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Integrating Ethnomathematics into Mathematics Learning: Effects on Students' Critical Thinking Skills, Self-Efficacy, and Learning Motivation

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Abstract

This study examines the effects of learning motivation and mathematical self-efficacy on students' critical thinking skills in an ethnomathematics-based learning context. A quantitative correlational design was employed. The sample consisted of 34 eighth-grade students selected through simple random sampling. Data were collected using a learning motivation questionnaire, a mathematical self-efficacy questionnaire, and a critical thinking test designed based on culturally contextualized mathematical problems. Data were analyzed using regression and path analysis. The results show that mathematical self-efficacy has a significant positive effect on students' critical thinking skills ($\beta = 0.550$, $p < 0.05$), while learning motivation does not have a significant direct effect ($\beta = 0.237$, $p > 0.05$). Simultaneously, learning motivation and self-efficacy significantly influence critical thinking skills, with a coefficient of determination of 0.464. This indicates that these variables can explain 46.4% of the variance in critical thinking skills within an ethnomathematics-based learning environment. These findings suggest that students' confidence in their mathematical abilities plays a more dominant role than motivation in supporting critical thinking, particularly when engaging with culturally contextualized mathematical tasks. Ethnomathematics-based learning provides meaningful contexts that enhance engagement; however, its effectiveness in fostering higher-order thinking depends largely on students' self-efficacy. This study highlights the importance of integrating culturally responsive approaches in mathematics education while simultaneously strengthening students' self-efficacy to optimize the development of critical thinking.

Keywords: ethnomathematics, self-efficacy, learning motivation, critical thinking, mathematics education

INTRODUCTION

Primary Mathematics education plays a fundamental role in developing students' higher-order thinking skills (Peterson, 2026; Widana, 2018), particularly critical thinking (Jablonka, 2020; Skovsmose, 2020), which is essential for solving complex and non-routine problems (Jablonka, 2020; Mashood, 2024; Skovsmose, 2020; Tamaulina, 2025). Critical thinking enables students to analyze, evaluate, and justify mathematical reasoning rather than merely applying procedural knowledge (Brown, 2016; Lai, 2011; Su, Ricci, and Mnatsakanian, 2016). However, numerous studies indicate that students' critical thinking skills in mathematics remain relatively low, as they tend to rely on memorization rather than on reflective and analytical reasoning. This issue becomes more evident when students are confronted with abstract concepts, such as geometry and the Pythagorean theorem, which require deep conceptual understanding and logical justification.

Beyond cognitive factors, students' success in developing critical thinking skills is also influenced by affective factors (Almulla & Al-Rahmi, 2023; Terenzini et al., 1995), particularly learning motivation and self-efficacy (Bandura, 1993; Zimmerman, 2000). Learning motivation encourages students to engage actively in the learning process, while self-efficacy reflects students' confidence in their ability to perform mathematical tasks successfully (Zimmerman, 2000). Students with high self-efficacy tend to demonstrate persistence (Lent, Brown, and Larkin 1984; Ponton, Carr, and Wiggers 2014), resilience (Cassidy, 2015), and willingness to explore multiple problem-solving strategies (Pajares, 1996). In contrast, those with low self-efficacy are more likely to avoid challenges and depend on routine procedures. Despite their importance, previous studies have yielded inconsistent findings regarding their relative contributions to students' critical thinking skills (Cassidy, 2015; Pajares, 1996), underscoring the need for further investigation across different learning contexts.

In recent years, there has been growing attention toward culturally responsive approaches in mathematics education, particularly through the integration of ethnomathematics. Ethnomathematics refers to the study of mathematical ideas embedded in cultural practices (Rosa and Orey, 2011, 2019), traditions (D'Ambrosio, 2006; Zhang & Zhang, 2010), and local knowledge systems (Rosa et al., 2016). Integrating ethnomathematics into mathematics learning provides meaningful, context-rich experiences by connecting abstract mathematical concepts with students' real-life cultural environments. This approach not only enhances conceptual understanding but also encourages students to engage in reflective and analytical thinking when solving problems situated in familiar contexts.

