Jurnal Gantang *11*(1) (2026): 69 - 84

JURNAL GANTANG

e-ISSN: 2548-5547
p-ISSN: 2503-0671

http://ojs.umrah.ac.id/index.php/gantang/index

Differentiated instruction for mathematical problem-solving ability: A study on kinesthetic learners in probability

Amirah Nada Pertiwi, Ely Susanti*
*Corresponding Author: ely_susanti@fkip.unsri.ac.id

Universitas Sriwijaya, Palembang, South Sumatra, 30125, Indonesia

Submission: November 23rd 2025; Accepted: May 24th 2026; Published: May 31st 2026
DOI: https://doi.org/10.31629/jg.v11i1.7936

Abstract
Mathematical problem-solving ability is essential in mathematics learning. This study aims to describe the mathematical problem-solving ability of ninth-grade students in class IX.E at SMP Negeri 1 Indralaya on the topic of probability through the implementation of differentiated learning tailored to kinesthetic learning styles. This research is a descriptive study involving 20 students who tend to have a kinesthetic learning style, identified through a learning style questionnaire. The learning process was designed to include physical activities, hands-on experiments, and group work to match the characteristics of kinesthetic learners. Data were collected through a mathematical problem-solving test developed from problem-solving indicators, supplemented by observations and interviews. The results showed that students' mathematical problem-solving abilities learning were categorized as high (25%), medium (30%), and low (45%) where kinesthetic learners were categorized as low. Students experienced difficulties in several indicators of problem-solving, particularly in understanding problems, planning solution strategies, implementing problem-solving steps, and rechecking the results. Most errors occurred because students were not accustomed to identifying important information, connecting information to formulate solution plans, and evaluating the correctness of their answers. These findings indicate that kinesthetic learners still need more support and practice to develop systematic and reflective problem-solving skills in learning probability.

Keywords: problem-solving ability; differentiated instruction; kinesthetic learning style; probability

How to cite: Pertiwi, A. N. & Susanti, E. (2026). Differentiated instruction for mathematical problem-solving ability: a study on kinesthetic learners in probability. *Jurnal Gantang, 11*(1), 69 – 84. https://doi.org/10.31629/jg.v311i1.7936

I. Introduction

Mathematics is a universal science and plays an important role in education (Hanggara, Aisyah, & Amelia, 2022). Mathematics learning in schools is not only aimed at understanding the material but also at developing reasoning, communication, representation, and problem-solving skills (Meika, Ramadina, Sujana, & Mauladaniyati, 2021). According to the National Council of Teachers of Mathematics (NCTM), there are five mathematical competency standards for achieving the objectives of mathematics learning, namely problem solving, reasoning and proof, communication, connection, and representation. Mathematical problem-solving skills are one of the mathematical skills that exist and are important skills that must be mastered (Rahmawati, Lukman, & Setiani, 2021).

Problem solving is defined as an effort to find a way out of a difficulty (Arifin, Zulkardi,

Putri, & Hartono, 2021). Problem solving is a process or method for solving mathematical problems using known data and information, drawing on previously acquired mathematical concepts (Lusiana, Armiati, & Yerizon, 2022). According to Putri & Juandi (2022), mathematical problem-solving skills are the achievement of individuals or groups in solving mathematical problems using the discovery method through the stages of problem solving. Problem-solving skills encompass students' efforts to find the right solution, as well as readiness, creativity, knowledge, and the ability to apply them in everyday life (Latifah & Afriansyah, 2021). According to Polya, mathematical problem-solving consists of four stages: understanding the problem, devising a plan, carrying out the plan, and looking back (Izzatunnisa & Rafianti, 2023).

Mathematical problem-solving skills are essential in mathematics education because they enable students to apply mathematical knowledge and problem-solving strategies to real-world problems (Sugiharti, Rahmawati, & Anwar, 2026; Syaputra, Mulyono, & Hasratuddin, 2022). Problem-solving is the first step for students in developing ideas, building new knowledge, and developing mathematical skills (Yunaeti, Arhasy, & Ratnaningsih, 2021). Students are considered able to solve mathematical problems if they can understand the problem, choose the right strategy, and apply it to problem solving (Sriwahyuni & Maryati, 2022).

However, many students still find it difficult to solve mathematical problems during the learning process (Cahyadi, Suryani, & Dewi, 2021; Rismen, Juwita, & Devinda, 2020). Students' difficulties in problem-solving stem from weaknesses in analyzing problems and reviewing previously discussed questions (Sagita, Ermawati, & Riswari, 2023), including difficulties in understanding the problems and solving the given questions (Bruno, Qohar, Susanto, & Permadi, 2021).

Students' low problem-solving ability is caused by their lack of understanding of the problem and how to approach its solution (Rahma, Tanjung, & Siregar, 2024). This is in line with research conducted by Sriwahyuni & Maryati (2022), which states that students' mathematical problem-solving abilities are still low, especially in terms of selecting and applying strategies to solve mathematical or non-mathematical problems; explaining or interpreting results according to the original problem and checking the correctness of the results or answers; and applying mathematics meaningfully.

Research conducted by Rahmadania, Novianti, Michael, Meldi, & Yani (2024) shows that students still frequently make mistakes—ranging from what they know, what is asked, the given elements, problem-solving strategies, and the steps they take—all the way to concluding—due to a lack of attention to detail and insufficient understanding of probability concepts. Students' learning outcomes and mastery of probability material are still low, as they are unable to determine the sample space and have difficulty determining the empirical probability of an experiment and solving problems related to the possibility/probability of an event (Maharani, Dasari, & Nurlaelah, 2022). Based on the results of the study (Sasiang, Tumalun, & Domu, 2024), the majority of students still experience difficulties in solving mathematical problems on probability material, as shown by 55% of students who have difficulty understanding the questions, 70% who have difficulty planning the solution, 60% who have difficulty solving the questions, and 75% who have difficulty checking their solutions.

Another factor contributing to the low level of students' mathematical ability is ineffective teaching methods used by teachers (Sutrisno, Muhtarom, & Subandijah, 2023). The key to student success in learning is the use of appropriate learning styles (Araiku, 2022). Teachers need to consider the individual differences between students because not all students are the same. Each person has their own learning style, which is influenced by their personality and the environment in which they

live. A person's learning style determines how they absorb information through their senses and indicates which senses are more developed during the learning process (Syahril, Maimunah, & Roza, 2022). In the process of successfully solving problems, a student also depends on factors related to themselves, such as their learning style, which influences how they obtain and absorb information (Amalia & Hadi, 2021).

Students with a kinesthetic learning style only meet one or two indicators; they can only understand the question and formulate the problem at hand. Thus, it can be concluded that students with a visual learning style and those with an auditory learning style have better mathematical problem-solving abilities than students with a kinesthetic learning style (Yani, Sofnidar, & Theis, 2024). Students with a visual learning style can understand problems and plan problem-solving strategies, but they are less capable of implementing those strategies and carefully reviewing the results (Abdullah, Satriani, & Emawati, 2022). Students with auditory learning styles are good at understanding problems and adequate at the planning and implementation stages, but very poor at reviewing (Nurhikmah, Hikmah, Wulandari, & Subarinah, 2025). Meanwhile, students with a kinesthetic learning style are very good at understanding problems and are adequate at the implementation stage, but very poor at the planning and review stages (Halilianti, Sripatmi, Azmi, & Sridana, 2022).

