JISIP (Jurnal Ilmu Sosial dan Pendidikan)
Vol. 10 No. 4 November 2026
e-ISSN : 2656-6753, p-ISSN: 2598-9944
DOI: *10.36312/jisip.v10i4.11611/http://ejournal.mandalanursa.org/index.php/JISIP/index*

Critical Thinking Skills of Junior High School Students in Solving Probability Problems Reviewed from the Student Learning Style

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Article Info
Article history:
Received: 21 October 2026
Publish: 1 November 2026

Keywords:
Critical Thinking Skills;
Probability Problems;
Learning Styles;
Visual;
Auditory;
Kinesthetic.

Abstract
This study aims to describe junior high school students' critical thinking skills in solving probability problems based on visual, auditory, and kinesthetic learning styles. The study employed a descriptive qualitative approach involving three ninth-grade students with high mathematical abilities, each representing a different learning style. Data were collected through a learning style questionnaire, a Mathematics Ability Test (TKM), a Mathematical Problem-Solving Test (TPMM) on probability, and semi-structured interviews. Data analysis consisted of data reduction, data display, and conclusion drawing, with triangulation between written test responses and interview results. The findings indicate that all three students fulfilled Facione's six critical thinking indicators: interpretation, analysis, inference, explanation, evaluation, and self-regulation. However, differences emerged in their problem-solving processes. The student with a visual learning style relied on written information, symbols, formulas, fractions, and calculation results to understand and solve problems. The student with an auditory learning style utilized previously heard explanations, particularly those provided by teachers, to understand concepts, determine strategies, explain reasoning, and verify solutions. Meanwhile, the student with a kinesthetic learning style preferred direct counting, sequential problem-solving steps, and recalculation to verify results. In conclusion, all students fulfilled the same critical thinking indicators but demonstrated different approaches to solving probability problems according to their learning styles.

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1. INTRODUCTION

Mathematics aims not only at the mastery of concepts and procedures but also at the development of higher order thinking skills, particularly critical thinking. It serves not merely as a tool for calculation, but as a means to cultivate the higher order thinking abilities required in daily life (Sumarmo, 2013). Through mathematical reasoning and problem solving activities, individuals are trained to move beyond the passive reception of information; instead, they learn to analyze assumptions, test for logical consistency, and draw valid conclusions based on objective evidence (Krulik & Rudnick, 1999).

Education plays a vital role in enhancing the quality of human resources, with mathematics instruction serving as one key avenue. Education is a primary factor in developing human resource quality, as it shapes an individual's cognitive abilities, skills, and attitudes (Tilaar, 2012). Mathematics education contributes significantly to improving human resource quality by fostering logical, analytical, systematic, and critical thinking skills (Depdiknas et al., 2006). The goal of mathematics education is to prepare learners to

navigate changing life circumstances and an ever-evolving world by training them to act based on logical, rational, critical, careful, efficient, and effective reasoning (Agustina, 2019). In this context, the junior high school (SMP) level represents a crucial stage for the development of students' critical thinking skills; according to Rosmalinda et al. (2021), students at this stage begin to encounter mathematical problems that require analytical, reasoning, and decision-making capabilities. Given that the junior high school level is a pivotal phase for developing critical thinking skills, an in-depth study is necessary to understand the characteristics of students' thinking abilities (Facione, 2011).

Mathematics learning outcomes in junior high schools (SMP) indicate that many students still struggle to solve problems that require reasoning and critical thinking. This is reflected in the results of the Programme for International Student Assessment (PISA) regarding mathematical literacy; Indonesian students assessed on their ability to apply knowledge to make decisions concerning mathematical problems ranked 68th out of 81 countries, with an average score of 366. Only 18% of these students reached "Level 2" the ability to solve only simple mathematical problems a figure well below the international average of 472 (OECD, 2023). Students tend to merely memorize formulas without a deep understanding of the underlying concepts, leaving them ill-equipped to tackle non-routine problems that demand analysis and logical reasoning. Instruction focused on procedures and rote memorization of formulas results in superficial knowledge, rendering students unable to explain the rationale behind the steps they take to reach a solution (Hiebert, 2007). This situation suggests that the critical thinking skills of junior high school students have yet to be optimally developed.

