Relationship Between Students' Learning Interest and Mathematical Critical Thinking Skills Students in Statistics

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Opened Access Article

Published Online on 03 March 2026

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Relationship Between Students' Learning Interest and Mathematical Critical Thinking Skills Students in Statistics

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Article Info

ABSTRACT

The urgency of this research is based on the importance of developing critical thinking skills in 21st-century mathematics education, as well as the assumption that learning interest is one of the internal factors contributing to these skills. This study aims to analyze the relationship between students' learning interest and mathematical critical thinking skills students in Statistics. The study employed a quantitative approach with a correlational method. The sample consisted of 35 Grade X students from a public senior high school in Garut Regency, selected through purposive sampling. The research instruments included a learning interest questionnaire developed based on four main indicators and an essay test measuring mathematical critical thinking skills constructed in accordance with critical thinking indicators. The instruments were validated through expert judgment for content validity, and reliability testing was conducted using Cronbach's Alpha coefficient for the questionnaire and internal consistency testing for the essay test. Data were analyzed using the Shapiro–Wilk normality test, followed by Spearman's rho correlation test since one of the variables was not normally distributed. The results showed a correlation coefficient of 0.247 with a significance value of 0.152 (p > 0.05), indicating a weak and statistically non-significant positive relationship between learning interest and mathematical critical thinking skills. The novelty of this study lies in examining the relationship between the two variables specifically in the Statistics topic at the senior high school level. The findings imply that improving mathematical critical thinking skills cannot rely solely on enhancing students' learning interest but must also be supported by instructional strategies that promote higher-order thinking activities.

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Introduction

Mathematical critical thinking skills constitute one of the essential competencies in mathematics education. These skills include the ability to analyze problems, evaluate information, draw logical conclusions, and determine solutions based on rational arguments (Siswanto & Ratiningsih, 2020). More specifically, Syafruddin & Pujiastuti (2020) explain that critical thinking requires students to identify problems, collect relevant information, process data, and formulate appropriate conclusions through systematic and in-depth thinking processes. Conceptually, Facione (as cited in Maesaroh, 2021) states that critical thinking is a self-regulatory activity in making decisions based on processes of inference, analysis, interpretation, evaluation, explanation, and self-regulation, while considering relevant evidence and context. This view emphasizes that critical thinking is not merely an ordinary cognitive activity, but a controlled and rational reflective process. Furthermore, critical thinking skills imply cognitive processes that encourage students to think consciously and structurally according to their own line of reasoning (Juliyantika & Batubara, 2022).

In the context of mathematics learning, critical thinking plays a more specific role. Pertiwi (2018) states that mathematical critical thinking serves as a foundation for analyzing arguments and generating meaningful ideas to build logical reasoning patterns. In line with this, Hartanti (2019) adds that mathematical critical thinking skills represent higher-order thinking skills that rely on logic in organizing, analyzing, and evaluating information rationally. Therefore, mathematics learning should not only focus on procedural mastery but also on developing reasoning and reflection at every stage of problem-solving. Despite the widely acknowledged urgency of critical thinking skills, various findings indicate that students' mathematical critical thinking skills remain in the low to moderate category (Syafitri et al., 2021). This condition suggests that the development of higher-order thinking skills has not yet been optimal and is influenced by various factors. Rosmaini (2023) argues that critical thinking skills are affected by physical condition, intellectual development, and learning motivation. This perspective is further expanded by Ni'mah et al. (2025) who state that these factors also include anxiety and students' learning habits. Based on these factors, it can be seen that in addition to external factors such as instructional strategies, internal factors within students also play a role in determining the quality of their thinking processes. One relevant internal factor in this context is learning interest.

Learning interest refers to an individual's tendency to feel attracted, pay attention, and actively engage in learning activities (Hasibuan et al., 2022). Nugroho et al. (2020) emphasize that learning interest is a form of attraction accompanied by feelings of enjoyment in the learning process without external pressure. In the context of mathematics, Wijaya et al. (2022) state that interest in learning mathematics is characterized by enjoyment, curiosity, and active involvement in learning, which positively impacts learning outcomes. The importance of learning interest is also highlighted by Asih & Imami (2021) who state that students will experience difficulties in following lessons if they do not have an interest in a particular subject. Furthermore, Atikah & Jumrah (2024) argue that learning interest is specific to certain fields of study, including mathematics. In general, learning interest is influenced by internal factors such as attention, curiosity, motivation, and students' needs, as well as external factors derived from the learning environment (Mesra et al., 2021).