Empirical evidence suggests that ethnomathematics-based learning has a significant positive effect on students' critical thinking skills (Indriani et al., 2024; Yanti, 2025). Several studies, including large-scale meta-analyses, have reported moderate to strong effect sizes, indicating that culturally contextualized mathematics instruction can improve students' problem-solving abilities and analytical reasoning. By linking mathematics to cultural practices such as traditional crafts, architecture, or local daily activities, students are encouraged to interpret problems, construct meaning, and apply reasoning in authentic situations. This contextualization supports deeper cognitive engagement and fosters critical thinking.

In addition to cognitive benefits, ethnomathematics also enhances students' self-efficacy (Valenia & Zaenuri, 2023). When students recognize that mathematical concepts are relevant to their own cultural experiences, they develop a stronger sense of competence and confidence in learning mathematics. This is particularly important in diverse classrooms, where conventional teaching approaches often fail to accommodate students' backgrounds (Westwood, 2018). Studies have shown that ethnomathematics-based instruction fosters positive attitudes toward mathematics, increases participation, and strengthens students' belief in their ability to solve mathematical problems effectively.

Furthermore, the integration of ethnomathematics has been shown to positively influence students' learning motivation (Simbolon, 2024). From the perspective of Self-Determination Theory, students' intrinsic motivation increases when learning activities are perceived as meaningful and relevant to their lives. Ethnomathematics provides this relevance by embedding mathematical learning within students' cultural identities and social contexts. As a result, students become more engaged, interested, and motivated to participate actively in the learning process.

Despite these promising findings, research integrating ethnomathematics with psychological constructs, such as self-efficacy and learning motivation, to explain students' critical thinking skills remains limited. Most previous studies have examined these variables separately, without exploring their structural relationships within a unified analytical framework. In addition, empirical studies using quantitative approaches, such as path analysis, to investigate the simultaneous effects of ethnomathematics-based learning, motivation, and self-efficacy on critical thinking are still scarce.

Therefore, this study aims to fill this gap by analyzing the relationships among learning motivation, mathematical self-efficacy, and students' critical thinking skills in the context of ethnomathematics-based mathematics learning. By integrating cultural context into the learning process and examining its interaction with key psychological factors, this study is expected to contribute to the development of more meaningful, adaptive, and culturally responsive mathematics education.

METODE

This study employed a quantitative, cross-sectional correlational design to examine the relationships among students' learning motivation, mathematical self-efficacy, and critical thinking skills in an ethnomathematics-based learning environment. This non-experimental design was deliberately selected to assess both the direct and simultaneous effects of the predictor variables on students' critical thinking performance (Creswell & Poth, 2018).

Research Design

A path analysis model was employed to delineate the structural relationships among the variables (Hair et al., 2014). This analytical approach was chosen for its robust capacity to estimate the direct effects of learning motivation (X1) and mathematical self-efficacy (X2) on critical thinking skills (Y). In the absence of a mediating variable, the analysis strictly evaluated the direct and concurrent predictive power of these independent variables.

Furthermore, the ethnomathematics approach served as the overarching contextual framework, anchoring mathematical problems in local cultural phenomena (D'Ambrosio, 1985). By weaving cultural practices and real-world contexts into the pedagogical design, this framework allowed students to navigate abstract mathematical concepts through familiar, culturally resonant scenarios (Rosa & Orey, 2011).

Participants

The target population comprised 76 eighth-grade students enrolled at Ma'arif Kalibawang Junior High School in Kulon Progo Regency, Indonesia. A sample of 34 participants was drawn using simple random sampling. This sample size satisfies the established heuristic for correlational and regression analyses, which posits a minimum threshold of 30 participants to ensure the stability of parameter estimates (Fraenkel, J.R., Wallen, N.E., and Hyun, 2011).

Ethnomathematics-Based Learning Context

Ethnomathematics was operationalized by aligning learning tasks and assessment instruments with indigenous cultural contexts. Specifically, mathematical problems focused on geometry and spatial reasoning were contextualized using elements inherent to the local culture, including traditional architecture, daily routines, and prevalent community practices.