In middle school mathematics, the topic of probability is one that demands critical thinking skills. Mastering the concept of probability not only strengthens students' critical and analytical thinking abilities but also facilitates the application of these concepts to real-life, everyday situations (Safari & Salbiah, 2025). Probability requires critical thinking because students must analyze possibilities, interpret random situations, and draw conclusions based on logical reasoning (Garfield & Ben-Zvi, 2008). Furthermore, the study of probability necessitates that students understand sample spaces, determine the likelihood of events, and analyze situations involving uncertainty. Solving probability problems requires more than just performing calculations; it entails understanding the context of the problem, selecting an appropriate problem-solving strategy, and evaluating the results obtained. As a process, problem-solving encompasses several activities: identifying whether sufficient elements are available to solve the problem, selecting and implementing a strategy, performing calculations, interpreting the solution in the context of the original problem, and verifying the accuracy of the solution (Hamid & Sugandi, 2018). In reality, however, many students struggle to grasp the concept of probability and frequently make errors when determining the steps required to solve such problems.

Research conducted in Indonesia has found that students encounter various types of difficulties when solving probability problems, including challenges in understanding the problems, performing transformations, and executing the procedural steps required for a solution (A. Fitri & Abadi, 2021). Studies indicate that students' grasp of probability concepts remains limited, as evidenced by their struggles with tasks such as restating concepts and classifying objects based on those concepts areas that have not yet been mastered in depth (Sofiatunnisa, 2025).

Beyond material-related factors, differences in individual student characteristics such as learning styles also influence critical thinking skills. Each student possesses a unique learning style that enables them to more easily absorb information and effectively address mathematical problems during the learning process (Mursari, 2019). Students exhibit distinct qualities and approaches when studying mathematics in the classroom, as

their individual learning methods vary. A learning style is a characteristic trait that defines how a student responds to the instruction they receive. According to Ghufron and Suminta (2012), a learning style refers to the preferred method a student uses to think about, process, and comprehend information. It encompasses the consistent ways in which a student perceives stimuli or information, recalls details, engages in thought, and solves problems (Mursari, 2019). Fleming and Mills (1992) define a learning style as an individual's dominant mode of receiving and processing information during the learning process. Fleming categorized learning styles into the VARK model, which consists of visual, auditory, read/write, and kinesthetic types. This study focuses on three of these visual, auditory, and kinesthetic as they are considered the most relevant to mathematics education. Consequently, students differ in how they receive and process information, manifesting in various learning styles such as visual, auditory, or kinesthetic. These differences influence how students grasp concepts, solve problems, and develop critical thinking skills; thus, students naturally possess distinct characteristics in how they think, act, and resolve issues. Such individual differences can shape how information is acquired throughout the learning process (Utami & Gafur, 2015). Research indicates that students' critical thinking abilities vary according to their specific learning styles, suggesting that learning styles are a significant factor in the development of critical thinking skills (Setiana & Purwoko, 2020a).

Differences in students' learning styles can lead to variations in critical thinking skills when solving mathematical problems, particularly those involving probability. Learning styles influence how students receive, process, and evaluate information, which in turn affects their critical thinking abilities in a mathematical context (Setiana & Purwoko, 2020). This relationship is especially significant in the study of probability, a topic that demands a high level of abstraction, careful analysis of sample spaces, and logical interpretation of events (Jones et al., 2007). For instance, students with a visual learning style may demonstrate greater critical thinking when evaluating probabilities through graphical representations such as tree diagrams whereas auditory or kinesthetic learners might require different, context-based approaches to construct their logical arguments (Fleming, 2006). It is these varying sensory preferences that account for differences in how students meet the indicators of critical thinking specifically regarding the analysis of problem assumptions, the detection of conceptual errors, and the formulation of valid mathematical conclusions when addressing probability problems (Facione, 2011).

The study by Wahyuningtiyas et al. (2024) examines students' critical thinking skills, not in terms of learning styles, but rather in relation to gender differences. Meanwhile, research by Izzati & Masriyah (2024) investigates critical thinking skills through the lens of learning styles. However, there has been no research to date that explores critical thinking specifically in the context of probability problems, categorized by learning styles. Consequently, the researcher is interested in examining students' critical thinking based on their learning styles when solving probability problems, while establishing specific parameters for the research subjects.

