

Critical Thinking Ability of Students on Probability Material in Class XII SMA Negeri 1 Ambon

Hidayah^(1,*), Lucyana Mirel Sapulete⁽²⁾, Fransina Ohoiwutun⁽³⁾, Anderson Palinussa⁽⁴⁾

^{1,2,3} Pre-service Teacher Professional Education, Pattimura University, Ambon, Indonesia

⁴ Mathematics Education, Faculty of Teacher Training and Education, Pattimura University, Ambon, Indonesia

Accepted: June 11, 2025

Abstract

This study aims to describe the critical thinking skills of students on the opportunity material in class XII SMA Negeri 1 Ambon. The type of research used is descriptive qualitative research—the research subjects, namely students of class XII-F10 SMA Negeri 1 Ambon, are a total of three people. The subjects in this study were selected through *purposive sampling* based on the categorisation of the test results of students' critical thinking skills, supported by the results of observations from researchers while teaching in class XII-F10 and opinions from subject teachers. The object of this research is the critical thinking ability of students measured through research instruments in the form of test questions and interviews, data analysis with data reduction, data presentation, and conclusion. The results showed that subject DF, with high critical thinking ability, showed good performance in analysing, evaluating, and drawing logical conclusions, although there were deficiencies in the interpretation indicator. HPH subject, with moderate critical thinking ability, was good in analysis and evaluation indicators but still needed improvement in interpretation and inference. Meanwhile, the JCP subject, who has low critical thinking ability, had difficulty interpreting the problem and applying the solution completely, and did not draw clear conclusions from the inference indicator. The results of this study also indicate the need to develop critical thinking skills on the inference indicator.

Keywords:

Critical Thinking Ability

Probability Material

Corresponding Author:

Name: Hidayah

Email: hhidayah145@gmail.com

INTRODUCTION

Learning that is expected in the 21st century is innovative, creative, collaborative, and learner-centred learning (Sugiyanti et al., 2018). 21st-century education faces complex demands, especially in developing relevant skills to prepare future generations. According to Siti Malikah and Wafroturrohman (2022), 21st-century education must prioritise critical, creative, and collaborative thinking skills and utilise information technology effectively to improve the quality of learning and human resource development in Indonesia. However, in reality, in the learning process at school, students are often asked to list, explain, define, and describe rather than interpret, analyse, evaluate, and draw conclusions.

According to Kurniawati and Ekayanti (2020), critical thinking, as one of the skills in the 21st century, can be trained through the mathematics learning process by inviting students to analyse, evaluate, and conclude relevant information in a mathematical context. Research from Oktaviani et al. (2020) shows that critical thinking skills not only help students in solving math problems but also improve their ability to argue and formulate appropriate solutions. Thus, mathematics activities it is expected to make an important contribution to students in developing reasoning, thinking logically,

systematically, critically, and carefully, and being objective and open in facing various problems (Damayanti & Afriansyah, 2018).

Critical thinking skills can help students think rationally in overcoming the problems faced and finding alternative solutions to these problems (Syafuruddin & Pujiastuti, 2020). Critical thinking makes students more sensitive to the situation so that they can sort out the information they receive. Critical thinking can be called the skill of thinking reflectively in order to determine decisions/actions, where the ability to think critically is certainly different from one student to another (Khoirunnisa & Malasari, 2021).

Probability material, which is related to measuring uncertainty and decision-making, provides opportunities for students to develop critical thinking skills that can be applied in everyday life (Hidayati, 2020). In the context of learning opportunities, students are expected to understand the basic concepts of probability, identify all possible outcomes of an event, and calculate the chances of each outcome occurring logically and systematically (Kurniawati et al., 2020).

Critical thinking helps learners not only to memorise formulas but also to understand and apply probability concepts in real situations so that they can make more accurate predictions and solve problems more effectively (Rahmaini et al., 2024). The development of critical thinking skills in learning probability is necessary to prepare learners for real-world challenges that often involve analysing data and making decisions based on probability.