Embedding cultural contexts within mathematical instruction has been empirically documented to foster conceptual understanding and critical thinking by bridging abstract theoretical constructs with tangible, real-life experiences (Bishop, 1991; Rosa & Orey, 2019). Moreover, culturally responsive pedagogy facilitates meaningful knowledge construction, thereby optimizing student engagement and cognitive processing (Gay, 2018). Grounding mathematical discourse in such familiar contexts naturally compels students to adopt a more critical stance when analyzing, interpreting, and justifying their problem-solving strategies.

Instruments

Data acquisition was facilitated through three primary instruments:

Learning Motivation Questionnaire: This tool evaluated student motivation across four dimensions: attention, relevance, confidence, and satisfaction (Deci & Ryan, 2000). Structured on a Likert scale, the instrument exhibited robust internal consistency (Cronbach's $\alpha = 0.82$) (Nunnally & Bernstein, 1994).

Mathematical Self-Efficacy Questionnaire: Designed to gauge students' self-perceived competence in executing mathematical tasks, solving problems, and grasping mathematical paradigms. The instrument yielded a high reliability coefficient ($\alpha = 0.87$), denoting excellent internal consistency (Bandura, 1997).

Critical Thinking Skills Test: Students' critical thinking proficiency was appraised via an essay-based test structurally aligned with Ennis's framework. The assessment targeted several cognitive dimensions (Ennis, 2011):

a. Problem clarification

b. Analysis and interpretation

c. Strategy formulation

d. Inference and reasoning

e. Solution justification

Crucially, these test items were framed within an ethnomathematical context to guarantee that students engaged with culturally attuned problem scenarios.

Data Analysis

Quantitative data were analyzed using multiple regression and path analysis in AMOS 26. Prior to hypothesis testing, prerequisite statistical assumptions were rigorously validated:

a. Normality was verified using the Lilliefors test.

b. Linearity was confirmed via regression analysis.

c. Multicollinearity was ruled out based on tolerance and Variance Inflation Factor (VIF) metrics.

Hypothesis testing adhered to a strict significance threshold of $\alpha = 0.05$, where a p-value < 0.05 denoted a statistically significant effect (Hair et al., 2014). The structural equation model was ultimately appraised by scrutinizing:

a. Direct effects (path coefficients)

b. The coefficient of determination (R^2)

c. The simultaneous impact of the independent variables on the dependent construct

Given the relatively small sample size, the empirical findings are treated as exploratory, offering foundational insights into the interplay among ethnomathematics-based pedagogy, learner motivation, self-efficacy, and critical thinking acuity.

RESULTS AND DISCUSSION

Results

Assumption Test

Before conducting the path analysis, several key statistical assumptions relevant to regression-based structural modeling were examined. Specifically, tests of normality, multicollinearity, and residual diagnostics were performed to ensure the appropriateness of the model estimation. The normality test indicated that all variables were approximately normally distributed, as the obtained Lcount values were lower than the Ltable values, supporting the assumption of normality. Multicollinearity diagnostics showed tolerance values above 0.10 and VIF values below 10, indicating no serious multicollinearity among predictors. In addition, residual analysis confirmed that the error terms were randomly distributed without evident patterns, suggesting that the regression assumptions were adequately met. The results of the assumption tests for the variables are shown in Tables 4, 5, 6, and 7.

Table 1. Summary Of Normality Test Results

Variable	L count	Ltable (DK)	Decision	Conclusion
Motivation to Learn	0,090	0,154	H_0 accepted	Normally distributed
Maths Self-Efficacy	0,143	0,154	H_0 accepted	Normally distributed
Critical thinking skills	0,120	0,154	H_0 accepted	Normally distributed

Table 2. Summary of the homogeneity test

Variable	L_{count}	L_{table}	Decision	Conclusion
X_1, X_2, dan Y	2,56	3,09	H_0 accepted	Variable data X1, X2, and Y are homogeneous

Table 3. Summary of X1-Y and X2-Y Linearity Tests

Variable	L_{count}	L_{table} (DK)	Decision	Conclusion	Variable
X_1-Y		0,524	2,35	$F_{Count} < F_{table}$	Linear pattern data
X_2-Y		0,109	3,83	$F_{Count} < F_{table}$	Linear pattern data

Table 4. Summary of Multicollinearity Test

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	7.215	4.200		1.718	.096		
Student Motivation to Learn	.391	.247	.237	1.580	.124	.722	1.385
Maths Self-efficacy	.708	.193	.550	3.668	.001	.722	1.385

The multicollinearity test results (Table 7) indicate that both independent variables meet acceptable thresholds, with tolerance values above 0.10 and VIF values below 10. These findings confirm the absence of serious multicollinearity, allowing learning motivation and mathematics self-efficacy to be included simultaneously in the path model.