One way for students to solve mathematical problems well is for educators to give students the freedom to explore their own learning styles (Rahmatika, Krairiani, & Akmal, 2022). Each child's learning style cannot be generalized, so in the learning process, teachers need to take varied actions using differentiated learning strategies (Himmah & Nugraheni, 2023).

To overcome this problem, a learning strategy is needed that can improve students' mathematical problem-solving skills. One approach that can be applied is learning differentiated based on learning styles. Differentiated learning is a way for teachers to meet the needs of each student because differentiated learning is a teaching and learning process in which students can learn subject matter according to their abilities, preferences, and needs so that they do not become frustrated and feel that they have failed in their learning experience (Purba, Purnamasari, Soetantyo, Suwarma, & Susanti, 2021). Based on the results and discussion in the study conducted by Sutrisno et al. 2023), there was an increase in the average test results of students' mathematical problem-solving abilities for each cycle, so it can be concluded that the application of differentiated learning can improve students' mathematical problem-solving abilities.

The application of differentiated learning has been proven to significantly improve students' abilities. This shows that adaptive learning strategies that account for individual differences in the classroom can yield better results than conventional approaches that are uniform for all students (Khoiriyah, Yustitia, & Supratiwi, 2024). According to research by Putri (2024), differentiated learning helps students learn more comfortably and enjoyably, and yields better results.

However, most previous studies have addressed differentiated instruction in general without focusing on any specific learning style, particularly the kinaesthetic learning style. Furthermore, research on problem-solving skills in probability generally focuses on students' difficulties; few studies have examined the relationship between these skills and the implementation of learning style-based differentiated instruction. Based on the above description, the researcher was interested in conducting research to describe the mathematical problem-solving abilities of students in class IX.E of SMP Negeri 1 Indralaya on the subject of probability through the application of differentiated learning tailored to the kinesthetic learning style.

JURNAL GANTANG. May 2026; *11*(1): 69 - 84
p-ISSN. 2503-0671
e-ISSN. 2548-5547

II. Research Method

This study uses a descriptive research method to describe students' mathematical problem-solving abilities through differentiated learning on probability in junior high school. A descriptive study is one designed to describe the distribution of one or more variables, without regard to any causal or other hypotheses (Aggarwal & Ranganathan, 2019).

The subjects of this study were 20 ninth-grade students at SMP Negeri 1 Indralaya in the odd semester of the 2025/2026 academic year who, based on the results of a learning style questionnaire, tended toward a kinesthetic learning style. Initially, all 34 students in Class IX.E completed a learning style questionnaire (visual, auditory, and kinesthetic) administered through Google Forms. The questionnaire had been validated by experts prior to its use in the study.

Table 1. Results of the learning style questionnaire

Class	Learning Style		
	Visual	Auditory	Kinesthetic
IX E	8	4	20

Based on these results, the 20 students with a kinesthetic learning style were selected as the research subjects.

This selection was made because the study focuses on implementing differentiated learning designed specifically for kinesthetic learners to investigate their mathematical problem-solving abilities. The main focus of this study was students' mathematical problem-solving abilities in probability through differentiated learning for kinaesthetic learners.

Data were collected through questionnaires, tests, and interviews. The instruments used had previously been validated by experts, namely mathematics teachers and mathematics education lecturers. Questionnaires were given to students to identify their learning styles. Tests were used to measure problem-solving abilities using two essay questions on probability. Initially, the researchers developed five test questions. However, following an expert validation process, it was recommended that two of the questions be deemed most appropriate for measuring students' mathematical problem-solving skills. These two questions were considered representative of problem-solving indicators and were selected to account for the time required to complete them, thereby making the test more effective for students.

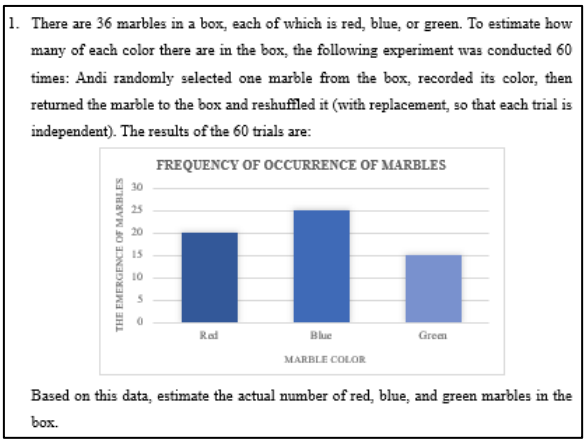


Figure 1. Test question number 1

In question 1, information is provided about red, blue, and green marbles in a box, and students are asked to estimate the actual numbers of red, blue, and green marbles. The process of solving this problem uses four indicators of mathematical problem-solving skills. The test questions were developed based on a test blueprint that refers to indicators of mathematical problem-solving skills. Students' mathematical problem-solving abilities in probability were evaluated using Polya's four problem-solving indicators: understanding the problem, devising a plan, carrying out the plan, and looking back. The following presents Question 2 from the test.

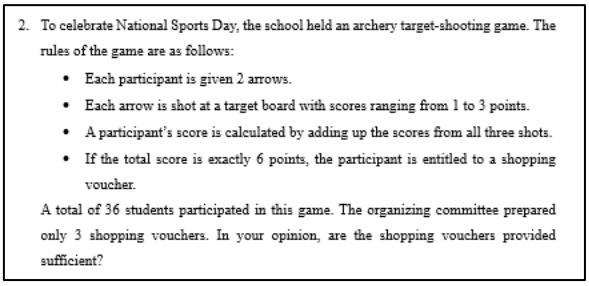


Figure 2. Test question number 2

In question number 2, information is provided about an archery game with several rules; students will then analyze whether the provided shopping vouchers are appropriate. The process of solving this problem uses four indicators of mathematical problem-solving skills.

The students' test scores will be analyzed based on assessment guidelines adapted from Asih, Mahayukti, & Ariawan (2025), and the test scores will then be calculated using the following formula:

$$Test\ Score = \frac{Score\ Obtained}{Maximum\ Score} \times 100$$

After obtaining the students' test scores, the researcher will categorize each student's score into three categories. The problem-solving ability categories adopted from the scoring guidelines of Mawardi et al. (2022) are presented in Table 2.

Table 2. Problem solving skills category

Value Range	Category
$80 < Value \leq 100$	High
$60 < Value \leq 80$	Medium
$Value \leq 60$	Low

Next, interviews were conducted to obtain more in-depth information about the results of the students' problem-solving ability tests. The research began with the distribution of learning style questionnaires, followed by written tests for students and interviews. Three subjects were selected for interviews, with each student representing a different ability category: high, moderate, and low. This selection was based on the results of a problem-solving ability test, in which the students were first grouped according to predetermined assessment criteria. Afterward, one student from each category was selected using purposive sampling.

