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The Relationship Between Learning Motivation and Critical Thinking on Mathematics Learning Outcomes of Class VIII Students at MTS PP Darussalam

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Abstract: This study aims to determine whether there is a significant relationship between learning motivation and students' mathematical critical thinking skills at MTs PP Darussalam. The research method used is quantitative correlation. The study population was all students of MTs PP Darussalam, with a sample of 21 students taken using a purposive sampling technique. The research instruments were a learning motivation questionnaire (25 statement items) and a mathematical critical thinking ability test (learning outcome scores). Data analysis used Product Moment correlation. The results of the analysis showed a positive correlation between learning motivation and critical thinking skills. This indicates that the higher a student's learning motivation, the higher their mathematical critical thinking skills.

Keywords: Learning motivation, critical thinking, mathematics learning outcomes

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INTRODUCTION

Within the framework of Indonesia's national education system, mathematics instruction is not only directed toward mastering procedures and computational outcomes, but also toward developing students' abilities to reason, analyze, and solve problems. Accordingly, mathematical critical thinking has become one of the essential competencies that should be cultivated in students. In mathematics learning, this ability is reflected in students' capacity to analyze information, evaluate solution strategies, provide logical justification, and draw accurate conclusions. Maghfiroh and Dasari (2023) emphasize that mathematical critical thinking is a crucial ability for understanding and solving mathematical problems rationally. This assertion is consistent with the findings of Marzuki et al. (2021), who showed that critical thinking in mathematical problem solving involves interpreting problems, assessing information, selecting strategies, and verifying results, as well as with Afifah, Prihaswati, and Suprayitno (2025), who stress that critical thinking in mathematics enables students to understand concepts comprehensively rather than merely perform mechanical calculations. In the national context, this orientation is also aligned with Law Number 20 of 2003, which positions education as a process of developing learners' potential in a holistic manner.

The urgency of strengthening mathematical critical thinking becomes even more apparent when linked to the learning achievement of Indonesian students, which remains weak in the domain of reasoning. OECD data show that in PISA 2022 only 18% of Indonesian students attained at least Level 2 in mathematics, far below the OECD average of 69%, and almost no Indonesian students reached Levels 5 or 6, which require the ability to model complex situations and to select and evaluate problem-solving strategies appropriately. This condition indicates that mathematics instruction still needs to be more strongly oriented toward higher-order thinking activities. In addition, research by Tambunan and Mahmudi (2024) shows that improvements in mathematical critical thinking are accompanied by increases in learning motivation, while a 2024 study on MTs students in Agam found that learning motivation has a significant effect on students' mathematical critical thinking ability. Thus, the development of mathematical critical thinking is important not only in terms of curriculum demands and international assessment outcomes, but also in terms of learning conditions that can stimulate student engagement and motivation.

One factor suspected of contributing to the low level of mathematical critical thinking is learning motivation. Empirical studies have shown that learning motivation is related to the quality of students' engagement in thinking processes. Aswin et al. (2022) demonstrated that learning motivation affects students' mathematical critical thinking ability and, together with intrapersonal intelligence, constitutes a significant factor in explaining variations in that ability. This finding is reinforced by Supriadi et al. (2024), who showed that learning motivation is closely related to mathematical cognitive processes, particularly through problem solving and mathematical reasoning. Thus, students with high learning motivation tend to be more persistent, more active, and more prepared to engage in analysis, evaluation, and mathematical decision-making processes, whereas students with low motivation tend to avoid challenges and focus only on final answers.

Although the relationship between learning motivation and mathematical critical thinking has begun to receive attention, studies over the past decade indicate that research on mathematical critical thinking is still dominated by

investigations focusing on instructional models, problem-based learning strategies, and classroom interventions. Suryawan et al. (2023), for example, in a systematic literature review, emphasized that research on mathematical critical thinking has largely centered on argumentation, reasoning, problem-based learning, and the digitalization of instruction. Tambunan and Mahmudi (2024) also showed that contextual learning interventions can enhance both mathematical critical thinking and learning motivation. However, there remains relatively limited research that specifically examines the extent to which learning motivation contributes to mathematical critical thinking in the context of MTs students. It is at this point that the research gap of the present study is located. This study was conducted to analyze the contribution of learning motivation to students' mathematical critical thinking ability, so that its findings are expected to provide an empirical basis for teachers to design instruction that not only improves learning outcomes but also strengthens the learning motivation that underpins students' critical thinking processes.