Based on the description above, the researcher will conduct a study titled “Critical Thinking Skills of Junior High School Students in Solving Probability Problems, Viewed from the Perspective of Learning Styles.” The objective of this research is to describe the critical thinking skills of junior high school students categorized by their visual, auditory, or kinesthetic learning styles when solving probability problems. This study is expected to provide both theoretical and practical contributions. Theoretically, the findings are intended to expand the existing literature on the critical thinking skills of junior high school students in solving mathematical problems related to probability, while accounting for differences in their learning styles. Practically, this research offers insights for teachers regarding how students' varying learning styles may influence their critical thinking skills when addressing

probability based mathematical problems. Furthermore, it serves as a reference for future researchers interested in further exploring the critical thinking skills of junior high school students in solving mathematical problems within the context of probability, specifically in relation to their learning styles.

2. RESEARCH METHODS

This study employs a qualitative approach with a descriptive research design to gain an in-depth understanding of students' critical thinking skill profiles. The subjects of this study are ninth-grade junior high school students during the odd semester of the 2026/2027 academic year. The selection of junior high school students is based on the fact that, at this educational level, the topic of probability has already been covered; thus, students possess the conceptual foundation necessary to solve mathematical problems related to probability. Furthermore, critical thinking skills begin to develop during the junior high school years, making it an important area to examine more thoroughly within the context of mathematical problem-solving.

The research subjects to be analyzed in depth consist of three students, each representing one of the following learning style categories: visual, auditory, and kinesthetic. These subjects were selected based on the results of a learning style questionnaire administered to all students. In addition to learning style categories, the selection process also took into account equivalent mathematical ability (at a high level), gender, and strong communication skills. Ensuring equivalent mathematical ability is essential so that any observed differences in critical thinking skills more accurately reflect variations in learning style characteristics, rather than disparities in academic achievement levels.

Students with high mathematical ability were selected based on the consideration that they would have a greater likelihood of optimally completing the Mathematical Problem Solving Test (MPST) on the topic of probability, thereby allowing for a more in depth analysis of their critical thinking processes. Furthermore, openness and fluency in communication were also taken into account to ensure that the interview process would proceed effectively and yield a richer set of data. The selected subjects were then administered the MPST to reveal their critical thinking skills in solving problems related to probability, followed by in-depth interviews designed to explore the students' thought processes in the context of their individual learning styles.

The analytical framework for critical thinking skills in this study draws upon the 6 key indicators developed by Facione (1990), as presented in Table 1 below.

Table 1. Indicators of Critical Thinking according to Facione

No	Indicator	Operational Description in Opportunity Problem-Solving
1	Interpretation	Capable of accurately understanding, identifying, and writing down the given information as well as what is being asked in a probability problem.
2	Analysis	Able to identify the relationship between statements, the concept of probability, the ratio formula $P(A) = \frac{n(A)}{n(S)}$, and determine a problem-solving strategy.

3	Inference	Capable of making logical estimates, connecting pieces of information, and drawing valid conclusions based on probability calculations.
4	Explanation	Capable of presenting and explaining the steps toward a solution, as well as providing logical mathematical reasoning to support the answer.
5	Evaluation	Capable of evaluating the validity of a strategy, verifying the accuracy of mathematical calculations, and ensuring there are no logical errors.
6	Self-Regulation	Capable of independently reviewing the entire completion process and correcting any errors that are found.

Data analysis was conducted following the interactive model proposed by Miles, Huberman, and Saldaña (2014), which consists of data reduction, data display, and conclusion drawing/verification. The validity of the data was tested through methodological triangulation specifically, by comparing students' written work on the TPMM with transcripts from in-depth interviews (Moleong, 2017).