Fithriyah et al. (2016) suggested critical thinking indicators from Facione, among others. *Interpretation* is the ability to understand and express the intent or meaning of a problem. *Analysis* is the ability to categorise and make conclusions about the relationship between statements, questions, concepts, descriptions, or other forms. *Evaluation* is the ability to assess the credibility of statements or representations and to logically assess the relationship between statements, questions, descriptions, or concepts. *Inference* is the ability to identify and obtain the elements needed to conclude. *Explanation* is the ability to determine and provide logical reasons based on the results obtained. *Self-regulation*, which is the ability to monitor one's cognitive activity, is the element used in problem-solving activities.

This article will describe the critical thinking skills of students of class XII.F10 SMA Negeri 1 Ambon on opportunity material; the analysis is carried out with reference to the indicators of critical thinking skills according to Facione, namely Interpretation, Analysis, Evaluation, and Inference. The other two indicators, namely explanation and self-regulation, it is not written again because, according to Jarmita & Hazami (2013), the skills of explanation and self-regulation both explain what they think and how they come to the conclusions that have been obtained at the time of inference.

METHOD

The type of research used is descriptive qualitative research. Moleong (2014) reveals that "Qualitative research is research that intends to understand phenomena about what is experienced by research subjects, for example, behaviour, perceptions, motivations, actions, etc. holistically and language, in a special natural context and by utilising various natural methods" (Moleong, 2014). Holistically and linguistically, in a special natural context and by utilising various natural methods" (Moleong, 2014). This study describes the critical thinking ability of students on the opportunity material in class XII SMA Negeri 1 Ambon. The subjects in this study were selected through *purposive sampling* with categorisation criteria from the students' test results, which included the answer sheets for students with high, medium, and low abilities. In addition, the subjects analysed were also in accordance with the consideration of teachers at school and the results of observations from researchers while teaching in the class. The object of this research is the critical thinking ability of students. The research instruments were test questions and interview guidelines. Data analysis techniques in this study used data analysis techniques proposed by Miles and Huberman (Sugiyono, 2015), namely data

reduction, *data display*, and *conclusion*. The results of students' answers refer to the criteria for scoring guidelines for critical thinking skills modified from Facione (1994), which can be seen in Table 1.

Table 1. Critical Thinking Ability Scoring Guidelines

Indicator	Description	Score
Interpretation	Did not write what was known and what was asked.	0
	Writes what is known and what is asked incorrectly.	1
	Write only what is known correctly or only what is asked correctly.	2
	Write what is known and what is asked for regarding the problem correctly, but incompletely.	3
Analysis	It does not provide further explanation of the issues to be resolved	0
	It provides further explanation of the issues to be resolved, but is incomplete and imprecise.	1
	It provides further explanation of the main issues to be resolved, but is incomplete and inaccurate.	2
	Provides further explanation of the issues to be resolved appropriately, but incompletely.	3
	Provides further explanation of the main issues that must be resolved completely and precisely.	4
Evaluation	Did not use a strategy to solve the problem.	0
	Using inappropriate and incomplete strategies in solving the problem.	1
	Using the right strategy in solving the problem, but incomplete, or using an inappropriate but complete strategy in solving the problem.	2
	I used the right strategy to solve the problem and completed it, but I made mistakes in my calculations and explanations.	3
	Use the right strategy to solve complete problems and correct calculations or explanations.	4
Inference	It does not draw a conclusion	0
	Makes inappropriate conclusions and does not fit the context of the problem	1
	Makes inappropriate conclusions, even though they are adapted to the context of the problem	2
	Makes appropriate conclusions, appropriate to the context, but incomplete	3
	Makes conclusions appropriately, in accordance with the context of the problem, and completes	4

Facione (Normaya, 2015: 93)

To determine whether students fulfil each indicator of critical thinking ability or not in solving opportunity problems can be seen from the following percentage value.

$$\text{Percentage Value} = \frac{\text{Skor perolehan}}{\text{Skor maksimal}} \times 100\%$$

The percentage value of critical thinking skills obtained from the calculation is then categorised according to Table 2.

Table 2. Category of Critical Thinking Skills Percentage

Value Interval (%0	Category
$81.25 < X \leq 100$	Very High
$71.50 < X \leq 81,25$	High
$62.50 < X \leq 71,50$	Medium
$43.75 < X \leq 62,50$	Low
$0 < X \leq 43,75$	Very Low

(Normaya, 2015: 96)

RESULTS & DISCUSSION

In the learning process that has been carried out, the researcher's observations and test results were given to 33 students in class XII-F10 SMA Negeri 1 Ambon; it is known that some students are able to answer opportunity questions with correct results. However, if the results of students' answers are classified by looking at and using indicators of critical thinking skills, according to Facione, some students have not fulfilled them optimally. Although students were able to answer correctly, they still did not fully fulfill the indicators of critical thinking skills, namely interpretation, analysis, evaluation, and inference.

The critical thinking ability of students is based on Facione's indicators, namely the results of answers to probability questions that students do individually and are directly supervised by researchers and mathematics teachers of SMA Negeri 1 Ambon. The level of critical thinking ability of students in working on probability problems can be seen in Table 3.

Table 3. Level of Critical Thinking Ability of Learners

Value Interval (%)	Many Learners	Percentage	Category
81,25 – 100	0	0%	Very High
71,50 – 81,25	1	3,03%	High
62,50 – 71,50	2	6,06%	Medium
43,75 – 62,50	4	12,12%	Low
0 – 43,75	26	78,78%	Very Low
Total	33	100%	

Based on Table 3, the level of critical thinking skills of students is very diverse; the results above show that there are no students who meet the very high category, and one student meets the high category, or 3.03%. Then two students meet the medium category, or 6.06%; four students meet the low category, or 12.12%; and 26 students are in the very low category, or 78.78%. Meanwhile, the percentage of each indicator of critical thinking skills from the two questions that have been given can be seen in Table 4.

Table 4. Percentage of Each Critical Thinking Ability Indicator

Critical Thinking Ability Indicator	Percentage (%)
Interpretation	26,10%
Analysis	37,13%
Evaluation	43,01%
Inference	1,47%

Based on Table 4, it can be seen that the evaluation indicator is more dominantly mastered by students in solving critical thinking skills test questions that have been given by researchers, with a

percentage of 43.01%, which reflects the ability of students to be able to analyse and assess information critically. While the inference indicator is the lowest indicator mastered by students in completing the test questions given with a percentage of 1.47%, it is the lowest critical thinking ability indicator achieved by students; this indicates that students still have difficulty in concluding the information available, thus indicating the need for improved learning strategies that focus more on developing their inferential abilities.

Furthermore, three subjects were analysed who were selected and who met each category, namely one subject in each of the high, medium, and low categories. In contrast, for the very low category, the average student did not answer the question and left the answer sheet blank, so the researcher did not analyse it further. The results of the following analysis are only on one probability question that is considered difficult by researchers.

Analysis of Test Results of High-Category Subjects (DF)

2. $S = \{1, 2, 3, 4, 5, 6\}$
 $S = \{(1,1), (1,2), (1,3), (1,4), (1,5), (1,6), \dots, (6,6)\}$
 $n(S) = 6 \times 6$
 $= 36$
 Pasangan jumlah ganjil
 $P(D) = ?$
 $D = \{(1,2), (1,4), (1,6), (2,1), (2,3), (2,5), (3,2), (3,4), (3,6), (4,1), (4,3), (4,5), (5,2), (5,4), (5,6), (6,1), (6,3), (6,5)\}$
 $n(D) = 18$
 $P(D) = \frac{n(D)}{n(S)} = \frac{18}{36} = \frac{1}{2}$
 Jadi peluang munculnya mata dadu yg berjumlah ganjil adalah $\frac{1}{2}$.

Figure 1. Test Results of Subject DF

- P : What information do you know?
 DF : It is known that one die is rolled twice.
 P : What do you understand from this information?
 DF : This means that there are dice thrown twice, so the sample space must be 36 because one throw of the dice has a sample space of 6. After all, it is rolled twice, 6 times 6.
 P : What are you looking for from this question, and what information did you find?
 DF : This problem asks for pairs of odd numbers of dice.
 P : How did you model the problem into a mathematical model? What did you do to answer this problem?
 DF : First, I know that the sample space of one dice is 6, so I noted it first, namely $S = \{1, 2, 3, 4, 5, 6\}$. After that, because the sample space of one dice that is rolled twice is 36, I have to find all odd pairs of dice. You can see I wrote it like this.
 $S = \{(1,1), (1,2), (1,3), \dots, (6,6)\}$
 P : What strategy did you use to solve the problem?
 DF : I denote D as the occurrence of an odd number of dice and write down the sample space, i.e. :
 Solution:
 $D = \{(1,2), (1,4), (1,6), \dots, (6,5)\}$
 After that, count the number of members of the sample space D
 $n(D) = 18$
 In the next step, I use the formula for probability, which is

- $$P(D) = \frac{n(D)}{n(S)}$$
- $$P(D) = \frac{18}{36} = \frac{1}{2}$$
- I simplified $\frac{18}{36} = \frac{1}{2}$
- P : What can you conclude from the answer using your strategy?
- DF : The first thing I did was to determine the sample space of the dice that were rolled twice. Then, calculate the number of members of the sample space by sorting them into a set of consecutive pairs. The simpler way is that I use 6x6 multiplication so that the number of sample spaces is 36. After that, determine the probability of an even number of dice using the probability formula. The probability formula is $P(D) = \frac{n(D)}{n(S)}$; I substituted the value in the formula so that the final answer is $\frac{1}{2}$
- P : What can you conclude from this answer?
- DF : The probability of an odd number of pairs of dice enumerator, one end numerator over 2, meaning that there will be as many as 18 odd-numbered pairs from rolling one die.

Based on the test and interview results from subject DF, the interpretation indicator is fulfilled by writing what is known but incomplete, and writing what is asked about the problem. However, the subject DF is able to answer the problem correctly, and the subject understands the meaning of the problem and can plan good problem-solving. DF was able to understand and explain the steps in determining the sample space. In the analysis indicator, subject DF was able to write the chance formula model correctly, and subject DF was able to compile the chance formula correctly, which shows that he understood how to calculate the probability of an event occurring. This is an important basic skill in probability.

In the evaluation indicator, subject DF showed good ability by writing down the solution method and performing calculations correctly. Subject DF used the correct strategy to work on the problem, which reflected a deep understanding of the material tested. The use of the right strategy in solving the problem shows that DF has developed critical and analytical thinking skills. Meanwhile, in the inference indicator, the subject DF can write the conclusion correctly. This ability reflects DF's understanding of the data analysed and the ability to draw logical conclusions from the information provided. The ability to conclude is one of the important aspects of critical thinking. According to Ennis (2018), critical thinking involves the ability to analyse information, evaluate arguments, and draw logical conclusions. DF demonstrated these skills well, which are very important in learning mathematics and other sciences.