METHODS

This study employed a quantitative approach because it focused on collecting and analyzing numerical data to measure students' learning motivation, critical thinking ability, and learning outcomes, which were subsequently analyzed statistically to determine the relationships among variables. The type of research used was correlational research, that is, a non-experimental design intended to measure the degree and direction of the relationship between two or more variables without manipulating the variables under investigation. This design was selected because the study aimed to examine the relationship between learning motivation and learning outcomes, the relationship between critical thinking and learning outcomes, as well as the simultaneous relationship of learning motivation and critical thinking with learning outcomes among সপ্ত-grade students at MTs PP Darussalam. Thus, this study did not seek to establish causal relationships, but rather to describe the strength and direction of naturally occurring relationships among variables.

To measure validity, a Likert scale was used in the questionnaire analysis, as shown in Table 2.

Table 1. Likert Scale Category Scores

Statement	Skor				
	Ss	**Sr**	**Kd**	**Jr**	**Js**
Positif	5	4	3	2	1
Negatif	1	2	3	4	5

Source: Sugiyono (2017)

The formula used to find the percentage of each questionnaire subject is as follows:

$$P = \frac{Jumlah\ skor\ yang\ diperoleh}{Skor\ maksimal}\ x\ 100\%$$

The percentage obtained from the validator's assessment results is then concluded with the following criteria:

Tabel 2. Percentage Range and Validity

No.	Interval (I)	Criteria
1	80%<I≤100%	Very Valid
2	60%<I≤100%	Valid
3	40%<I≤100%	Fairly Valid
4	20%<I≤100%	Invalid
5	0%<I≤100%	Very Invalid

Source: modified from Arikunto (2012)

RESULT AND DISCUSSION

This section presents the research findings and discussion based on data that have been processed statistically. The presentation of the findings aims to provide an empirical description of students' level of learning motivation and its relationship with their learning outcomes. To examine this relationship, correlation analysis was employed, enabling the researcher to determine the direction and strength of the relationship between learning motivation and students' learning outcomes. Before presenting the results of the correlation test, a recapitulation of the main research data is first provided, containing the students' learning motivation scores in percentage form and their learning outcome scores for 21 students. The presentation of these preliminary data is necessary so that the distribution and tendencies of each variable can be understood more

clearly. On this basis, the statistical analysis presented in the following section can be interpreted more systematically.

Table 3. Recapitulation of Students' Motivation Scores and Learning Outcomes

No.	Student Name	Motivation Score	Learning outcomes
1	S-01	82	70
2	S-02	106	60
3	S-03	75	70
4	S-04	78	70
5	S-05	101	95
6	S-06	101	98
7	S-07	97	95
8	S-08	76	70
9	S-09	78	60
10	S-10	88	95
11	S-11	82	70
12	S-12	79	55
13	S-13	77	70
14	S-14	79	60
15	S-15	89	93
16	S-16	88	90
17	S-17	85	70
18	S-18	98	95
19	S-19	91	88
20	S-20	77	30
21	S-21	104	93

Based on data from 21 students, learning motivation scores ranged from 75 to 106, with a mean of 87.19, while learning outcomes ranged from 30 to 98, with a mean of 76.05. The Pearson correlation analysis yielded r = 0.626, indicating that learning motivation had a moderately strong positive relationship with learning outcomes. This means that, in general, the higher the motivation score, the higher the student's learning outcome. The value of $R^2 = 0.392$ indicates that approximately 39.2% of the variance in learning outcomes could be explained by learning motivation, while the remaining 60.8% was influenced by other factors.