3. RESULTS AND DISCUSSION

3.1.Research Results

a. Visual learning style of students

Based on the analysis of written responses and interviews, students with a visual learning style demonstrated critical thinking skills in solving problem number 1, which concerns probability. These students were able to comprehend the problem by attending to the available information, noting down key details, presenting calculations in the form of fractions and percentages, and subsequently comparing the results to determine which box offered a more favorable outcome. The characteristics of a visual learning style were evident in the students' tendency to rely on visual information, record data in a structured manner, and utilize numerical values such as fractions and percentages to facilitate understanding and comparison. This was further supported by interview responses, in which students explained that they would first read the problem, record essential information, identify the numbers that met the given criteria, and then calculate the corresponding probabilities. The students also noted that representing the data as fractions made it easier for them to compare the probabilities associated with the two boxes.

b. Auditory Learning Style of Students

Based on the results of the written test and interviews, students with an auditory learning style demonstrate critical thinking when solving problem number 1, which concerns comparing the chances of winning a prize from the "Fortune Box" (Kotak Rezeki) versus the "Star Box" (Kotak Bintang). The characteristics of an auditory learning style are evident in the students' tendency to comprehend and explain information through verbal means specifically by recalling the teacher’s explanations and articulating their reasoning orally during the interviews. This is reflected in several student responses, where they mention "remembering the teacher's explanation" and applying methods that were "explained during the lesson." Consequently, the students' thought processes are supported not only by

written calculations but also by their ability to recall and verbally communicate explanations they heard during instruction.

c. Kinesthetic Learning Style of Students

Based on the analysis of written responses and interviews, students with a kinesthetic learning style demonstrated reasonably good critical thinking skills when solving problem number 1, which concerned probability. The characteristics of a kinesthetic learning style were evident in the students' tendency to approach problems through direct action testing out solution steps incrementally and performing concrete calculations. This was reflected in the interviews, where one student explained that they "immediately tried to count the number of cards that met the criteria," choosing this method because it was easier to "count them one by one." Such a statement indicates that these students tend to understand and process information through direct, hands-on activity during the problem-solving process a trait consistent with the characteristics of kinesthetic learners.

3.2.Discussion

a. Visual learning style of students

Based on the analysis of the written test and interview, the subject who possesses a visual learning style demonstrated strong critical thinking skills when solving probability problems. In the written test, the subject met five of Facione's critical thinking indicators: interpretation, analysis, inference, explanation, and evaluation. While the indicator for self-regulation was not explicitly evident in the written responses, the interview revealed that the subject was capable of reflecting on their problem-solving process, reviewing their answers, and explaining the steps they would take if they discovered an error. Consequently, the interview findings complement the results from the written test, leading to the conclusion that the subject has met all of Facione's critical thinking indicators.

Regarding the interpretation indicator, the subject demonstrated the ability to identify both the given information and the information requested in the two problems, subsequently interpreting this information within the framework of probability concepts. This was evidenced by the subject's process of determining the outcomes that met the specified criteria for each box, identifying the sample space for a die roll, and relating this information to the probability formulas previously learned. Based on the interview, the subject explained that they would first read the problem and note key information before beginning to solve it. These findings indicate that the subject is capable of grasping the meaning of the information provided in a problem prior to determining a solution strategy. This ability aligns with the perspective of Facione (1990), who defines interpretation as the capacity to understand, identify, and assign meaning to information a foundational element in the process of critical thinking.

Regarding the analysis indicator, the subject is able to connect the information provided in the problem with the appropriate probability concept. This is evident when the subject identifies the outcomes that satisfy the given conditions, determines the total number of outcomes in the sample space, and constructs a probability model before performing calculations. Based on the interview, the subject explained that they matched the information from the problem with the relevant probability formula and then expressed the data as fractions, which made it easier to compare the results. These characteristics are indicative of a visual learning style a tendency to process information through text, symbols, numbers, and visual representations. The subject finds it easier to grasp the relationships between pieces of information once the data is presented in the form of fractions or

percentages. This finding aligns with Fleming's (2001) perspective that learners with a visual learning style tend to understand concepts through information presented via text, symbols, diagrams, or other visual representations, which in turn facilitates their ability to analyze a given problem.

Regarding the inference indicator, the subject is able to use calculation results to draw logical conclusions. In the first problem, the subject concludes that the "Fortune Box" (Kotak Rezeki) is more advantageous because it offers a 40% probability, whereas the "Star Box" (Kotak Bintang) only offers a probability of approximately 33.3%. In the second problem, the subject concludes that the probability of rolling a 6 remains $\frac{1}{6}$, even though a 6 did not appear in the five preceding rolls. This conclusion is based on both the calculation results and the probabilistic concept that each die roll is an independent event. This demonstrates that the subject is capable of using acquired information as a basis for drawing logical conclusions, in accordance with the inference indicator as defined by Facione.