Regression Tast

Table 5. Summary of Correlation Tests

Variable	Student Motivation to Learn	Self-Efficacy	Critical Thinking Skills
Motivasi Belajar Siswa	1	.527**	.527**
Sig. (2-tailed)	—	.001	.001
N	34	34	34
Self-Efficacy	.527**	1	.675**
Sig. (2-tailed)	.001	—	.000
N	34	34	34
Kemampuan Berpikir Kritis	.527**	.675**	1
Sig. (2-tailed)	.001	.000	—
N	34	34	34

Table 6. Model Summary

Model	R	R Square	Adjusted R-Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.705ᵃ	.496	.464	2.32333	.496	15.277	2	31	.000

Table 7. ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	164.931	2	82.466	15.277	.000ᵇ
Residual	167.333	31	5.398		
Total	332.265	33			

Table 8. Coefficients

Model	Unstandardized Coefficients (B)	Std. Error	Standardized Coefficients (Beta)	t	Sig.	95.0% Confidence Interval for B	Correlations		
						Lower Bound	Upper Bound	Zero-order	Partial
(Constant)	7.215	4.200	—	1.718	.096	-1.351	15.782	—	—
Motivasi Belajar Siswa	.391	.247	.237	1.580	.124	-.114	.896	.527	.273
Self-Efficacy	.708	.193	.550	3.668	.001	.314	1.102	.675	.550

The results of the normality test (Table 1) indicate that all variables, learning motivation, mathematical self-efficacy, and critical thinking skills, are normally distributed, as the obtained Lcount values are lower than Ltable. This finding confirms that the data meet the normality assumption required for parametric statistical analysis. Within the context of ethnomathematics-based learning, this result suggests that students' responses to culturally contextualized mathematical tasks are distributed evenly, reflecting consistent engagement across participants.

Furthermore, the homogeneity test (Table 2) indicates that the data are homogeneous, indicating consistent variance across the variables. This implies that students demonstrated relatively uniform response patterns when engaging with ethnomathematics-based learning activities. Such consistency may indicate that culturally relevant mathematical contexts provide a shared experiential basis that supports comparable levels of understanding among students.

The linearity test results (Table 3) confirm that the relationships between learning motivation (X1), mathematical self-efficacy (X2), and critical thinking skills (Y) follow a linear pattern. This indicates that increases in motivation and self-efficacy are proportionally associated with improvements in critical thinking skills. In an ethnomathematics-based learning environment, this linear relationship suggests that affective factors consistently influence students' ability to interpret and solve culturally contextualized mathematical problems.

The multicollinearity test (Table 4) indicates that tolerance values are above 0.10 and VIF values are below 10, confirming the absence of multicollinearity between the independent variables. This means that learning motivation and mathematical self-efficacy independently contribute to students' critical thinking skills. In the context of ethnomathematics, this suggests that both variables represent distinct psychological dimensions that support students' engagement with culturally embedded mathematical reasoning.

Correlation Analysis

The correlation analysis (Table 5) shows that all variables are positively and significantly related. Learning motivation is moderately correlated with both self-efficacy ($r = 0.527$, $p < 0.01$) and critical thinking skills ($r = 0.527$, $p < 0.01$). In contrast, mathematical self-efficacy demonstrates a stronger correlation with critical thinking skills ($r = 0.675$, $p < 0.01$).

These findings indicate that students who are more confident in their mathematical abilities tend to perform better in solving problems that require critical thinking. Within an ethnomathematics-based learning context, this relationship suggests that students' confidence becomes increasingly important when they are required to interpret and analyze mathematical problems rooted in cultural contexts. Such tasks often demand deeper reasoning and flexible thinking, which are more likely to be demonstrated by students with higher self-efficacy.