Descriptively, the data pattern also showed that several students with high motivation tended to achieve high learning outcomes, such as S-05, S-06, S-07, S-18, and S-21. However, there were also data points that deviated from the general pattern, such as S-02, who had a very high motivation score (106) but a relatively low learning outcome (60), and S-20, who had a moderate motivation score (77) but a very low learning outcome (30). This pattern indicates that the relationship between motivation and learning outcomes is real, but not absolute.

The findings show that learning motivation has a fairly strong positive relationship with students' mathematics learning outcomes, with a Pearson correlation coefficient of 0.626. This indicates that the higher the students' learning motivation, the stronger the tendency for their learning outcomes to improve. Theoretically, this finding is consistent with Howard et al. (2021), who explained that intrinsic motivation and identified regulation are associated with academic success, academic well-being, and student persistence. Thus, learning motivation can be understood as one of the important forms of capital in supporting students' academic achievement.

Nevertheless, this relationship is not absolute. In this study, there were students with very high motivation but still low learning outcomes. This condition indicates that motivation alone is not sufficient to produce optimal achievement. Rovan et al. (2024) stated that motivational beliefs in mathematics are related to learning engagement through self-regulated learning, meaning that students who are motivated but unable to manage their learning effectively may still obtain low results. This is reinforced by Liu et al. (2024), who showed that mathematics self-efficacy is positively related to mathematics achievement, meaning that learning outcomes are also determined by students' beliefs in their own abilities.

In addition, Shimizu (2025) showed that self-efficacy is positively related to mathematics learning outcomes, whereas mathematics anxiety is negatively related to them. Therefore, the findings indicate that mathematics learning outcomes are influenced not only by motivation, but also by self-efficacy, learning engagement, and students' emotional conditions. Xia et al. (2022) even found that there are groups of students who still obtain low scores despite demonstrating high learning engagement. Thus, learning motivation in this study plays an important role, but it needs to be supported by strengthening conceptual understanding, self-regulation, and self-confidence so that mathematics learning outcomes can improve optimally.

This study examined the relationship between learning motivation and mathematics learning outcomes. Based on the processed data, the average learning motivation of students reached 73.73%, with scores ranging from 60.0% to 84.8%, which can be categorized as moderate to high. Meanwhile, the average mathematics learning outcome was 76.14, with the highest score being 98 and the lowest 30. These findings indicate that, in general, students had fairly good learning drive, although their learning outcomes still showed considerable variation.

Before the relationship analysis was conducted, the scores for the unfavorable items, namely P15, P21, and P23, were first reversed so that the direction of all item scores became consistent. After the score correction, the Pearson correlation analysis produced a correlation coefficient of $r = 0.485$. This value indicates a positive relationship of moderate strength between learning motivation and mathematics learning outcomes. In other words, the higher the students' learning motivation, the more likely their mathematics learning outcomes were to improve. Based on this correlation value, the coefficient of determination was approximately 23.5%, meaning that learning motivation contributed 23.5% to the variation in students' mathematics learning outcomes, while the rest was influenced by other factors outside the variables examined in this study.

The simple linear regression analysis produced the equation $Y = -23.98 + 1.36X$. This equation means that every one-unit increase in the learning motivation score was followed by an increase of 1.36 points in mathematics learning outcomes. Thus, learning motivation can be understood as one predictor that contributes to improving learning outcomes, although it is not the only determining factor.

Individually, the data also showed variation in the relationship pattern. Some students demonstrated an ideal pattern, namely high motivation accompanied by high learning outcomes. However, anomaly cases were also found, namely students with relatively high motivation but very low learning outcomes. This pattern indicates that learning motivation does not automatically produce high academic performance. On the other hand, there were also students with relatively lower motivation who were still able to achieve fairly good scores. This variation shows that mathematics learning outcomes are influenced by the interaction of many factors, not motivation alone.