Regarding the explanation indicator, the subject is able to outline the steps for solving the problem systematically and provide justifications for the strategies employed. Based on the interview, the subject explained that the initial steps taken were reading the problem, noting down key information, identifying the outcomes that meet the given criteria, calculating the probability using the appropriate formula, converting the result into a percentage (if necessary), and finally comparing the results to draw a conclusion. The subject further noted that the probability formula was chosen because it was well-suited to the nature of the problem presented. This demonstrates that the subject is capable of communicating their thought process in a coherent manner and providing justification for the answers obtained.

Regarding the evaluation indicator, the subject demonstrated the skill of assessing the results of their work by reviewing each step taken. Based on the interview, the subject stated that they re-examined the count of numbers meeting the criteria, verified the results of the division, and reread the question to ensure that the provided answer aligned with the requirements of the problem. These actions indicate that the subject is capable of evaluating the accuracy of both the process and the final outcome before settling on a definitive answer.

Meanwhile, regarding the indicator of self-regulation, the written test results provide no evidence that the subject reviewed their problem-solving process. However, interview findings indicate that the subject is aware of the need to re-examine all steps taken and is prepared to correct any calculations should errors be discovered. The subject further stated that, upon re-examination, no parts required correction, as all steps and calculations were found to be accurate. These findings suggest that self-regulation is more apparent through the subject's verbalized thought processes than through their written responses.

Based on the overall research findings, it can be concluded that subjects with high mathematical ability and a visual learning style demonstrate comprehensive critical thinking skills, as defined by Facione's indicators. These skills are supported by the characteristics of a visual learning style, which enable subjects to identify information, connect data to probability concepts through symbolic and numerical representations, carefully evaluate calculation results, and reflect on the problem-solving process before reaching a conclusion. Consequently, the presentation of information in a visual format contributes to the systematic

development of students' critical thinking processes when solving probability problems.

b. Auditory Learning Style of Students

Based on the analysis of written test results and interviews, a subject with high mathematical ability and an auditory learning style was able to fulfill all the critical thinking skill indicators as defined by Facione: interpretation, analysis, inference, explanation, evaluation, and self-regulation. Regarding the interpretation indicator, the subject demonstrated the ability to identify essential information within the problem such as determining the elements of an event that meet specific criteria, grasping the given and requested information, and interpreting the concept of probability as the ratio of the number of favorable outcomes to the total number of possible outcomes. These findings indicate that the subject was able to comprehend the meaning of the problem before determining a strategy for its solution. This aligns with Facione's (1990) perspective, which posits that interpretation is the capacity to understand, identify, and assign meaning to acquired information prior to making decisions in the problem-solving process.

Regarding the analysis indicator, the subject connects the information provided in the problem to the concept of probability by applying probability formulas and establishing the relationship between the number of favorable outcomes and the total number of elements in the sample space. During the interview, the subject explained that, before solving the problem, they recalled the teacher's verbal explanations regarding the steps for solving probability problems, subsequently using that information to devise a solution strategy. These characteristics indicate an auditory learning style specifically, the tendency to utilize information acquired through oral explanations as a foundation for grasping concepts and determining the steps toward a solution. This finding supports the research of Izzati and Masriyah (2024), which posits that students with different learning styles exhibit distinct critical thinking characteristics when solving mathematical problems. In this study, the auditory characteristic is evidenced by the subject's ability to link previously heard explanations to the analytical process required to solve probability problems.

Furthermore, regarding the inference indicator, the subject demonstrated the ability to perform probability calculations accurately and draw conclusions based on the obtained results. In the first problem, the subject concluded that the "Fortune Box" (Kotak Rezeki) was more advantageous, as it offered a 40% probability, compared to only 33.3% for the "Star Box" (Kotak Bintang). In the second problem, the subject concluded that Vio's assertion was correct, noting that each die roll is an independent event; therefore, the probability of rolling a 6 remains $\frac{1}{6}$. These conclusions were derived from accurate calculations and a sound understanding of probability concepts. These findings indicate that the subject did not merely execute computational procedures but was also able to use the results as a basis for making logical decisions. This aligns with the work of Rodiah et al. (2023), who stated that in the study of probability, the ability to grasp concepts and relate computational outcomes to the context of a given problem is a crucial component of the mathematical problem-solving process.