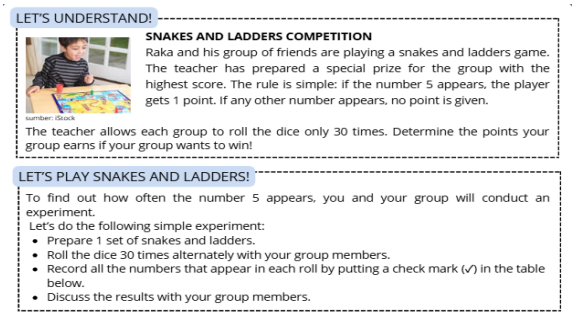
III. Results and Discussion

Results

The study was conducted over two sessions using differentiated learning for kinesthetic students. In the first meeting, the learning process discussed the material on the probability of an event and relative frequency. The activity began with an introduction that included greetings, a prayer, a check of student attendance, thought-provoking questions, and the learning objectives. Next, the researcher divided the students into five groups according to their kinesthetic learning styles, then distributed Worksheet 1 and experimental materials in the form of a set of Snakes and Ladders games to each group. The researcher guided the students in understanding the problems related to the Snakes and Ladders game in Worksheet 1.

In this activity, the researcher applied differentiated learning in terms of content by presenting material on probability and relative frequency through concrete activities, specifically a Snakes and Ladders game. The learning process uses instructional modules aligned with the learning outcomes and objectives for the probability unit, as well as differentiated instruction principles tailored to students' kinesthetic learning styles. Before use, the instructional modules were validated by experts-namely, university professors and high school mathematics teachers-to assess the appropriateness of the content and learning steps and their alignment with the desired learning indicators.

Through this activity, kinesthetic learners could understand probability not only theoretically but also through direct experience while playing and recording the results of dice rolls. This content presentation was tailored to the characteristics of kinesthetic learners, who find it easier to understand material through movement, physical activity, and direct practice.


LET'S UNDERSTAND!

SNAKES AND LADDERS COMPETITION

Raka and his group of friends are playing a snakes and ladders game. The teacher has prepared a special prize for the group with the highest score. The rule is simple: if the number 5 appears, the player gets 1 point. If any other number appears, no point is given.

sumber: iStock

The teacher allows each group to roll the dice only 30 times. Determine the points your group earns if your group wants to win!

LET'S PLAY SNAKES AND LADDERS!

To find out how often the number 5 appears, you and your group will conduct an experiment.

Let's do the following simple experiment:

- Prepare 1 set of snakes and ladders.
- Roll the dice 30 times alternately with your group members.
- Record all the numbers that appear in each roll by putting a check mark (✓) in the table below.
- Discuss the results with your group members.

Figure 3. Snakes and ladders game

JURNAL GANTANG. May 2026; *11*(1): 69 - 84
p-ISSN. 2503-0671
e-ISSN. 2548-5547

Next, students and their groups were asked to play Snakes and Ladders according to the steps outlined in the worksheet. The researcher guided the students to play the game in turns with their groupmates and instructed them to record the numbers that appeared each time they rolled the dice on the table provided in Worksheet 1.

This activity is an application of differentiated learning in the process aspect, where the researcher adjusted the learning strategy to the students' kinesthetic learning style through the game of Snakes and Ladders. Through this activity, students are expected to understand the concepts of probability and relative frequency in a fun and contextual way.

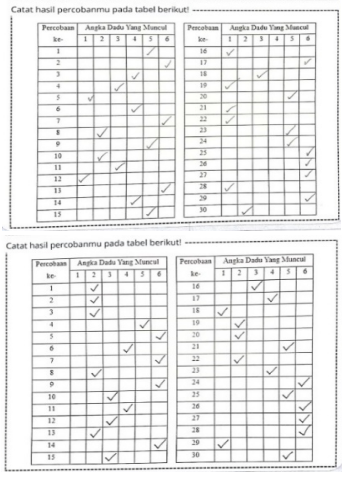


Figure 4. Record of the numbers that appear on the dice

Based on the Snakes and Ladders game, the two groups obtained different outcomes.

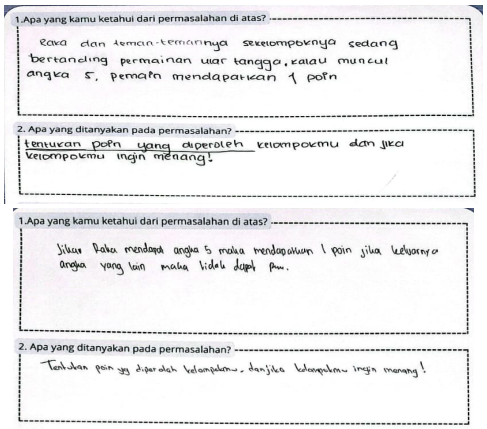


Figure 5. Group responses in understanding problems

Students are asked to identify the problem by writing down what they know and what the question asks. In the picture, students write that they know from the problem that Raka and her friends are playing Snakes and Ladders. If the number 5 appears, the group gets 1 point. This information shows that students can identify important facts from the question, namely the rules of the game, which form the basis for solving the problem. In the section on what is being asked, students write that they are asked to determine the points earned by the group and what happens if the group wants to win. From this answer, it can be seen that students understand the purpose of the problem: to find the number of points and relate it to the conditions for winning.

Meanwhile, students in the other group correctly stated the known information, namely that they would receive 1 point if the number 5 appeared and no points if it did not. As shown in Figure 1, the students were able to identify the main information in the question that was directly related to the probability of a specific number appearing. Regarding what was asked, the answers in the image show that the students grasped the essence of the question and understood that the problem was not just the rules of the game, but how points were calculated to achieve the winning condition.

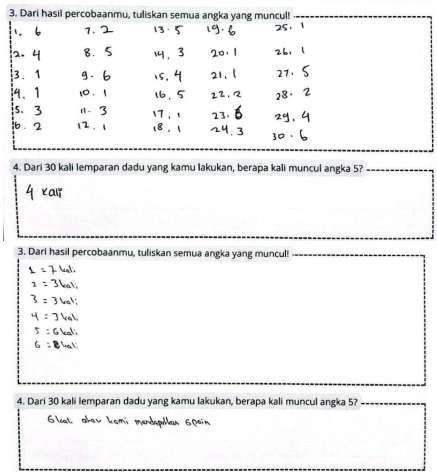


Figure 6. Write down the numbers that appear on the dice

Based on data from the Snakes and Ladders game, students calculated how often each

number appeared on the dice, especially 5, and then determined the relative frequency by comparing the number of times 5 appeared to the total number of trials. From the groups' answers, it is clear that there are differences in how the data is presented across groups. One group recorded the numbers that appeared on each roll of the dice and found that 5 appeared 4 times in 30 rolls. Meanwhile, another group recorded the total number of appearances of each number over 30 rolls and observed that the number 5 appeared 6 times.