Regression Analysis

The model summary (Table 6) indicates that the coefficient of determination (R^2) is 0.496, meaning that learning motivation and mathematical self-efficacy together explain 49.6% of the variance in students' critical thinking skills. This suggests that nearly half of students' ability to engage in critical thinking can be explained by these psychological factors within an ethnomathematics-based learning environment. The remaining 50.4% may be influenced by other factors such as instructional strategies, prior knowledge, or classroom interactions.

The ANOVA results (Table 7) show that the regression model is statistically significant ($F = 15.277$, $p < 0.001$). This indicates that learning motivation and self-efficacy simultaneously have a significant effect on students' critical thinking skills. In the context of ethnomathematics, this finding reinforces the idea that culturally contextualized learning environments can effectively engage both cognitive and affective dimensions of learning.

Regression Coefficients

The regression coefficients (Table 8) provide further insight into the individual contributions of each variable. Mathematical self-efficacy has a significant positive effect on critical thinking skills ($\beta = 0.550$, $p = 0.001$), whereas learning motivation does not ($\beta = 0.237$, $p = 0.124$).

This result indicates that self-efficacy is a stronger predictor of critical thinking skills compared to learning motivation. Within an ethnomathematics-based learning context, this finding can be interpreted as follows: students who believe in their mathematical abilities are more able to engage with culturally embedded problems that require interpretation, reasoning, and justification. These students are more likely to explore multiple solution strategies and make meaningful connections between mathematical concepts and cultural contexts.

On the other hand, the non-significant effect of learning motivation suggests that motivation alone may not be sufficient to enhance critical thinking skills. In culturally contextualized learning environments, students may require not only interest and engagement but also a strong sense of confidence to participate in complex reasoning processes actively.

The combined effect of learning motivation (X1) and mathematical self-efficacy (X2) on critical thinking skills (Y) is reflected in the Model Summary ($R^2 = 0.464$) and the significance value of the F-change (sig. = 0.000). Since the p-value is less than 0.05, the null hypothesis is rejected and the alternative hypothesis is accepted. This indicates that learning motivation and mathematical self-efficacy simultaneously have a significant effect on students' critical thinking skills.

Within the context of ethnomathematics-based learning, this finding suggests that students' affective characteristics jointly contribute to their ability to engage in culturally contextualized mathematical problem-solving. The integration of cultural elements into mathematical tasks provides meaningful learning experiences; however, the effectiveness of these contexts in fostering critical thinking depends on students' intrinsic motivation and, more importantly, their confidence in handling culturally embedded mathematical situations. Regarding indirect effects, this study does not estimate a structural path from learning motivation (X1) to mathematical self-efficacy (X2). Therefore, indirect effects were not tested, and the analysis focuses solely on the direct effects of each predictor on critical thinking skills. The results are summarized in Table 12.

Based on Table 12, mathematical self-efficacy (X2) shows a stronger direct contribution ($\beta = 0.550$) compared to learning motivation (X1) ($\beta = 0.237$). This indicates that, in an ethnomathematics-based learning environment, students' confidence in their mathematical abilities plays a more dominant role in supporting critical thinking processes when dealing with culturally contextualized problems. Meanwhile, the combined contribution of both variables ($R^2 = 0.464$) suggests that nearly half of the variance in students' critical thinking skills can be explained by these factors, while the remaining variance ($\varepsilon = 0.709$) may be influenced by other elements such as instructional design, prior knowledge, or the depth of cultural integration in the learning process. The results of the study are summarised in Table 9 as follows:

Table 12. Summary of Direct and Indirect Effects

Table 9. Summary of Direct and Indirect Effects

Variable	Path coefficient	Contribution			Joint Contribution
		Directly	Indirectly	Total	
X_1	0,237	0,237	-	0,237	-
X_2	0,550	0,550	0,237	0,130	-
ε	0,709	-	-	-	-
X_1 dan X_2	-	-	-	-	0,464

Based on Table 12, the research findings can be interpreted as follows. First, learning motivation (X1) does not show a significant direct effect on students' critical thinking skills (Y). This suggests that, within an ethnomathematics-based learning context, motivation alone may not be sufficient to enhance students' ability to engage in higher-order thinking when solving culturally contextualized mathematical problems.