Several empirical studies have examined the relationship between learning interest and critical thinking skills. Ningrum et al.(2023) found that learning interest has a positive relationship with students' mathematical critical thinking skills. This finding is consistent with the results of Ismayanti et al. (2022), which show that learning interest contributes to the development of critical thinking skills. In general, students with higher learning interest tend to

demonstrate better critical thinking skills. However, the strength of the relationship reported in various studies varies, ranging from weak to moderate categories, and is not always statistically significant across different contexts. In this study, the topic of Statistics was selected because of its close relationship with critical thinking processes. Statistics teaches concepts of data presentation in the form of tables, diagrams, or graphs, as well as skills in interpreting and drawing conclusions from presented data (Wijayanti et al., 2024). In addition, Arifin (2020) states that learning statistics helps students analyze problems and make valid decisions based on data. These characteristics indicate that Statistics directly demands analytical, evaluative, and inferential skills, which are key indicators of critical thinking. Based on these considerations, this study aims to analyze the relationship between learning interest and mathematical critical thinking skills of Grade X students in the topic of Statistics using a quantitative correlational approach. The findings of this study are expected to provide a more comprehensive understanding of the relationship between the two variables in the context of Statistics learning at the senior high school level and to serve as a consideration for teachers in designing instruction that fosters students' interest while simultaneously developing their critical thinking skills.

Method

Research Design

This study employed a quantitative approach with a correlational design. The correlational design was selected because the study aimed to determine whether there is a relationship between learning interest and mathematical critical thinking skills without administering any treatment or manipulation to the variables under investigation. This research does not seek to examine a cause-and-effect relationship; rather, it aims to identify the strength and direction of the relationship between variables empirically based on the data obtained. The correlational design enables researchers to analyze the degree of association between two variables as they naturally occur within the context of ongoing classroom learning.

Population and Sample

Batara et al.(2025) determining the research population involves several stages, including defining the focus and objectives of the study, establishing inclusion and exclusion criteria, classifying the population as finite or infinite, and considering feasibility in terms of cost, time, and ethics. Based on these considerations, the population of this study comprised all Grade X students of SMAN 19 Garut in the second semester of the 2024/2025 academic year. A sample is a subset of the population that possesses certain characteristics and represents the research population. Sugiyono (2023), defines a sample as part of the number and characteristics of the population used for measurement and drawing conclusions. In this study, the sampling technique employed was purposive sampling, which involves selecting participants based on their suitability with the research objectives. The inclusion criteria were as follows: Students had completed the Statistics topic in accordance with the applicable curriculum, Students had heterogeneous academic characteristics based on information from the subject teacher, Students were willing to participate in the entire data collection process. A total of 35 students were selected as the sample because this number meets the minimum requirement for correlational analysis involving interval/ordinal scale data in educational research and is sufficient for the Shapiro–Wilk normality test, which is recommended for samples of fewer than 50 respondents.

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Table 1. Sample Demographics

Gender	Frequency	Percentage
Male	15	42,9%
Female	20	57,1%
Total	35	100%

Instruments and Procedures

This study employed two types of instruments. The learning interest instrument was a questionnaire consisting of 30 statements developed based on the indicators of learning interest proposed by Safari (Apriyanto & Herlina, 2020). Safari's indicators were selected because they have been widely used in educational research and encompass affective and behavioral dimensions relevant to the context of mathematics learning. The indicators of learning interest used in this study included: 1) enjoyment in learning, 2) interest in the subject matter, 3) active involvement in learning activities, and 4) effort and attention in understanding the lesson. Of the 30 statements, 15 were positive statements and 15 were negative statements. Each statement was rated using a four-point Likert scale. For positive statements, the scoring categories were: Strongly Agree (4), Agree (3), Disagree (2), and Strongly Disagree (1). For negative statements, reverse scoring was applied: Strongly Agree (1), Agree (2), Disagree (3), and Strongly Disagree (4). Prior to implementation, the questionnaire was tested for validity and reliability. Validity was examined using the Product Moment correlation, while reliability was calculated using Cronbach's Alpha coefficient. The instrument was considered reliable if the Alpha value was greater than 0.70. The maximum possible score for the questionnaire was 120, and the minimum score was 30. Score classification was determined based on the ideal score range shown in Table 2, and examples of the learning interest questionnaire items are presented in Table 3.