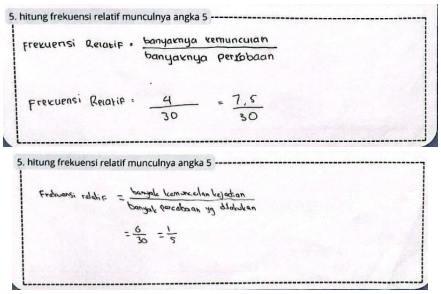


Figure 7. Calculating relative frequency

Then the researcher instructed the students to calculate the relative frequency of the number 5 appearing. Based on the students' answers, there was a group that wrote that the relative frequency was 4/30 because the number 5 appeared 4 times in 30 dice throws. However, this group was still mistaken in simplifying the fraction. Meanwhile, another group reported a relative frequency of 6/30 from the Snakes and Ladders game, in which the number 5 appeared 6 times in 30 dice rolls. This group correctly simplified the fraction 6/30 to 1/5.

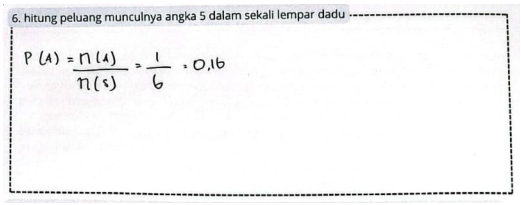


Figure 8. Determining the probability of the number 5 appearing

In the next stage, students are asked to calculate the theoretical probability that the number 5 appears on a single roll of a die. After that, the results of the theoretical probability calculation are compared with the relative frequency obtained from the previous experiment. Through this activity, students can observe the differences and similarities between theoretical and practical results, so that they understand that probability can be calculated mathematically as well as demonstrated through real experiments.

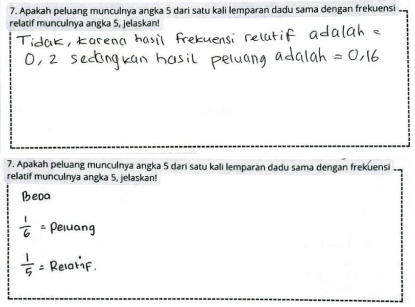


Figure 9. Comparing probabilities with relative frequencies

The researcher then directed the students to compare the theoretical probability and relative frequency of the number 5 appearing. Both groups wrote that the theoretical probability differed from the relative frequency. One group compared the results in decimal form, while the other group compared them in fractional form. However, both groups still had difficulty explaining the discrepancy between the theoretical and experimental results.

After that, students were asked to reflect on the learning outcomes by answering follow-up questions, such as determining the group's total score and analyzing the likelihood of achieving a minimum score of 10 points. Based on the activity results, one group scored 4 points and the other 6. These scores corresponded to the number of times the number 5 appeared during the game of Snakes and Ladders. In response to the follow-up questions, both groups answered that it was still possible to achieve 10 points, but one group gave a logical reason that this could happen if the number of dice throws was increased, for example, to more than 30 attempts.

JURNAL GANTANG. May 2026; *11*(1): 69 - 84
p-ISSN. 2503-0671
e-ISSN. 2548-5547

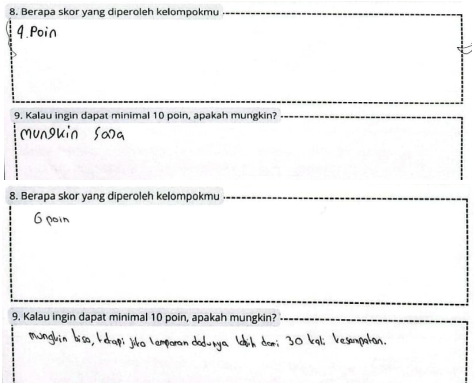


Figure 10. Group score

After completing the Snakes and Ladders game experiment, the researchers continued the learning activity by asking questions about relative frequency. The researchers guided the students in understanding and solving the problems. The students also responded to each of the researchers' questions, including known information, questions asked, and other information, which led to the final results. The researchers also allowed the students to ask questions about things they did not understand.

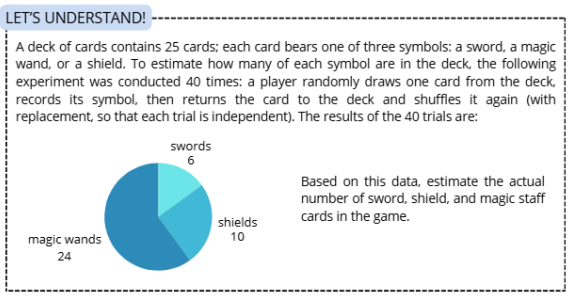


Figure 9. Relative frequency issues

Researchers guide students to understand the problems in the questions and to discuss how to identify them.

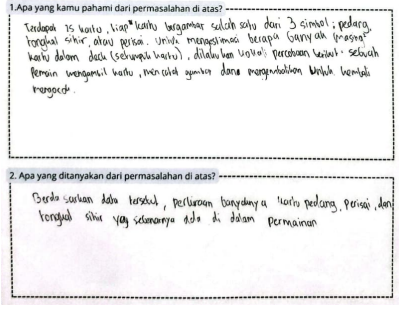


Figure 12. Understanding of problem

At this stage, students are asked to write down what they know and what the question asks. This stage aligns with the first problem-solving skill indicator, namely understanding the problem, in which students seek to understand the question's meaning by gathering the information it contains and writing it down systematically. Based on the students' answers, it can be seen that they can accurately write down what is known and what is asked from the problems presented.

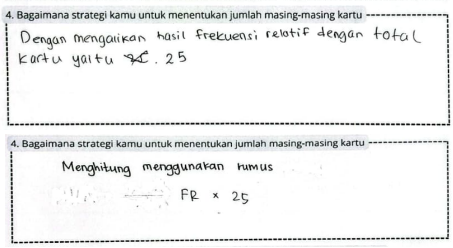


Figure 13. Planning problem-solving strategies

This stage guides students in developing indicators for planning problem-solving strategies as they begin determining the steps to solve the problem by calculating the relative frequency of each card type. Students write down these steps in sequence on their answer sheets. In the first column, students write down the Sword card type with a frequency of 6 out of 40 trials, then write it as a fraction, 6/40, and simplify it to 3/2. A similar step is taken for the Wand card type, with a relative frequency of 24/40, simplified to 3/5, and for the Shield card type, with a relative frequency of 10/40, simplified to 1/4.

From the answers, students can write down the obtained fractions and simplify them to their simplest form.