Second, mathematical self-efficacy (X2) demonstrates a significant direct contribution to critical thinking skills, with a coefficient of 0.550 ($\approx$ 30.25%). This indicates that students' confidence in their mathematical abilities plays a crucial role in supporting their capacity to analyze, interpret, and solve problems embedded in cultural contexts. In ethnomathematics-based learning, such confidence enables students to navigate more effectively between abstract mathematical concepts and their real-life cultural representations.

Third, the simultaneous contribution of learning motivation (X1) and mathematical self-efficacy (X2) to critical thinking skills (Y) is reflected in the coefficient of determination ($R^2 = 0.464$, $\approx$ 21.53%). This finding suggests that both variables together explain a meaningful proportion of students' critical thinking performance within culturally contextualized mathematics learning environments.

Meanwhile, the remaining variance (ε = 0.709, $\approx$ 50.26%) indicates that other factors not examined in this study also influence students' critical thinking skills. In the context of ethnomathematics, these factors may include the quality of cultural integration in instructional design, students' prior knowledge of local contexts, classroom interaction patterns, and the extent to which cultural elements are meaningfully connected to mathematical concepts.

Discussion

The findings of this study reveal that mathematical self-efficacy has a significant and dominant influence on students' critical thinking skills, while learning motivation does not show a significant direct effect. Learning motivation shows a positive correlation with performance (learning outcomes), yet it failed to predict performance significantly. This occurred because the topic of Pythagoras requires high-level cognitive abilities (understanding of spatial concepts, algebraic manipulation, and abstraction skills). In line with Welker et al. (2024), even if students are motivated (i.e., they want to succeed), high motivation will not lead to good performance if they lack an understanding of basic concepts such as the area of a square or square roots. These results provide important insights into how affective factors operate within an ethnomathematics-based learning environment.

The significant role of self-efficacy in shaping critical thinking skills is consistent with Albert Bandura's social cognitive theory, which emphasizes that individuals' beliefs in their capabilities determine how they think, behave, and perform tasks (Bandura, 1997). In the context of mathematics learning, students with higher self-efficacy are more likely to engage in complex problem-solving processes, persist when facing difficulties, and apply diverse strategies to reach solutions. This becomes particularly relevant in ethnomathematics-based learning, where students are required not only to understand abstract mathematical concepts but also to interpret and apply them within culturally meaningful contexts.

Ethnomathematics, as introduced by Ubiratan D'Ambrosio, emphasizes the integration of mathematical ideas with cultural practices and local knowledge systems (D'Ambrosio, 1985). In such learning environments, students encounter problems that are embedded in real-life cultural contexts, requiring deeper reasoning and contextual interpretation. Therefore, students' confidence in their mathematical abilities becomes a crucial factor that enables them to navigate between formal mathematical representations and their cultural applications. This explains why self-efficacy emerges as a stronger predictor of critical thinking compared to learning motivation.

Furthermore, the findings support previous studies indicating that ethnomathematics-based learning enhances students' engagement and cognitive processes by providing meaningful and relevant learning experiences (Rosa & Orey, 2011). When students recognize that mathematics is closely related to their daily lives and cultural backgrounds, they are more likely to participate in the learning process actively. However, active participation alone does not automatically translate into higher critical thinking skills unless it is accompanied by strong self-belief in handling complex and unfamiliar problem situations.

Interestingly, the non-significant effect of learning motivation suggests that motivation alone may not be sufficient to influence critical thinking skills directly. This finding aligns with the perspective of Self-Determination Theory proposed by Richard M, which highlights that motivation must be supported by competence and autonomy to produce meaningful learning outcomes (Deci & Ryan, 2000). In ethnomathematics-based learning, students may feel interested and engaged by the material's cultural relevance. However, without sufficient confidence in their abilities, they may still struggle with higher-order thinking tasks.

The combined effect of learning motivation and self-efficacy, which explains 46.4% of the variance in critical thinking skills, indicates that both variables play an important role within a culturally responsive learning environment. This finding reinforces the idea that effective mathematics learning should not only focus on cognitive development but also address students' affective dimensions, particularly their beliefs and attitudes toward learning.