Discussion

The research findings indicate that learning motivation has a positive relationship of moderate strength with mathematics learning outcomes. This result suggests that motivation functions as a form of psychological energy that encourages students to engage in learning activities, persist when facing difficulties, and continue striving to complete mathematical tasks. This explanation is consistent with Self-Determination Theory, which emphasizes that more autonomous forms of motivation, particularly intrinsic motivation and personal value, are more strongly associated with achievement, learning well-being, and student persistence. The meta-analysis by Howard et al. (2021) shows that intrinsic motivation is associated with student success, whereas identified regulation is strongly related to persistence. In line with this, the meta-analysis by Wang et al. (2024) shows that interventions based on Self-Determination Theory are able to enhance students' intrinsic motivation, autonomy, and competence. Thus, the relatively high average level of motivation in this study represents an important form of capital that may support students' mathematics learning outcomes.

Nevertheless, the fact that the strength of the relationship falls only within the moderate category indicates that motivation is not the sole determinant of learning outcomes. This finding is consistent with expectancy-value and self-regulated learning perspectives, which regard motivation as an important driving force, but suggest that its effect on learning outcomes often operates through learning engagement, self-regulation strategies, and effort management. Rovan, Petričević, and Pavlin-Bernardić (2024) show that motivational beliefs in mathematics do not directly predict learning engagement, but are instead mediated by beliefs related to self-regulation. Jiang and Zhang (2023) also found that students' expectancy, value, and cost profiles are meaningfully related to engagement and achievement. This means that motivated students will not necessarily achieve high outcomes if they do not yet possess adequate self-regulation, competence perceptions, and cost management in learning.

This explanation helps clarify why some students with relatively high motivation still obtain low learning outcomes. In this context, motivation may be viewed as a necessary condition, but not a sufficient one, for producing strong mathematics achievement. Research by Liu, Jong, and Fan (2024) shows that self-efficacy is significantly related to mathematics achievement over time. Zou (2025) also found that mathematical self-efficacy positively mediates the relationship between motivation and mathematics performance. Meanwhile, Shimizu (2025) shows that self-efficacy is positively related to behavioural engagement and mathematics achievement, whereas mathematics anxiety tends to suppress learning engagement. Therefore, cases in which motivated students still obtain low scores are very likely related to weak self-efficacy, high mathematics anxiety, or ineffective engagement in solving mathematical problems.

The large proportion of variation in learning outcomes that is not explained by motivation also indicates that cognitive factors continue to play an important role. In mathematics learning, outcomes are determined not only by the willingness to learn, but also by the ability to reason, solve problems, and think critically. Duru and Obasi (2023) found a significant, although low, positive correlation between critical thinking ability and mathematics achievement, especially among low-ability students. On the other hand, Supriadi et al. (2024) showed that mathematical reasoning is positively related to learning motivation, and that problem solving serves as an important mediator in enhancing motivation. This means that motivation will be more effective in producing academic achievement when students also possess adequate reasoning and problem-solving skills. In other words, your finding that motivation explains only part of the variation in learning outcomes is theoretically logical.

The pedagogical implication of these findings is that mathematics learning should not merely aim to stimulate students' enthusiasm for learning, but should also be designed to train higher-order thinking processes. The systematic review by Nafiah, Kusumah, and Dahlan (2024) shows that, in mathematics education, the most popular and most effective method for improving critical thinking skills is problem-based learning. Therefore, instruction that places students in contextual problems, demands argumentation, and provides space for reflection may be a more appropriate strategy for linking motivation with learning outcomes. In the context of this study, students who appear motivated but have not yet succeeded may require conceptual scaffolding, gradual reasoning exercises, and support in problem solving, rather than merely affective encouragement.

CONCLUSION

Based on the results of the research data analysis, it can be concluded that the learning motivation and critical thinking ability of eighth-grade students at MTs PP Darussalam are in the high category. This finding indicates that most students have demonstrated good learning engagement as well as adequate critical thinking skills in mathematics learning. The research findings also provide empirical support that learning motivation is related to critical thinking ability, in which students with high motivation tend to be more active, persistent, and able to use reasoning more effectively in solving academic problems. Thus, learning motivation and critical thinking ability can be regarded as two important factors that contribute to the improvement of students' mathematics learning outcomes.

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