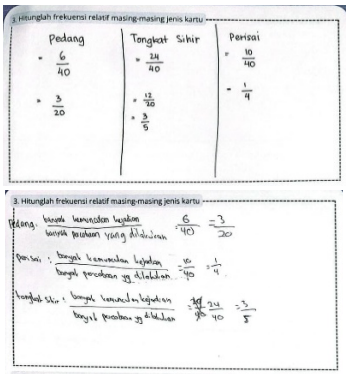


Figure 14. Calculating relative frequency

Next, students were asked to determine a strategy for estimating the number of cards. Based on the students' answers, the strategy used is to multiply the relative frequency by the total number of cards, which is 25 cards. This strategy shows that students understand the relationship between relative frequency and the total number of cards. In this way, students can estimate the number of specific cards based on the results of the experiment conducted. This shows that students have the right strategy to obtain the correct calculation results.

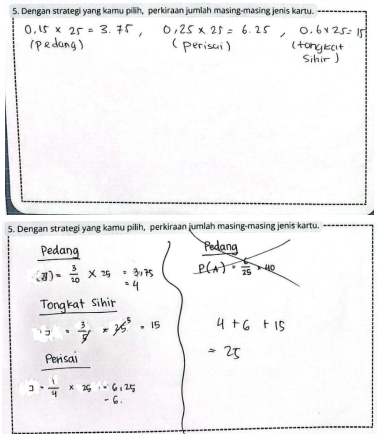


Figure 15. Implementing problem solving

At this stage, the researcher directed the students to estimate the number of each card using a previously planned strategy. Based on the group's answers, the students calculated the estimated number of each card type by multiplying each card type's relative frequency by the total number of cards. From the calculation results, it was found that the estimated number of Sword cards was 3.75, Shield cards was 6.25, and Magic Wand cards was 15. Some groups rounded their calculations because the values were decimals, resulting in a final total of 4 Sword cards, 6 Shield cards, and 15 Magic Wand cards. These results show that students were able to implement the planned problem-solving strategy correctly.

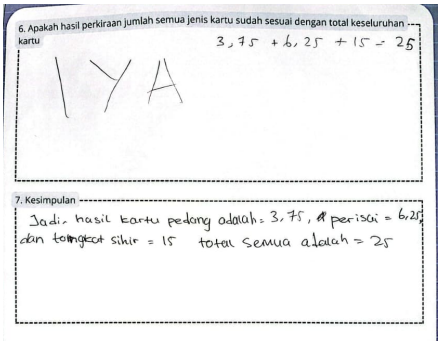


Figure 16. Rechecking the results

In the next stage, in line with the indicators, the students checked the results of their problem-solving. Based on the calculations, the students checked by adding up the estimated counts of the three types of cards: 4 Sword cards + 6 Shield cards + 15 Magic Wand cards = 25 cards. This result matches the total number of cards available, which is 25 cards. In addition, students also write down the correct conclusion. Thus, it can be concluded that students have met the problem-solving competency indicator during the rechecking of results.

In the next meeting, learning will continue to be delivered using differentiated instruction for kinaesthetic students, with the material presented at the expected frequency. In this activity, students play a ring-toss game presented in the LKPD to understand the concept of expected frequency in a concrete and fun way.

Written Test Result

In the third meeting, a mathematical problem-solving test consisting of three descriptive questions was conducted to assess students' mathematical problem-solving abilities. This test covered material on the probability of an event, relative frequency, and expected frequency, with questions compiled from validated indicators of mathematical problem-solving abilities. Students' mathematical problem-solving abilities were as follows:

Table 3. Average mathematical problem-solving ability of students

Value Range	F	Percent	Category
$80 < value \leq 100$	5	25%	High
$60 < value \leq 80$	6	30%	Medium

value ≤ 60	9	45%	Low
Total	**20**		
Avarage		60,597	
Category		Medium	

Based on the table above, the average score for students' mathematical problem-solving skills through differentiated learning for kinaesthetic learners is 60.597, which is categorized as Medium ability.

High Level Ability (MRA)

MRA subjects are subjects with a high level of ability because they can solve both questions. MRA subjects can demonstrate understanding of the problem, plan a solution strategy, implement the solution, and review the results. The answers to question number 1 for MRA subjects are shown in the image.

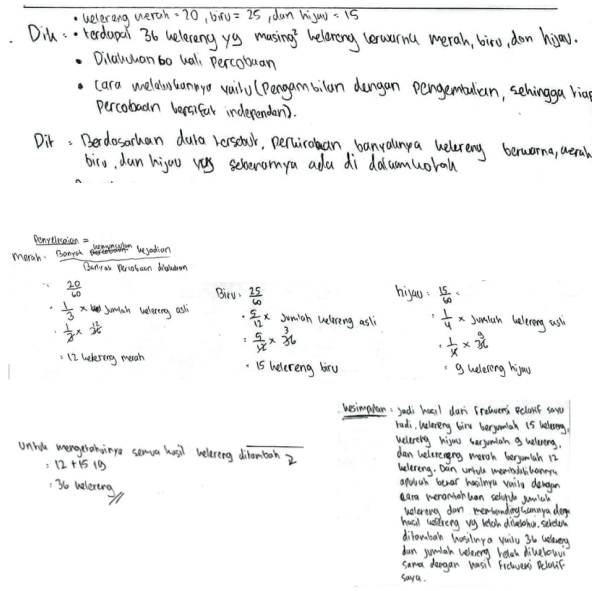


Figure 17. MRA answer to question number 1

The picture is the result of the MRA subject's work. The MRA subject has met the indicator of understanding the problem. This can be seen from their ability to understand the given problem. The MRA subject wrote that, based on the problem, red, blue, and green marbles were taken from the experiment 60 times, as shown in the graph in the question. The MRA subject wrote that red marbles appeared 20 times, blue marbles 25 times, and green marbles 15 times. The MRA subject also wrote that the question was to estimate the actual number of red, blue, and green marbles in the box.

Furthermore, the MRA subject has fulfilled the indicator of planning a problem-solving strategy. This can be seen in their ability to accurately calculate the relative frequency of each marble colour. The MRA subject wrote that the relative frequency of red marbles is 20/60, which is simplified to 1/3. The relative frequency of blue marbles is 25/60. Meanwhile, the relative frequency of green marbles was 15/60, which was simplified to 1/4.

Then, the MRA subject met the indicator of implementing a problem-solving plan, as evidenced by the subject's accurate calculation of the estimated number of marbles of each colour. To estimate the number of each type of marble, the MRA subject multiplied the relative frequency by the total number of marbles known from the question. Furthermore, the MRA subject also met the indicator of rechecking the problem-solving results. This was demonstrated by the subject's ability to write down the conclusion, namely, the estimated number of each colour of marble that was actually in the box. To prove the correctness of the results, the MRA subject added up all the estimated marbles and concluded that the number matched the total number of marbles.

