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PREDICTING THE GENERAL MATHEMATICS PERFORMANCE OF LEARNERS THROUGH CRITICAL THINKING DISPOSITION AND MATHEMATICS RESILIENCE

Aivin B. Balquedra *[1)], Angelica D. Padua [2)]
1. College of Education, Nueva Ecija University of Science and Technology, Philippines
Email address : aivinbalquedra19@gmail.com
2. Palayan City National High School, Department of Education

***Abstract*— Mathematics education develops not only content knowledge but also essential life skills such as critical thinking and problem-solving, which foster resilience and adaptability in addressing contemporary challenges. This study examined the predictive roles of critical thinking disposition and mathematics resilience on learners' performance in General Mathematics. Employing a descriptive-correlational design, the study involved 611 senior high school students from various strands in a selected senior high school during the first semester of school year 2024– 2025, chosen through total enumeration. Data were gathered using a researcher-made survey questionnaire aligned with the study objectives.Results showed that most respondents were 16-year-old females enrolled in the HUMSS strand, with parents who were predominantly high school graduates. Learners generally expressed agreement with the dimensions of critical thinking disposition and mathematics resilience, reporting the highest levels in systematicity and growth, respectively. Their General Mathematics performance was largely rated as Very Satisfactory. Correlation analyses revealed significant associations between learners' profiles, critical thinking disposition, and mathematics resilience, alongside a strong interrelationship between the two constructs. While mathematics resilience, particularly its value and growth components, demonstrated significant positive correlations with academic performance, critical thinking disposition exhibited limited influence, with only open- mindedness and cognitive maturity showing positive associations. Regression analysis indicated that neither construct significantly predicted mathematics performance.These findings emphasize the relevance of resilience and critical thinking in mathematics learning, while suggesting that other factors may play a stronger role in academic achievement. The study recommends the adoption of inquiry-based learning strategies, integration of varied teaching approaches, and enhanced support from teachers, parents, and school administrators to foster students' resilience and critical thinking.**

Keywords*— *critical thinking disposition, mathematics resilience, predictors, learner's performance, General Mathematics

I. INTRODUCTION

Mathematics holds a vital role in both individual development and societal advancement, serving as a foundation for scientific progress, economic prosperity, and the cultivation of essential skills such as critical thinking and problem-solving (Kolar-Begović et al., 2017; Obradovic & Mishra, 2020; Sachdeva & Eggen, 2021). It extends beyond the boundaries of formal education, functioning as a life skill necessary for navigating the complexities of contemporary society. By fostering analytical thinking, resilience, and adaptability, mathematics education equips learners with the competencies required to engage with technological innovations, address societal issues, and respond effectively to global challenges.

Within the Philippine context, educational reforms, particularly the K to 12 curriculum, emphasize the necessity of strengthening mathematics education to meet international standards and ensure that learners remain globally competitive (Barrot, 2021). General Mathematics, as a core subject in senior high school, is designed to enhance mathematical proficiency, critical thinking, and problem-solving skills, which are indispensable for higher education and future professional endeavors (DepEd, 2016). Despite its significance, numerous learners encounter barriers such as mathematics anxiety, which limits their engagement with the subject and diminishes their capacity for critical and logical thinking (Olaco & Rebucas, 2021). Learners who demonstrate a strong disposition toward critical thinking are more inclined to approach mathematical tasks systematically, whereas those with low resilience may struggle when confronted with challenges (Çelik & Özdemir, 2020; Moala & Hunter, 2019).

Although the Department of Education (2023) has acknowledged the importance of mathematical disposition and resilience through the MATATAG curriculum, scholarly inquiry remains limited regarding their combined influence on General Mathematics performance. Existing literature predominantly highlights cognitive competencies such as reasoning, problem- solving, and computational fluency (Supriadi et al., 2024), while often neglecting dispositional factors such as critical thinking disposition and mathematics resilience (Salviejo et al., 2024). To address this gap, the present study underscores the need to investigate the interplay between these non-cognitive variables and their potential association with the academic performance of senior high school learners in General Mathematics, thereby contributing to a more comprehensive understanding of mathematics education.

Research Objectives

Specifically, this study sought answer to the following:

1. How may the critical thinking disposition of the learners be described in terms of truth-seeking, open-mindedness, inquisitiveness, analyticity, systematicity, critical thinking self-confidence, and cognitive maturity?

2. How may the mathematics resilience of the learners be described in terms of value, struggle, and growth?

3. How may the academic performance of the learners in General Mathematics be described in terms of their final grades?

4. Is there a significant relationship between the critical thinking disposition of the learners and their mathematics resilience?

5. Is there a significant relationship between critical thinking disposition and General Mathematics performance of the learners?

6. Is there a significant relationship between mathematics resilience and General Mathematics performance of the learners?

7. Do critical thinking disposition and mathematics resilience significantly predicts General Mathematics performance of the learners?.

II. Methodology

This study employed a descriptive-correlational research design, wherein the descriptive method was used to present the learners' levels of critical thinking disposition and mathematics resilience in General Mathematics, while the correlational approach examined the relationship and predictive power of these variables on their academic performance. Conducted in a public national high school in Palayan City, Nueva Ecija, Philippines, the study focused on Grade 11 learners enrolled during the school year 2024–2025. A total of 611 students from various strands participated as respondents, selected through total enumeration..

III. Result and Discussion

A. *Critical Thinking Disposition of the Learners in General Mathematics*

TABLE 1. SUMMARY RESULTS OF THE CRITICAL THINKING DISPOSITION OF THE LEARNERS IN GENERAL MATHEMATICS

Critical Thinking Disposition	Overall Mean	Verbal Description
Truth-Seeking	2.91	Agree
Open-Mindedness	2.91	Agree
Inquisitiveness	2.85	Agree
Analyticity	2.99	Agree
Systematicity	3.04	Agree
Critical Thinking Self-Confidence	2.87	Agree
Cognitive Maturity	3.16	Agree
GRAND MEAN	**2.96**	**Agree**

Table 1 shows that the learners in General Mathematics demonstrated an overall favorable critical thinking disposition, with a grand mean of 2.96 ("Agree"). Among the seven domains, Cognitive Maturity ranked highest (3.16), reflecting learners' strong reflective judgment and openness to multiple perspectives, followed by Systematicity (3.04) and Analyticity (2.99), which highlight their organized problem-solving and logical reasoning skills. