. Wahyuni, Roza, and Maimunah (2019) It was revealed that students in the low category could not complete some questions.

Based on the student's answers above, it can be concluded that students in the high category have good critical thinking skills in a mathematical context. They can explain problem situations, present arguments, and evaluate the credibility of arguments to solve SPLDV problems. Students in the medium category cannot still achieve several indicators of mathematical critical thinking abilities. Even though they could explain the problem situation and develop arguments, they still made mistakes in assessing the credibility of SPLDV's problem-solution arguments. Students in the low category fail to achieve essential indicators of mathematical reasoning ability. They cannot explain the problem situation, put forward arguments, and evaluate the credibility of arguments to resolve SPLDV problems.

Based on this analysis, it can be seen that students' ability to think critically in mathematics as a whole in SPLDV material still needs to be improved. Because some students fail to meet the critical mathematical thinking indicators, it is best to examine these students to determine where they went wrong. This research shows that this group of students needs to develop critical mathematical thinking skills intensively. However, the author did not conduct interviews in this study to ascertain why students failed to meet the critical mathematical thinking indicators. This is due to time constraints.

5. Conclusion

From the research and discussion above, some students have high mathematical critical thinking abilities with a percentage of 9.68%; there are students with moderate mathematical essential abilities to think with a rate of 70.96% and students with low mathematical critical thinking abilities. With a percentage of 19.36%. Therefore, it is concluded that the mathematically essential thinking abilities of class VIII-5 students at SMP N 1 Tualang are at a medium level in dealing with problems related to SPLDV. For further research, it is recommended to add an interview method to strengthen the research results and to use more diverse mathematical critical thinking indicators to provide more comprehensive and relevant results in improving students' mathematical critical thinking abilities.

References

Angraini, Lilis Marina and Arcat, Arcat and Sohibun, Sohibun (2022) Improvement of Computational Thinking through Interactive Multimedia Learning Based on Initial Mathematical Ability. International Journal of Contemporary Studies in Education (IJ-CSE), 1 (1). pp. 45-54. ISSN 2963-5993

Angraini, L. M., Kania, N., & Gürbüz, F. (2024). Students' Proficiency in Computational Thinking Through Constructivist Learning Theory. International Journal of Mathematics and Mathematics Education, 2(1), 45–59. https://doi.org/10.56855/ijmme.v2i1.963

Angelina, Mardotillah, and Kiki Nia Sania Effendi. 2021. "Analisis Kemampuan Koneksi Matematis Siswa Smp Kelas IX." *Jurnal Pembelajaran Matematika Inovatif* 4(2):383–94. doi: 10.22460/jpmi.v4i2.383-394.

Apriliani, Surroni. 2020. "Analisis Kemampuan Berpikir Kritis Matematis Siswa Kelas X Di Ma. Nurul Jannah Nw Ampenan." 1(69):5–24.

Aprilianti Dwi Fani, Ayu, and Kiki Nia Sania Effendi. 2021. "Kemampuan Koneksi Matematis Siswa Ditinjau Dari Kecemasan Belajar Pada Siswa Smp Pada Materi Lingkaran." *Jurnal Pembelajaran Matematika Inovatif* 4(1):137–48. doi: 10.22460/jpmi.v4i1.137-148.

Daniarti, Eva;, Sugiatno;, and Asep Nursangaji. 2015. "Kemampuan Penalaran Matematis Ditinjau Dari Analogi Siswa Dalam Materi Aljabar Di SMP." *Jurnal Pendidikan Dan Pembelajaran Khatulistiwa* 4(4):1–14.

Early, Oppie Andara. 2017. "Analisis Kemampuan Berpikir Kritis Matematis Ditinjau Dari Kemandirian Siswa Kelas Viii Melalui Pembelajaran Model Pbl Pendekatan Saintifik Berbantuan Fun Pict Skripsi." *Doctoral Dissertation, Universitas Negeri Semarang*.

Effendi, Kiki Nia, and Ehda Farlina. 2017. "Kemampuan Berpikir Kreatif Siswa SMP Kelas VII Dalam Penyelesaian Masalah Statistika." *Jurnal Analisa* 3(2):130–37. doi: 10.15575/ja.v3i2.2013.

Fazzilah, Evi, Kiki Nia Sania Effendi, and Rina Marlina. 2020. "Analisis Kesalahan Siswa Dalam Menyelesaikan Soal Pisa Konten Uncertainty Dan Data." *Jurnal Cendekia : Jurnal Pendidikan Matematika* 4(2):1034–43. doi: 10.31004/cendekia.v4i2.306.

Feriyanto. 2019. "Analisis Kemampuan Representasi Matematis Mahasiswa Dalam Menyelesaikan Soal Program Linear Ditinjau Dari Perbedaan Gender." *Prosiding SNP2M (Seminar Nasional Penelitian Dan Pengabdian Masyarakat) UNIM*.