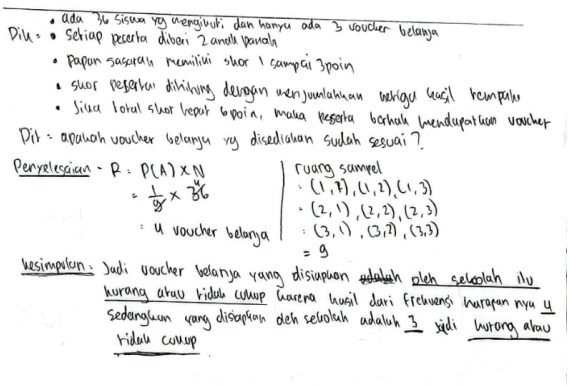


Figure 18. MRA answer to question number 2

In question 2, the MRA subject met the indicator for understanding the problem. This can be seen in the MRA subject writing down what is known and what is asked in the question. The MRA subject also met the indicator for planning a problem-solving strategy, namely, writing down

the sample space for 2 arrows with scores of 1-3. Next, for the planning indicator, the MRA subject planned to find all possible outcomes of two shots and determine how many would total 6. Since each arrow is worth 1–3, the possible outcomes are: (3,3) only. This means that there is only 1 possibility out of a total of 9 possibilities.

For the indicator of implementing problem-solving plans, the MRA subject uses the expected frequency, obtained by multiplying the probability by the number of participants, to estimate how many participants will receive vouchers. Finally, on the indicator of rechecking the results of problem solving, the subject writes the conclusion correctly, namely that because the expected frequency results show that there are about 4 students who will receive vouchers, the 3 vouchers provided by the committee are not enough.

Moderate Ability (A)

Subject A falls into the moderate ability category because they completed one question correctly but did not fully complete another. In question 1, subject A met only two indicators of problem-solving ability: understanding the problem and planning a problem-solving strategy. Based on the results of the work on question 1, as shown in the picture, subject A met the understanding-of-the-problem indicator. This can be seen in their ability to correctly write down the known and asked questions.

Subject A also met the indicator of planning a problem-solving strategy, as shown by their step of writing down the relative frequency of each marble colour. However, Subject A was not yet able to implement the problem-solving plan correctly and did not write down the final conclusion. This was because Subject A seemed to be less thorough in relating the concept of relative frequency to the total number of marbles known from the question, so that the calculation stopped in the middle of the process and did not reach the stage of obtaining the final result. This was confirmed by an interview with the subject.

Teacher : Is there more to the answer after calculating the relative frequency?
Student : Yes, ma'am, but it's not finished yet.
Teacher : Why isn't it finished?
Student : I don't understand, ma'am.

Meanwhile, on question number 2, subject A was able to fulfil all problem-solving ability indicators well. Furthermore, for question 2, subject A met the understanding-of-the-problem indicator. This can be seen in subject AA, who wrote down what was known and what was asked in the question.

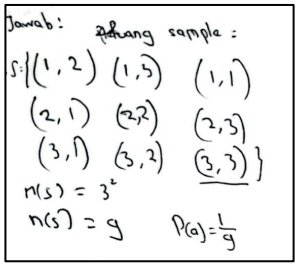


Figure 19. Answer 1 subject A

Next, on the indicator of planning a problem-solving strategy. Subject A plans to find all possible outcomes of two shots and determine how many pairs of scores total 6. Subject A writes down the complete sample space and also calculates the number of members of the sample space by squaring 3, which results in 9. Since each arrow is worth 1–3, the possible outcome is (3,3). This means that there is only 1 possibility out of a total of 9 possibilities.

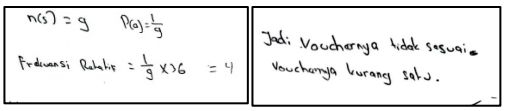


Figure 20. Answer 2 subject A

In the indicator for implementing the problem-solving plan, the subject used the concept of expected frequency, which is multiplying the probability by the number of participants to estimate how many would receive vouchers. Finally, in the indicator for reviewing the results of problem solving, the subject wrote down the correct conclusion: because the expected frequency indicated that about 4

students would receive vouchers, the 3 vouchers provided by the committee were insufficient.

Low Ability (AA)

Subject AA is a subject with a low level of ability because subject AA cannot complete the questions.

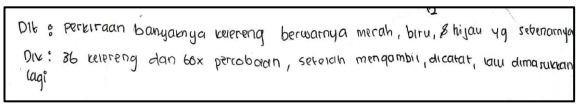


Figure 21. Answer 1 subject AA

AA is only able to meet the indicators of understanding the problem and developing a problem-solving strategy. This can be seen in the correctly written relative frequency. This is explained through an interview with subject AA.

Teacher : What did you do to estimate the number of red, blue, and green marbles?
Student : Calculate the relative frequency of each.
Teacher : What colors are there?
Student : There are 20 red marbles, 25 blue marbles, and 15 green marbles.
Teacher : Well, where did you get that information?
Student : From the graph in the question.
Teacher : What's the relative frequency?
Student : The frequency of red marbles is 20/60, blue marbles 25/60, and green marbles 15/60.
Teacher : Where did you get 60 from?
Student : The total number of trials, ma'am.

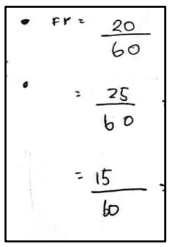


Figure 22. Answer 1 subject AA

Understand how to calculate card estimates. This was because subject AA had difficulty understanding the meaning of the question and ran out of time. Therefore, subject AA was unable to answer question number 2.

Discussion

The results of the study show that students' mathematical problem-solving abilities in probability through differentiated learning are in the high category (25%), medium category (30%), and low category (45%). It can be concluded that the mathematical problem-solving abilities of kinaesthetic learners through differentiated learning in probability are categorized as low. The low mathematical problem-solving ability of students was due to their difficulty in planning problem-solving strategies, implementing problem-solving, and rechecking the results. In line with the results of Anggraeni & Kadarisma (2020), this indicates that many students still make mistakes when solving problems because they are unfamiliar with the problems, have difficulty understanding them, make calculation errors, and do not recheck their answers.

In the problem comprehension indicator, there are still some kinaesthetic learners who are not yet fully able to identify important information from the questions. This is evident in students' incomplete answers when writing down what is known and what is asked, as well as in their inability to fully understand the questions. In line with the research conducted by Safitri, Prayitno, & Hayati (2021), kinaesthetic learners are not yet able to write down all the information they are asked to know.

In the planning phase of problem-solving, there are still students who are unable to determine the appropriate steps to solve the problem. However, some students are already able to correctly compile the steps for solving the problem, such as determining the relative frequency and relating it to the total number of trials. In line with the research by Simatupang, Napitupulu, & Asmin (2021) on the stage of developing a solution plan, errors occur when students are unable to connect one piece of information to another. In the study by Cahyana, Lestari, & Abadi (2024), many students skipped

the problem-solving planning stage, particularly those in the moderate and low performance categories, who tended to rush through the process—though not on every problem.

In the indicator for implementing the solution plan, most kinaesthetic students are already able to correctly apply the strategies they have developed. They can calculate the results of relative frequency and probability. According to Simatupang et al. (2021), errors in formulating a solution plan arise because students are not yet able to process and connect information comprehensively.

The final stage, which is checking the results, shows that not all students are accustomed to reflecting on their answers. Some students immediately assume the final result is correct without checking the calculations. According to Inastuti, Subarinah, Kurniawan, & Amrullah (2021), students' abilities in the indicator of concluding or checking answers are still very low. Students expressed uncertainty about their answers when questioned by the researcher and were not thorough in checking their answers (Ica, Prihatin, & Hartono, 2022).

IV. Conclusion

Based on the results of research involving 20 ninth-grade students from SMP Negeri 1 Indralaya with a kinesthetic learning style, it was found that the students' mathematical problem-solving abilities in probability through differentiated learning were in the high category at 25%, moderate at 30%, and low at 45%. Based on data obtained through written test observations and interviews, it can be generally concluded that the students' mathematical problem-solving abilities were in the moderate category because they did not carry out problem-solving and rechecking of results, and they also had difficulty managing their time to solve problems. Furthermore, mathematical problem-solving skills in the low category were due to difficulties in planning problem-solving strategies, implementing problem-solving, and rechecking results. In addition, for mathematical problem-solving skills in the high category, students were able to meet the problem-solving ability indicators, with only a few incorrect answers in their work due to a lack of accuracy on the part of the students.

Acknowledgement

The author would like to thank the school for granting permission to the researcher to conduct this study, as well as the students of class IX.E at SMP N 1 Indralaya for agreeing to participate in this study, thereby enabling the data collection process to run smoothly. The author also extends gratitude to Sriwijaya University for the 2025 Fiscal Year in accordance with the Rector's Decree No. 0028/UN9/LPPM.PT/2025 dated September 17, 2025.

Reference

Abdullah, H., Satriani, S., & Ernawati. (2022). Kemampuan pemecahan masalah matematika siswa ditinjau dari gaya belajar. *SIGMA: Jurnal Pendidikan Matematika*, *14*, 198–208. https://doi.org/10.26618/sigma.v14i2.9464

Aggarwal, R., & Ranganathan, P. (2019). Study designs : Part 2 – Descriptive studies. *Perspectives in Clinical Research*, 34–36. https://doi.org/10.4103/picr.PICR_154_18

Amalia, R. Z., & Hadi, W. (2021). Analisis kemampuan pemecahan masalah matematis bermuatan higher-order thinking skill ditinjau dari gaya belajar siswa. *Jurnal Program Studi Pendidikan Matematika*, *10*(3), 1564–1578. https://doi.org/10.24127/ajpm.v10i3.3743

Anggraeni, R., & Kadarisma, G. (2020). Analisis kemampuan pemecahan masalah matematik siswa smp kelas vii pada materi himpunan. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *04*(02), 1072–1082. https://doi.org/10.31004/cendekia.v4i2.334

Araiku, J. (2022). Pengaruh model pembelajaran ditinjau dari gaya belajar terhadap hasil belajar kelas VIII SMP Negeri 3 Gelumbang. *Jurnal Gantang*, *6*(2), 169–176. https://doi.org/10.31629/jg.v6i2.3954

Arifin, S., Zulkardi, Z., Putri, R. I. I., & Hartono, Y. (2021). Analisis kemampuan pemecahan masalah siswa smp ditinjau dari kemampuan

memahami, merencana, dan menyelesaikan masalah. *Jurnal Gantang*, *6*(1), 29–38. https://doi.org/10.31629/jg.v6i1.3050

Asih, N. M. A., Mahayukti, G. A., & Ariawan, I. P. W. (2025). Evaluasi kualitas pelaksanaan kurikulum merdeke pada mata pelajaran matematika. *SIGMA: Jurnal Pendidikan Matematika*, *17*, 677–691. https://doi.org/10.26618/48t4tg33

Bruno, A., Qohar, A., Susanto, H., & Permadi, H. (2021). Kesulitan siswa dalam pemecahan masalah soal cerita matematika dilihat dari adversity quotient (AQ) students ' difficulties in solving problems with math story problems seen from adversity quotient (AQ). *EDUMATICA: Jurnal Pendidikan Matematika, 11*(November). https://doi.org/10.22437/edumatica.v11i03.15395

Cahyadi, F., Suryani, E. D., & Dewi, A. C. (2021). Kesulitan siswa dalam memecahkan masalah matematika materi pecahan. *Dwijaloka Jurnal Pendidikan Dasar & Menengah, 2*(3), 343–349.

Cahyana, Y., Lestari, K. E., & Abadi, A. P. (2024). Analisis kemampuan pemecahan masalah matematis siswa SMP dalam soal sistem persamaan linear dua variabel. *Jurnal EDUCATIO, 10*(3), 936–941. https://doi.org/10.31949/educatio.v10i3.9350

Halilianti, B. Y., Sripatmi, Azmi, S., & Sridana, N. (2022). Kemampuan pemecahan masalah matematika ditinjau dari gaya belajar siswa kelas VIII SMP Negeri 6 Mataram Tahun Pelajaran 2020/2021. *Journal of Mathematics Education and Application*, *2*(2), 557. https://doi.org/10.29303/griya.v2i2.186

Hanggara, Y., Aisyah, S. H., & Amelia, F. (2022). Analisis kemampuan pemecahan masalah matematis siswa ditinjau dari perbedaan gender. *Pythagoras: Jurnal Pendidikan Matematika*, *11*(2), 189–201. https://doi.org/10.33373/pythagoras.v11i2.4490

Himmah, F. I., & Nugraheni, N. (2023). Analisis Gaya belajar siswa untuk pembelajaran berdiferensiasi analysis of student learning styles for differentiated learning. *Jurnal Riset Pendidikan Dasar (JRPD), 4*, 31–39. https://doi.org/10.30595/jrpd.v4i1.16045

Ica, A., Prihatin, I., & Hartono. (2022). Analisis kemampuan pemecahan masalah matematis siswa ditinjau dari gaya belajar pada materi SPLTV Kelas X SMA Karya Sekadau. *JURRIMIPA: Jurnal Riset Rumpun Matematika dan Ilmu Pengetahuan Alam (JURRIMIPA)*, *1*(2).

Inastuti, I. G. A. S., Subarinah, S., Kurniawan, E., & Amrullah. (2021). Analisis kemampuan pemecahan masalah pola bilangan ditinjau dari gaya belajar. *Griya*, *1*(2020), 66–80. https://doi.org/10.29303/griya.v1i1.4

Izzatunnisa, R., & Rafianti, I. (2023). Analisis kemampuan pemecahan masalah tahapan polya ditinjau dari kecerdasan logis matematis. *Jurnal Inovasi dan Riset Pendidikan Matematika*, *4*(4).

Khoiriyah, F., Yustitia, V., & Supratiwi, W. (2024). Pembelajaran berdiferensiasi untuk meningkatkan pemecahan masalah matematika : penelitian tindakan kelas di sekolah dasar. *Journal Innovation in Education, 2*(3), 353–358. https://doi.org/10.59841/inoved.v2i3.1777

Latifah, T., & Afriansyah, E. A. (2021). Kesulitan dalam kemampuan pemecahan masalah matematis siswa pada materi statistika. *Journal of Authentic Research on Mathematics Education (JARME)*, *3*(2), 134–150.

Lusiana, Armiati, & Yerizon. (2022). Kemandirian belajar dan persepsi siswa mengenai guru terhadap kemampuan pemecahan masalah matematis siswa SMK. *Mosharafa: Jurnal Pendidikan Matematika*, *11*(1), 155–166. https://doi.org/10.31980/mosharafa.v11i1.695

Maharani, R. D., Dasari, D., & Nurlaelah, E. (2022). Analisis hambatan belajar (learning obstacle) siswa SMP pada materi peluang. *11*(4), 3201–3213. https://doi.org/10.24127/ajpm.v11i4.6214

Meika, I., Ramadina, I., Sujana, A., & Mauladaniyati, R. (2021). Kemampuan Pemecahan masalah matematis siswa dengan menggunakan model pembelajaran SSCS. *Jurnal Cendekia, 05*(01), 383–390. https://doi.org/10.31004/cendekia.v5i1.388

Nurhikmah, Hikmah, N., Wulandari, N. P., & Subarinah, S. (2025). Kemampuan Pemecahan masalah matematika ditinjau dari gaya belajar siswa kelas viii smp negeri 21 mataram tahun pelajaran 2024/2025.

Jurnal Pendidikan dan Pembelajaran Indonesia (JPPI), *5*(1), 494–503. https://doi.org/10.53299/jppi.v5i1.1452

Purba, M., Purnamasari, N., Soetantyo, S., Suwarma, I. R., & Susanti, E. I. (2021). Prinsip pengembangan pembelajaran berdiferensiasi (differentiated instruction). *In Pusat Kurikulum dan Pembelajaran Badan Standar, Kurikulum, dan Asesmen Pendidikan Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi*.

Putri, A. A., & Juandi, D. (2022). Kemampuan pemecahan masalah matematis ditinjau dari self efficacy: systematic literature review (SLR) di Indonesia. *Symmetry: Pasundan Journal of Research in Mathematics Learning and Education*, *7*(2), 135–147. https://doi.org/10.23969/symmetry.v7i2.6493

Putri, K. A. M. (2024). Efektifitas pembelajaran berdiferensiasi terhadap kemampuan pemecahan masalah matematis siswa. *Mathematics Paedagogic*, *VIII*(2), 133–143. https://doi.org/10.36294/jmp.v8i2.3888

Rahma, F. L., Tanjung, M. S., & Siregar, R. (2024). Studi literatur : pentingnya berpikir komputasional dalam meningkatkan kemampuan pemecahan masalah matematis peserta didik. *Bilangan: Jurnal Ilmiah Matematika, Kebumian dan Angkasa*, *2*(2). https://doi.org/10.62383/bilangan.v2i2.36

Rahmadania, A., Novianti, I., Michael, Meldi, N. F., & Yani, A. (2024). Analisis kemampuan pemecahan masalah matematis peserta didik dalam menyelesaikan soal materi peluang tingkat sma. *Khazanah Pendidikan*, *18*(1), 88–94. https://doi.org/10.30595/jkp.v18i1.20396

Rahmatika, Krairiani, & Akmal, N. (2022). Analisis kemampuan pemecahan masalah matematika ditinjau dari gaya belajar siswa. *Ar-Riyadhiyyat*, *3*(1), 10–19. https://doi.org/10.47766/arriyadhiyyat.v3i1.497

Rahmawati, A., Lukman, H. S., & Setiani, A. (2021). Analisis kemampuan pemecahan masalah matematis ditinjau dari tingkat self-efficacy. *Equals, 4*, 79–90. https://doi.org/10.46918/equals.v4i2.979

Rismen, S., Juwita, R., & Devinda, U. (2020). Analisis kemampuan pemecahan masalah matematika siswa ditinjau dari gaya kognitif impulsif. *Jurnal Gantang*, *5*(1), 1. https://doi.org/10.33772/jpbm.v5i1.12541

Safitri, E. L., Prayitno, S., & Hayati, L. (2021). Analisis kesalahan dalam menyelesaikan soal cerita matematika ditinjau dari gaya belajar siswa. *Griya, 1*(September), 348–358. https://doi.org/10.29303/griya.v1i3.80

Sagita, D. K., Ermawati, D., & Riswari, L. A. (2023). Kemampuan pemecahan masalah matematis siswa sekolah dasar. *Jurnal EDUCATIO, 9*(2), 431–439. https://doi.org/10.31949/educatio.v9i2.4609

Sasiang, I., Tumalun, N. K., & Domu, I. (2024). Analisis kesulitan belajar siswa dalam pemecahan masalah matematis menurut polya pada materi peluang. *Dharmas Education Journal*, *5*(2), 856–862. https://doi.org/10.56667/dejournal.v5i2.1342

Simatupang, R., Napitupulu, E., & Asmin. (2021). Analisis kemampuan pemecahan masalah matematis dan self-efficacy siswa pada pembelajaran proble based learning. *Paradikma Jurnal Pendidikan Matematika*, *13*. https://doi.org/10.24114/paradikma.v13i1.22944

Sriwahyuni, K., & Maryati, I. (2022). Kemampuan pemecahan masalah matematis siswa pada materi statistika. *2*, 335–344.

Sugiharti, A., Rahmawati, D., & Anwar, R. B. (2026). Trends in mathematical problem-solving skills in mathematics learning. *International Journal of Studies in Education and Science*, *7*, 188–201. https://doi.org/10.46328/ijses.6725

Sutrisno, H., Muhtarom, & Subandijah, S. (2023). Penerapan pembelajaran berdiferensiasi untuk meningkatkan kemampuan pemecahan masalah matematis siswa SMK. *Seminar Nasional PPG UPGRIS*, 2517–2527.

Syahril, R. F., Maimunah, & Roza, Y. (2022). Analisis kemampuan pemecahan masalah matematis siswa SMA Kelas XI SMAN 1 Bangkinang Kota ditinjau dari gaya Belajar. *Edumatica: Jurnal Pendidikan Matematiak*, *11*(November 2021). https://doi.org/10.22437/edumatica.v11i03.15320

Syaputra, D. A., Mulyono, & Hasratuddin. (2022). Analisis kemampuan pemecahan masalah matematis siswa dalam pembelajaran berbasis lesson study for

learning community berdasarkan gaya belajar kolb. *Jurnal Cendekia, 06*(01), 721–734. https://doi.org/10.31004/cendekia.v6i1.1225

Yani, A. A., Sofnidar, & Theis, R. (2024). Analisis kemampuan pemecahan masalah matematis siswa SMP berdasarkan gaya belajar V-A-K (visual, auditori, kinestetik). *Jurnal Pendidikan Mipa*, *14*(2), 324–334. https://doi.org/10.37630/jpm.v14i2.1541

Yunaeti, N., Arhasy, E. A., & Ratnaningsih, N. (2021). Analisis kemampuan pemecahan masalah matematik peserta didik menurut teori John Dewey ditinjau dari gaya belajar. *Journal of Authentic Research on Mathematics Education (JARME)*, *3*(1), 10–21. https://doi.org/10.37058/jarme.v3i1.2212