However, the relatively large residual effect suggests that other factors also contribute to students' critical thinking skills. In the context of ethnomathematics, these factors may include the depth and authenticity of cultural integration in instructional design, the teacher's ability to facilitate culturally responsive pedagogy, and students' prior experiences with culturally embedded knowledge. As noted by Alan J. Bishop (1991), mathematics learning is deeply influenced by cultural processes, meaning that the effectiveness of ethnomathematics depends on how well cultural elements are integrated into meaningful mathematical activities.

Overall, this study highlights that ethnomathematics-based learning provides a promising approach to enhancing students' critical thinking skills. However, its effectiveness is strongly influenced by students' self-efficacy. Therefore, educators should not only design culturally relevant learning experiences but also actively foster students' confidence in their mathematical abilities. This can be achieved through supportive learning environments, scaffolding strategies, and opportunities for students to experience success in solving culturally contextualized problems.

Implications

The findings of this study have several important implications for mathematics education, particularly in the context of ethnomathematics-based learning. First, the significant role of mathematical self-efficacy indicates that fostering students' confidence should be a central focus in instructional design. Teachers need to create learning environments that not only present culturally relevant mathematical content but also support students in developing a strong belief in their ability to solve problems. This aligns with Albert Bandura's perspective that self-efficacy influences individuals' persistence and performance on complex tasks.

Second, the integration of ethnomathematics, as conceptualized by Ubiratan D'Ambrosio, should go beyond mere contextual examples and be meaningfully embedded in the learning process. Cultural elements should be used to stimulate reasoning, interpretation, and critical analysis, rather than merely serving as illustrative contexts. This approach can enhance students' engagement while simultaneously strengthening higher-order thinking skills.

Third, the findings suggest that learning motivation alone is not sufficient to improve critical thinking skills unless it is accompanied by strong self-efficacy. Therefore, educators should design learning strategies that simultaneously address both affective and cognitive dimensions, such as scaffolding, collaborative problem-solving, and reflective activities within culturally contextualized tasks.

Limitations

This study has several limitations that should be considered when interpreting the findings. First, the sample size was relatively small (n = 34), which may limit the generalizability of the results. Future studies with larger and more diverse samples are needed to validate these findings.

Second, this study employed a correlational design, which does not allow for causal conclusions. Although significant relationships were identified, the direction of causality cannot be fully established.

Experimental or quasi-experimental designs would provide stronger evidence regarding the effectiveness of ethnomathematics-based learning.

Third, ethnomathematics in this study was implemented as a learning context rather than as a fully controlled intervention. As a result, the extent and depth of cultural integration may vary and influence the outcomes. More structured implementation models are needed to capture the impact of ethnomathematics better.

Finally, this study focused only on learning motivation and self-efficacy as predictors of critical thinking skills. Other important factors, such as prior knowledge, teaching strategies, and classroom interaction, were not included and may contribute to the unexplained variance.

Suggestions for Future Research

Based on the limitations and findings, several recommendations for future research can be proposed. First, future studies should involve larger sample sizes and multiple schools to enhance the generalizability of the findings.

Second, researchers are encouraged to employ experimental or quasi-experimental designs to examine the causal effects of ethnomathematics-based learning on students' critical thinking skills.

Third, future research should explore additional variables, such as metacognitive skills, cultural identity, and teacher competence in implementing culturally responsive pedagogy, to provide a more comprehensive understanding of factors influencing critical thinking.

Fourth, a deeper exploration of the implementation of ethnomathematics is needed, including the development of culturally grounded learning materials, task design, and assessment instruments. This will ensure that ethnomathematics is not only used as context but also as a meaningful pedagogical approach.

CONCLUSION

This study concludes that mathematical self-efficacy plays a significant and dominant role in influencing students' critical thinking skills, while learning motivation does not have a significant direct effect. However, both variables simultaneously contribute significantly to students' critical thinking abilities within an ethnomathematics-based learning context.

The findings indicate that while ethnomathematics provides meaningful and culturally relevant learning experiences, its effectiveness in enhancing critical thinking largely depends on students' confidence in their mathematical abilities. Students with higher self-efficacy are better able to interpret, analyze, and solve culturally contextualized mathematical problems.

Therefore, mathematics learning should not only integrate cultural contexts but also prioritize the development of students' self-efficacy. By combining culturally responsive approaches with strategies that strengthen students' confidence, educators can create more effective learning environments that support the development of critical thinking skills.

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