Regarding the explanation indicator, the subject is able to restate the steps taken to reach a solution in a logical sequence, while providing justifications for the chosen strategy. The subject explains that the probability formula was used because it is appropriate for the type of problem presented, and relates this to the teacher's previous explanations during instruction. Furthermore, the subject is able to argue

that the chance of winning a prize is not determined by the total number of cards in the box, but rather by the ratio of the number of favorable outcomes to the total number of possible outcomes. This ability to provide logical reasoning demonstrates that the subject is capable of communicating their thought process systematically, consistent with the explanation indicator as defined in Facione's (1990) theory.

Regarding the evaluation indicator, the subject reviews their work by re-reading the steps taken to reach a solution, verifying calculations against probability formulas, and ensuring that the final answer aligns with the specific question asked. Furthermore, concerning the self-regulation indicator, the subject states that if an error is discovered, they would re-calculate the problem and recall the teacher's explanations to correct any inaccurate steps. Interview findings indicate that, although no revisions are visible in the written work, the subject possesses the awareness to reflect upon and rectify their solution upon identifying an error. This suggests that the process of self-regulation is more evident through verbal explanation than in the written test results.

Based on the overall research findings, it can be concluded that subjects with high mathematical ability and an auditory learning style demonstrate comprehensive critical thinking skills, as defined by Facione's indicators. This capability is supported by the characteristics of an auditory learning style, which facilitate the development of critical thinking skills by inclining students to utilize information gained from a teacher's explanations to grasp concepts, determine strategies, provide justifications, and evaluate the outcomes of problem-solving processes.

c. Kinesthetic Learning Style of Students

Based on the analysis of the written test and interview, the subject with a kinesthetic learning style met all the critical thinking indicators as defined by Facione: interpretation, analysis, inference, explanation, evaluation, and self-regulation. The written test results indicate that the subject was able to identify information provided in the problems, determine appropriate problem-solving strategies, perform probability calculations accurately, justify their chosen answers, and draw conclusions based on probability concepts. The interview results reinforce these findings, as the subject was able to coherently explain their thought process from understanding the problem, determining a solution strategy, and performing calculations to evaluating the results and reflecting on the answers obtained.

Regarding the interpretation indicator, the subject is able to identify the given and requested information in both problems, and understands the concept of probability as the ratio of the number of favorable outcomes to the total number of possible outcomes. This ability demonstrates that the subject can grasp the meaning of the information provided in the problems before determining the steps for a solution. These findings align with the theory of Facione (1990), which states that interpretation is the ability to understand and assign meaning to information, serving as a foundation for the critical thinking process.

Regarding the analysis indicator, the subject is able to connect the information provided in the problem with relevant probability concepts. This is evident when the subject determines the number of outcomes that satisfy the given conditions and relates this to the total number of outcomes in the sample space to construct a probability model. Based on the interview, the subject explained that it is easier to grasp the problem by calculating each element individually, which then helps in identifying the subsequent steps toward a solution. This characteristic suggests a

kinesthetic learning style, where the individual understands material through direct involvement in the problem-solving process. These findings align with Fleming's perspective, which posits that learners with a kinesthetic learning style tend to grasp concepts through hands-on activities and concrete learning experiences.

Regarding the inference indicator, the subject is able to draw conclusions based on the calculations performed. The subject determines that the probability of winning a prize from the "Fortune Box" (Kotak Rezeki) is higher than that from the "Star Box" (Kotak Bintang), and therefore concludes that the Fortune Box is the more advantageous choice. In the second problem, the subject concludes that the probability of rolling a 6 remains $\frac{1}{6}$, as each die roll is an independent event. This conclusion is derived from accurate calculations and supported by appropriate probability concepts. This demonstrates that the subject is not only capable of carrying out computational procedures but is also able to use those results as a basis for making logical decisions.