Analysis of Test Results of Moderate Category Subjects (HPH)

1 dadu = 6 sisi

2 Kali dilambungkan = $6 \times 6 = 36$ kemungkinan

mata dadu ganjil $\{1, 3, 5\}$

mata dadu genap $\{2, 4, 6\}$

kemungkinan 1 lemparan ganjil + genap $= 3 \times 3 = 9$

kemungkinan 2 lemparan genap ganjil $= 3 \times 3 = 9$

Jumlah ganjil $= 9 + 9 = 18$

Peluang $\frac{n(A)}{n(S)} = \frac{18}{36} = \frac{1}{2}$

Figure 2. Test Results of HPH Subject

- P : After reading the problem, what information do you know?
 HPH : It is known that one die is rolled twice...
 P : What is being asked in the question?
 HPH : What is the probability that a dice roll will result in a ganji?
 P : Okay, so how do you model the problem into a mathematical model?
 HPH : Write down 1 die = 6 sides; if rolled 2 times, then $6 \times 6 = 36$
 P : What strategy did you use to solve the problem?
 HPH : I first counted the number of starry dice and even dice, i.e.:
 Odd die = {1,3,5}
 Even number of dice = {2,4,6}
 Oh, the number of odd and even dice eyes is three each.
 In the next step, I calculated the probability of 2 throws. After that, determine the value of the odds using the odds formula.
 P : Can you solve the problem using a strategy that you are good at?
 HPH : He is the first (while looking for the answer on the paper)
 Completion:
 Possible role = number of odd dice x number of even dice
 Possible 1st throw = $3 \times 3 = 9$
 Possible 2nd throw = $3 \times 3 = 9$
 Number of possible two throws = 18
 $P(A) = \frac{n(A)}{n(S)}$
 $P(A) = \frac{18}{36} = \frac{1}{2}$
 P : What can you conclude from this answer?
 HPH : So the conclusion is that the probability of an odd-edged die is $\frac{1}{2}$.
 P : What do you think the answer to half means? Try to relate it to the question.
 HPH : Eeee, that is the answer.

Based on the test and interview results from the HPH subject, it can be seen that in the interpretation indicator, the subject did not write or show what parts were known and what was asked in the problem. However, the HPH subject was able to write down the steps in determining the sample space of the problem given. In the analysis indicator, the HPH subject was able to write and explain the chance formula model correctly; more than that, the subject was able to make groupings when working on problems for odd and even dice. Overall, HPH's ability to write the chance formula correctly reflects a strong analytical understanding and critical skills in analysing the meaning of the given problem.

In the evaluation indicator, the HPH subject showed good ability by writing down the solution method and doing the calculations correctly. HPH subject chose a different working strategy from the DF subject, but the strategy chosen was the right strategy, too. Although HPH chose a different strategy from subject DF, the choice was still appropriate and effective in the context of the problem. This shows that HPH has flexibility in thinking and is able to adjust approaches based on a personal understanding of the problem. In the inference indicator, the HPH subject did not draw or write the conclusion of the answer obtained from the test results. This shows a lack of ability to draw inferences from existing data. However, the subject has a basic understanding of the material presented. It is able to provide the correct answer. However, it is unable to provide conclusions to the answer, indicating a gap in understanding, and the subject does not fully understand the relationship between the answer and the underlying concept.

Analysis of Test Results of Low Category Subjects (JCP)

$S = \{1, 2, 3, 4, 5, 6\}$, $n(S) = 6$
 $A = \{1, 3, 5\}$, $n(A) = 3$
 $B = \{1, 2, 3, 4\}$, $n(B) = 4$
 $C = \{2, 3, 5\}$, $n(C) = 3$

$P(A) = \frac{n(A)}{n(S)}$
 $= \frac{3}{6} = \frac{1}{2}$

Perhatikan satu dadu dilempar dua kali

Figure 3. Test Results of JCP Subject

- P : After reading the problem, what information is known?
 JCP : Given the sample space of a die, $S = \{1, 2, 3, 4, 5, 6\}$
 P : What is being asked in the question?
 JCP : What is the probability that the dice will appear with a number of ganji?
 P : How can you model the problem into a mathematical model?
 JCP : The first one I
 $A = \{1, 3, 5\}$, $n(A) = 3$
 $B = \{1, 2, 3, 4\}$, $n(B) = 4$
 $C = \{2, 3, 5\}$, $n(C) = 3$
 P : What strategy did you use to solve the problem?
 JCP : I used the odds formula.
 P : Can you solve the problem using a strategy that you are good at?
 JCP : He is the first (while looking for the answer on the paper)
 Solution:
 $P(A) = \frac{n(A)}{n(S)}$
 $P(A) = \frac{3}{6} = \frac{1}{2}$
 P : What can you conclude from a half-answer? That is, what about the question asked?
 JCP : That is half the answer, sis. That is what I understand.
 P : Are you sure about the answer you have solved?
 JCP : I am still unsure of my answer, but I hope it is correct.