Table 2. Classification of Learning Interest

Interval	Level of Learning Interest
30-59	Low
60-89	Moderate
90-120	High

Table 3. Sample Items of the Learning Interest Questionnaire

Questionnaire Item	Indicator
Item #1. I ask questions when there is a Statistics concept that I do not yet understand.	Active involvement in learning
Item #2. I allocate time to study Statistics material independently at home to deepen my understanding	Effort and attention in understanding the lesson

The mathematical critical thinking skills test consisted of five essay questions developed based on the indicators of critical thinking skills proposed by Lestari & Roesdiana (2021), These indicators were selected because they specifically measure critical thinking skills in the context of mathematics and have been used in various similar studies. The indicators used in this study included: 1) providing simple explanations, 2) building basic skills, 3) drawing conclusions, 4) providing further explanations, and 5) organizing strategies and tactics. All items were constructed in accordance with the Statistics topic for Grade X students in the second semester. Each item was scored on a scale ranging from 0 to 4 based on a predetermined

scoring rubric. Thus, the total possible score ranged from 0 as the minimum score to 20 as the maximum score. The classification of mathematical critical thinking skills scores is presented in Table 4, and a sample essay test item is shown in Table 5.

Table 4. Classification of Mathematical Critical Thinking Skills

Interval	Level of Critical Thinking Skills
0-6	Low
7-13	Moderate
14-20	High

The test was also examined for content validity through expert judgment and tested for reliability using the Cronbach's Alpha technique.

Table 5. Sample Essay Test Instrument

Question	Indicator
The mathematics test scores of 40 students are presented in the following frequency distribution table: 	**Drawing conclusions** Students are expected to accurately calculate the mean of grouped data and draw conclusions based on the calculation results within the given problem context.

Score Interval	Frequency
40 – 49	2
50 – 59	4
60 – 69	8
70 – 79	15
80 – 89	7
90 – 99	4

Calculate the mean (arithmetic average) of the grouped data above, and interpret what this mean implies for a teacher who wants to determine the average ability of students in the class.

Procedure

This study was conducted through several systematic stages. The initial stage involved developing the research instruments, namely the learning interest questionnaire and the mathematical critical thinking skills test, which were constructed in accordance with the indicators of each variable. The instruments that had been developed were then validated by experts to assess their content relevance, construction, and language clarity. Afterward, a pilot test was conducted to determine the validity and reliability of the instruments. Instruments that met the established criteria were subsequently used for data collection. The data collection process began with administering the mathematical critical thinking skills test to students after the completion of the Statistics learning material, followed by the distribution of the learning interest questionnaire. The data obtained were then processed and analyzed according to the predetermined analysis procedures.

Analysis

Data analysis was carried out through several stages. First, descriptive statistical analysis was conducted to determine the mean scores, score distribution, and the categories of students' learning interest and mathematical critical thinking skills. Next, a normality test was performed using the Shapiro–Wilk test because the sample size was fewer than 50 students. The results of

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the normality test served as the basis for determining the appropriate correlation test. If both variables were normally distributed, the Pearson Product Moment correlation test was applied. However, if one or both variables were not normally distributed, the Spearman Rank correlation test was used. The decision-making criteria were based on the significance value (p). If $p < 0.05$, there is a significant relationship between learning interest and mathematical critical thinking skills; conversely, if $p \geq 0.05$, there is no significant relationship between the two variables.

Research Findings

This study aimed to determine whether there is a significant relationship between students' learning interest and their mathematical critical thinking skills. The data were obtained from 35 students of Class X-9 at SMAN 19 Garut. The data collected included students' learning interest questionnaire responses and the post-test results of mathematical critical thinking skills. To test the research hypothesis, a correlation analysis was conducted. Prior to performing the correlation test, a prerequisite test namely the normality test was carried out to determine the appropriate type of correlation analysis to be used.

Results of Students' Learning Interest

Based on the research findings, the percentage distribution of students' learning interest questionnaire results is presented in Figure 1.
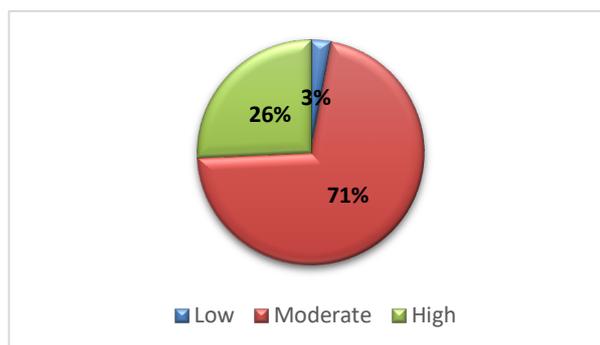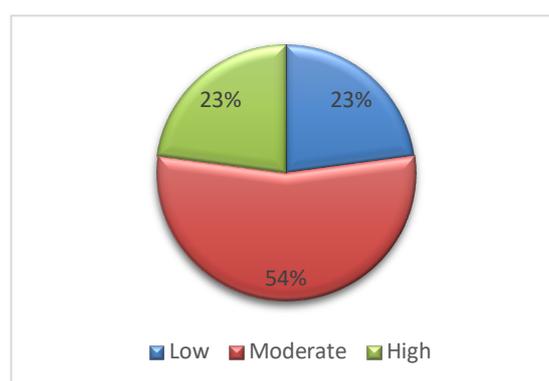

Figure 1. Percentage Distribution of Students' Learning Interest Categories

Based on Figure 1, it is known that the majority of Class X-9 students fall into the moderate category of learning interest, accounting for 71%. Meanwhile, 26% of students are categorized as having high learning interest, and only 3% are in the low category. This indicates that most students already possess a sufficient level of motivation and interest in participating in learning activities.

Results of Mathematical Critical Thinking Skills

The percentage distribution of students' mathematical critical thinking skills categories is presented in Figure 2.

Figure 2. Percentage Distribution of Mathematical Critical Thinking Skills

Based on Figure 2, 54% of the students fall into the moderate category, while 23% are in the high category and another 23% are in the low category. This indicates that the majority of students demonstrate an adequate level of critical thinking skills in solving mathematical problems, although there are still students in both the low and high categories in equal proportions.

Normality Test

Before conducting the correlation analysis between variables, a normality test was performed using the Shapiro–Wilk test because the sample size consisted of 35 students ($n < 50$), with a significance level of 0.05. The following presents the results of the normality test for the mathematical critical thinking skills test data and the learning interest questionnaire data using SPSS software.

Table 6. Results of the Normality Test for Learning Interest and Mathematical Critical Thinking Skills

Tests of Normality

	Shapiro-Wilk		
	Statistic	df	Sig.
Learning Interest	0,966	35	0,334
Mathematical Critical Thinking Skills	0,910	35	0,007

Based on Table 6, it can be concluded that the learning interest variable has a significance value of $0.334 > 0.05$, indicating that the data are normally distributed. However, the mathematical critical thinking skills variable has a significance value of $0.007 < 0.05$, indicating that the data are not normally distributed. Therefore, to determine the relationship between the variables, the non-parametric Spearman's Rho correlation test was used.

Spearman Correlation Test

The results of the correlation test between learning interest and mathematical critical thinking skills using Spearman's rho are presented in Table 7.

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Table 7. Results of the Spearman Correlation Test between Students' Learning Interest and Mathematical Critical Thinking Skills

Correlations			Learning Interest	Mathematical Critical Thinking Skills
Spearman's rho	Learning Interest	Correlation Coefficient	1,000	0,247
		Sig. (2-tailed)		0,152
		N	35	35
	Mathematical Critical Thinking Skills	Correlation Coefficient	0,247	1,000
		Sig. (2-tailed)	0,152	
		N	35	35

The results of the Spearman correlation test show a correlation coefficient of 0.247 with a significance value of 0.152 ($p > 0.05$). Therefore, it can be concluded that there is no statistically significant relationship between students' learning interest and their mathematical critical thinking skills. This finding indicates that, in the context of Statistics learning in Grade X, learning interest has not yet emerged as a factor that is directly correlated with students' mathematical critical thinking skills.