Regarding the explanation indicator, the subject is able to outline the steps for reaching a solution in a sequential manner and provide justifications for the strategies employed. The subject explains that the probability formula was chosen because it is the appropriate method for solving both of the given problems. Furthermore, the subject is able to articulate why the "Fortune Box" (Kotak Rezeki) offers a higher probability and why the outcome of a previous trial does not influence the probability of subsequent trials. This demonstrates that the subject is capable of communicating their thought process logically and providing justification for the decisions made.

Regarding the evaluation indicator, the subject demonstrated the ability to review their work by recalculating each step of the solution process and ensuring that the final answer aligned with the requirements of the problem. Meanwhile, concerning the self-regulation indicator, the subject stated that if any errors were discovered, they would correct the calculations and re-examine the entire solution process until the correct answer was obtained. These findings indicate that the interview results complement the data from the written test, as the processes of reflection and self-correction are not explicitly visible on the student's answer sheet.

Based on the overall research findings, it can be concluded that subjects with high mathematical ability and a kinesthetic learning style demonstrate comprehensive critical thinking skills across all of Facione's indicators. Active engagement in every step of the problem-solving process, a tendency to learn through hands-on experimentation, and the habit of double-checking one's work are the primary characteristics that facilitate critical thinking. These results reinforce the notion that a kinesthetic learning style influences how students understand, analyze, solve, evaluate, and reflect upon mathematical problem-solving, specifically within the context of probability.

Based on an analysis of the critical thinking skills of students with visual, auditory, and kinesthetic learning styles, it was found that all three subjects were able to meet the critical thinking indicators as defined by Facione namely interpretation, analysis, inference, explanation, evaluation, and self-regulation. Although the indicators achieved were relatively similar, there were differences in how each subject understood information, connected that information to concepts of probability, determined problem-solving strategies, explained their thought processes, conducted evaluations, and reflected on their solutions. These differences were evident in the specific characteristics of the problem-solving processes demonstrated by each subject.

Subjects with a visual learning style relied more on written information, numbers, fractions, and mathematical representations; those with an auditory learning style leaned more on verbal explanations they had previously heard; while subjects with a kinesthetic learning style emphasized direct engagement through step-by-step calculation and verification.

To provide a clearer picture of the similarities and differences in critical thinking skills across the three learning styles, the research findings are presented by grouping them according to each critical thinking indicator. This categorization serves to examine the characteristics of how each indicator manifests in students with visual, auditory, and kinesthetic learning styles, as well as to identify the differences in the processes they employ when solving probability problems. The comparison of critical thinking skills based on these learning styles is presented in the following table.

Table 2. Comparison of Critical Thinking Skills Based on Students' Learning Styles

Indicators of Critical Thinking	Visual	Auditory	Kinesthetic
Interpreta-tion	Understanding information by reading, observing, and noting down key points, as well as using mathematical representations.	Understanding information by recalling verbal explanations previously provided by the teacher.	Understanding information through direct application in the problem-solving process.
Analysis	Connecting information to the concept of probability through numbers, fractions, and percentages.	Connecting information with concepts and strategies based on the teacher's explanations that one remembers.	Connecting information with concepts through direct and step-by-step calculations.
Inference	Using calculation results and percentage representations to draw conclusions.	Using calculation results and explaining the reasoning behind the conclusion verbally.	Using the results from a direct calculation process to reach a conclusion.
Explanation	Explaining the steps in a logical sequence by utilizing written information and mathematical representations.	Clearly articulate the steps and reasoning for the solution.	Explaining a process based on actions and calculations performed directly.
Evaluation	Reviewing information, calculations, and the appropriateness of answers by	Cross-referencing the steps and answers with the formulas or explanations one recalls.	Calculating and double-checking the results firsthand to ensure no errors occur.

Indicators of Critical Thinking	Visual	Auditory	Kinesthetic
	examining the written results.		
Self-Regulation	Reviewing answers and prepared to correct errors based on written information.	There is an awareness of the need for improvement and a tendency to rely on the teacher's explanations, yet concrete corrective actions do not always follow.	Demonstrates a tendency to carry out checks and corrections through direct action and recalculation.