Based on the test and interview results from the JCP subject, it can be seen that in the interpretation indicator, the JCP subject wrote what was known incorrectly and did not write what was asked. This can indicate an error in understanding or interpreting the information provided by the problem. The subject has recorded the known things, but when trying to explain or answer the questions asked, there are errors or inaccuracies in explaining the relationship or context between the information. In the analysis indicator, it can be seen that the JCP subject has written a mathematical model in the form of an exact chance formula. This shows that the JCP subject has a good analytical understanding of the basic concepts used in the problem, especially related to the odds formula.

In the evaluation indicator, the JCP subject used the right strategy to solve the problem, but the results obtained were incomplete. This shows that although the subject has chosen the correct approach to solving the problem, the application is not done correctly. This incomplete solution reflects a gap in the evaluation process, either in terms of understanding the problem, applying the solution steps, or fully utilising the strategy. Meanwhile, in the inference indicator, the JCP subject did not conclude at the end of the solution and was unable to explain the answer obtained.

CONCLUSION

Based on the results and discussion, it can be concluded that the critical thinking skills of students in class XII SMA Negeri 1 Ambon, namely subjects with high critical thinking skills (DF), have shown good critical thinking skills in solving math problems, especially in probability material. DF was able to understand the problem well, plan the problem-solving steps, and answer the question correctly. Although there is a slight lack of complete information in the interpretation indicator, DF's ability to analyse, formulate formulas, and use appropriate strategies shows a deep understanding of the material. In addition, DF was also able to draw logical and appropriate conclusions, reflecting strong critical thinking skills. Overall, DF showed a good ability to analyse information, evaluate arguments, and draw in-depth conclusions, which are important aspects of learning mathematics and science. Subjects with moderate critical thinking ability (HPH) have shown good critical thinking skills, especially in analysing and evaluating problems. Despite shortcomings in the interpretation of information and the ability to conclude, HPH was able to solve the problem with the right strategy and effective grouping. This shows a strong understanding of the material, although there is still room to improve skills in making inferences and connecting answers with logical conclusions. Subjects with low critical thinking ability (JCP) have shown a good understanding of analysing the chance formula, but there are difficulties in interpreting the problem and applying complete solution steps. Although the strategy used was appropriate, the results obtained were still not comprehensive, and the subject did not draw clear conclusions from the answers given. This shows that the subject needs to improve skills in understanding information, applying solutions more completely, and drawing logical conclusions. Overall, the indicator of critical thinking ability that students achieve most dominantly is the evaluation indicator, while the inference indicator is the lowest critical thinking ability indicator achieved by students. This shows that learners are able to understand the meaning of the problem and are able to write strategies or steps to solve the problems given correctly. However, learners cannot draw logical and relevant conclusions from the results obtained. There needs to be an increased focus on inference skills so that students can more effectively draw relevant conclusions and connect information with the results obtained. This is important to improve overall critical thinking skills.