Hapsari, Sri. 2016. "A Descriptive Study of the Critical Thinking Skills of Social Science at Junior High School." *Journal of Education and Learning (EduLearn)* 10(3):228–34. doi: 10.11591/learn.v10i3.3791.

Hasanah, Euis Nurul, and Indrie Noor Aini. 2021. "Analisis Kemampuan Berpikir Kritis Siswa Dalam Menyelesaikan Soal Pada Materi Persamaan Linear Satu Variabel." *MAJU: Jurnal Ilmiah Pendidikan …* 8(1):313–17.

Hidayat, Fauziah, Padillah Akbar, and Martin Bernard. 2019. "Analisis Kemampuan Berfikir Kritis Matematik Serta Kemandiriaan Belajar Siswa SMP Terhadap Materi SPLDV." *Journal on Education* 1(2):515–23.

Kania, N., Fitriani, C., & Bonyah, E. (2023). Analysis of Students' Critical Thinking Skills Based on Prior Knowledge Mathematics. International Journal of Contemporary Studies in Education (IJ-CSE), 2(1). https://doi.org/10.56855/ijcse.v2i1.248

Kania, N., Suryadi, D., Kusumah, Y. S., Dahlan, J. A., Nurlaelah, E., & Elsayed, E. E. (2024). Comparative Praxeology: Assessing High-Level Cognitive Skills in TIMSS and Indonesian National Examinations . International Journal of Applied Learning and Research in Algebra, 1(1), 25–47. https://doi.org/10.56855/algebra.v1i1.1160

Mutia, K. N. S. Effendi, and Sutirna. 2021. "PISA-LIKE: Uncertainty and Data Content in Statistics Subject with Futsal Context." *Journal of Physics: Conference Series* 1778(1). doi: 10.1088/1742-6596/1778/1/012028.

Noviyanti, D., Selafia, S., & Angraini, L. M. (2024). Analysis of Junior High School Students' Mathematical Creative Thinking Abilities on Plane Shapes Subject. International Journal of Geometry Research and Inventions in Education (Gradient), 1(01), 48–57. https://doi.org/10.56855/gradient.v1i01.1155

Rahyubi, H. (2022). The Influence of Self Development and Individual Competence on the Performance of Private Higher Education Managers : (By Intervening Organizational Climate and Controlled Behavioral Tendencies). International Journal of Contemporary Studies in Education (IJ-CSE), 1(1), 64–71. https://doi.org/10.56855/ijcse.v1i1.51

Razak, Firdha. 2017. "Hubungan Kemampuan Awal Terhadap Kemampuan Berpikir Kritis Matematika Pada Siswa Kelas VII SMP Pesantren Immim Putri Minasatene Relationship of Initial Capacity Critical Thinking Ability in Mathematics Class Vii Smp Boarding Immim Putri Minasatene." *Jurnal "Musharafa"* 6(1):2086–4280.

Risah, Yayu, Sutirna, and Dori Lukman Hakim. 2021. "Pencapaian Kemampuan Berpikir Kritis Matematis Siswa Pada Materi Trigonometri." *JPMI (Jurnal Pembelajaran Matematika Inovatif)* 4(2):308. doi: 10.22460/jpmi.v4i2.307-316.

Suliani, Mega, and Abdan Matin Ahmad. 2021. "Faktor Yang Mempengaruhi Hasil Pembelajaran Jarak Jauh Di MTs Negeri 6 HSS Di Masa Pandemik Covid-19." *SJME (Supremum Journal of Mathematics Education)* 5(2):179–88. doi: 10.35706/sjme.v5i2.5155.

Suningsih, Ari, and Ana Istiani. 2021. "Analisis Kemampuan Representasi Matematis Siswa." *Mosharafa: Jurnal Pendidikan Matematika* 10(2):225–34. doi: 10.31980/mosharafa.v10i2.984.

Syifa, Nadia Raudhi. 2019. *Pengaruh Strategi I-Think Terhadap Kemampuan Berpikir Kritis Matematis Siswa*.

Wahyuni, Zulfa, Yenita Roza, and Maimunah Maimunah. 2019. "Analisis Kemampuan Penalaran Matematika Siswa Kelas X Pada Materi Dimensi Tiga." *Jurnal Ilmiah Pendidikan Matematika Al Qalasadi* 3(1):81–92. doi: 10.32505/qalasadi.v3i1.920.

Yolanda, Fitriana, and Putri Wahyuni. 2020. "Pengembangan Bahan Ajar Berbantuan Macromedia Flash." *SJME (Supremum Journal of Mathematics Education)* 4(2):170–77. doi: 10.35706/sjme.v4i2.3612.