Based on the research findings, all three subjects with visual, auditory, and kinesthetic learning styles, respectively met the six indicators of critical thinking as defined by Facione: interpretation, analysis, inference, explanation, evaluation, and self-regulation. Although they achieved the same indicators, there were differences in the processes they employed to solve probability problems. Visual subjects tended to rely on written information, numbers, symbols, and mathematical representations; auditory subjects leaned toward utilizing verbal explanations they had previously heard; while kinesthetic subjects tended to grasp problems through direct engagement, step-by-step calculation, and re-checking. Thus, differences in learning styles do not manifest in the attainment of critical thinking indicators, but rather in the specific ways students process information and demonstrate critical thinking skills when solving probability problems.

4. CONCLUSION

Based on the results of the data analysis and discussion, the research findings can be summarized as follows.

1. Critical thinking skills of junior high school students with a visual learning style in solving probability problems.

   Students with a visual learning style demonstrate proficiency across all aspects of critical thinking skills. They are able to identify given information and what is being asked, while also grasping the concept of probability through information presented in the form of text, symbols, and formulas. Furthermore, these students can connect the information provided in a problem to the concept of probability by constructing appropriate mathematical models. During the problem solving process, they perform probability calculations accurately and draw conclusions based on these results. Additionally, they can outline the steps taken in a logical, sequential manner and provide sound reasoning for their answers. They also review their calculations to ensure that their final answers align with the requirements of the problem. Moreover, they are capable of reflecting on their problem-solving process, indicating a willingness to correct their steps should any errors be discovered. The characteristics of a visual learning style are evident in the students' tendency to comprehend problems through information presented as text, symbols, formulas, fractions, and numerical results all of which are visually compared before reaching a conclusion.

2. Critical thinking skills of junior high school students with an auditory learning style in solving probability problems.

   Students with an auditory learning style also fulfill all aspects of critical thinking skills as defined by Facione. These students are able to comprehend the information provided in a problem by recalling probability concepts previously explained by their teacher. They can also connect known information to relevant probability concepts by applying the problem-solving steps they have learned. Throughout the process, these students can accurately determine probabilities and draw logical conclusions consistent with probability theory for instance, by recognizing that each die roll constitutes an independent event. They are capable of explaining their problem-solving process systematically, providing justifications for the use of specific probability formulas. Furthermore, they review their own problem solving steps and the resulting calculations. If they discover an error, they indicate that they would re-calculate the problem and recall the teacher's prior explanations. The characteristics of an auditory learning style are evident in these students' tendency to rely on information they have heard such as a teacher's explanations as a foundation for understanding concepts, devising problem-solving strategies, and verifying their results.

3. Critical thinking skills of junior high school students with a kinesthetic learning style in solving probability problems.

   Students with a kinesthetic learning style are also capable of fulfilling all aspects of critical thinking skills as defined by Facione. These students can comprehend the information provided in a problem and identify the data necessary for its resolution. They determine a solution strategy by directly counting the number of outcomes that meet the given criteria and linking this to the concept of probability. Throughout the problem solving process, they perform probability calculations accurately and draw conclusions based on their results. Furthermore, they are able to outline the steps taken to reach a solution in a logical sequence, providing justifications for the use of specific probability concepts. Additionally, they review their calculations to ensure that their answers align with the original problem. These students demonstrate an ability to reflect on their own thought processes, indicating that they would correct their calculations should any errors be discovered. The characteristics of a kinesthetic learning style are evident in the students' tendency to grasp concepts through hands on activity such as counting individual outcomes, solving problems in a step by step manner, and verifying their calculations before arriving at a final conclusion.

Overall, the research findings indicate that students with high mathematical ability across all three learning styles (visual, auditory, and kinesthetic) are equally capable of meeting all the critical thinking skill indicators as defined by Facione. The observed differences do not lie in the extent to which these indicators are met, but rather in the characteristics of the thought processes employed to solve probability problems. Students with a visual learning style rely more on information presented in visual form; those with an auditory learning style make greater use of explanations they have heard; and students with a kinesthetic learning style grasp concepts more effectively through active involvement in the problem-solving process. Thus, while all three groups are equally capable of arriving at accurate solutions, their learning styles lead to differences in how they construct their critical thinking processes.

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