REFERENCES

- Creswell, J. W. (2014). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches (4th ed.)*. Thousand Oaks, CA: Sage Publications.
- Damayanti, R., & Afriansyah, E. A. (2018). Perbandingan kemampuan representasi matematis siswa antara contextual teaching and learning dan problem based learning. *JIPM (Jurnal Ilmiah Pendidikan Matematika)*, 7(1), 30-39.
- Ennis, R. H. (2018). *Critical Thinking*. New Jersey: Prentice Hall. Education (RME). *Jurnal Ilmiah Didaktika*, 13(2): 92 – 104.
- Fithriyah, I., Sa'dijah, C., & Sisworo, S. (2016). Analisis kemampuan berpikir kritis siswa kelas IX-D SMPN 17 Malang. *Prosiding Konferensi Nasional Penelitian Matematika dan Pembelajarannya*, 580-590.
- Facione, A.P. (1994). *Holistic Critical Thinking Scoring Rubric*. California Academia Press, San Francisco
- Hidayati, N. (2020). Pengembangan kemampuan berpikir kritis peserta didik melalui pembelajaran matematika. *Jurnal Pendidikan Matematika*, 4(1), 45-58.
- Iskandar, A. (2019). Analisis kesulitan peserta didik dalam memahami materi peluang di sekolah menengah atas. *Jurnal Penelitian Pendidikan*, 12(2), 123-135.
- Karim, A. (2015). Pengaruh gaya belajar dan sikap peserta didik pada pelajaran matematika terhadap kemampuan berpikir kritis matematika. *Formatif: Jurnal Ilmiah Pendidikan MIPA*, 4(3).

- Khoirunnisa, P. H., & Malasari, P. N. (2021). Analisis kemampuan berpikir kritis matematis siswa ditinjau dari self confidence. *JP3M (Jurnal Penelitian Pendidikan dan Pengajaran Matematika)*, 7(1), 49–56. <https://doi.org/10.37058/jp3m.v7i1.2804>.
- Kurniawati, N., & Ekayanti, D. (2020). Penerapan model pembelajaran kooperatif untuk meningkatkan kemampuan berpikir kritis peserta didik pada materi peluang. *Jurnal Pendidikan dan Pembelajaran*, 7(2), 89-98.
- Malikah, S., & Wafroturrohman, N. (2022). Pendidikan abad 21: Tantangan dan peluang. *Jurnal Pendidikan dan Teknologi*, 5(1), 1-10.
- Mardiyah, R. H., & lainnya. (2021). Pembelajaran matematika abad 21: Meningkatkan keterampilan berpikir kritis peserta didik. *Jurnal Pendidikan Matematika*, 6(1), 12-22.
- Moleong, L. J. (2014). *Metodologi Penelitian Kualitatif*. Bandung, Indonesia: PT Remaja Rosdakarya.
- Miles, M. B., & Huberman, A. M. (2014). *Qualitative Data Analysis: A Methods Sourcebook (3rd ed.)*. Thousand Oaks, CA: Sage Publications.
- Jarmita, N., & Hazami, H. (2013). Ketuntasan hasil belajar siswa melalui pendekatan realistic mathematics education (rme) pada materi perkalian. *Jurnal Ilmiah Didaktika: Media Ilmiah Pendidikan dan Pengajaran*, 13(2).
- Oktaviani, S., et al. (2023). Pengaruh pembelajaran berbasis masalah terhadap kemampuan berpikir kritis peserta didik. *Jurnal Ilmiah Pendidikan*, 10(2), 101-110.
- Rahmaini, R., et al. (2024). Menerapkan konsep peluang dalam kehidupan sehari-hari: analisis kemampuan berpikir kritis peserta didik. *Jurnal Matematika dan Pendidikan*, 8(1), 23-34.
- Sugiyono. (2015). *Metode Penelitian Kuantitatif Kualitatif dan R & D*. Bandung, Indonesia: Alfabeta.
- Sugiyanti, D., et al. (2018). Inovasi pembelajaran di era digital. *Jurnal Pendidikan dan Pembelajaran*, 4(2), 77-85.
- Syafruddin, I. S., & Pujiastuti, H. (2020). Analisis kemampuan berpikir kritis matematis: Studi kasus pada siswa MTs Negeri 4 Tangerang. *Suska Journal of Mathematics Education*, 6(2), 89–100