Discussion

This study aimed to analyze the relationship between learning interest and mathematical critical thinking skills of Grade X students in the topic of Statistics. The findings indicate that the majority of students fall into the moderate category for both learning interest and mathematical critical thinking skills. This suggests that students have demonstrated a certain level of interest and engagement in mathematics learning; however, they have not yet reached an optimal level in higher-order thinking activities. The correlation test results revealed a coefficient of 0.247 with a significance value of 0.152 ($p > 0.05$). Statistically, these results indicate a positive but weak and non-significant relationship between learning interest and mathematical critical thinking skills. Although the direction of the relationship suggests that students with higher learning interest tend to have better critical thinking skills, the weak strength of the correlation implies that learning interest is not a dominant factor in shaping mathematical critical thinking skills within the context of this study.

These findings differ from several previous studies that reported a positive and significant relationship between learning interest and mathematical critical thinking skills. Ningrum et al.(2023) and Ismayanti et al.(2022) for example, found that learning interest contributes to the improvement of students' critical thinking skills. The discrepancy in findings may be influenced by variations in student characteristics, the subject matter examined, and the instructional approaches implemented. The variation in correlation strength across studies also suggests that the relationship between these two variables is contextual in nature. In the context of Statistics, critical thinking skills require not only interest in learning but also the ability to analyze data, interpret information, and draw conclusions based on data representations. This process involves higher-order cognitive abilities that require conceptual understanding, accuracy, and experience in data-based problem solving. Therefore, although learning interest may enhance students' engagement, mathematical critical thinking skills in Statistics appear to be more strongly influenced by cognitive factors and systematic learning experiences.

Theoretically, critical thinking is a self-regulatory process involving analysis, evaluation, and inference in decision-making (Maesaroh, 2021). This process is influenced not only by affective factors such as interest but also by intellectual readiness, study habits, and instructional strategies applied by teachers. Thus, the results of this study reinforce the view that mathematical critical thinking skills constitute a multidimensional construct that cannot be explained by a single internal variable. The findings imply that improving mathematical critical thinking skills cannot rely solely on strengthening learning interest. Teachers need to design learning experiences that promote analytical activities, argumentative discussions, data exploration, and challenging contextual problem solving. Learning interest may serve as a supporting factor; however, the development of critical thinking requires instructional strategies that explicitly train students' analytical, evaluative, and reasoning processes. Overall, the results of this study indicate that the relationship between learning interest and mathematical critical thinking skills in the Statistics topic falls into a weak and non-significant category. These findings suggest that the relationship between the two variables is not always consistent across learning contexts. Therefore, further research involving a larger sample size and considering additional variables such as self-efficacy, instructional models, prior knowledge, and learning environment factors is recommended to obtain a more comprehensive understanding.

Conclusion

Based on the research findings, both learning interest and mathematical critical thinking skills of Grade X students in the Statistics topic fall into the moderate category. The results of the Spearman correlation test indicate that the relationship between learning interest and mathematical critical thinking skills is positive but weak and not statistically significant ($r = 0.247$; $p = 0.152$). These findings suggest that learning interest is not a dominant factor that directly determines students' mathematical critical thinking skills in the context of Statistics learning. The results imply that the development of mathematical critical thinking skills requires a more comprehensive approach. It cannot rely solely on strengthening affective aspects such as learning interest, but must also involve instructional strategies that systematically train students' analytical, evaluative, and reasoning activities. Teachers need to design learning experiences that promote higher-level cognitive engagement in order to optimize the development of students' critical thinking skills. This study is limited by the relatively small sample size and the involvement of only one class in a single learning topic, which means the findings cannot be broadly generalized. Therefore, future research is recommended to involve a larger sample, consider additional variables such as self-efficacy, prior knowledge, or instructional models, and employ more diverse research designs to obtain a more comprehensive understanding of the factors influencing mathematical critical thinking skill.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this study.

Authors' Contributions

N.S. conceptualized the research idea presented in this study and was responsible for data collection, theoretical development, methodology design, data organization, and data analysis. U.I., as the research supervisor, actively participated in the discussion of the results and approved the final version of the manuscript. All authors declare that the final version of this

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paper has been read and approved. The total percentage of contribution to the conceptualization, writing, and revision of this manuscript is as follows: N.S.: 50%, and U.I.: 50%.

Data Availability Statement

The data supporting the findings of this study are available from the corresponding author, N.S., upon reasonable request.

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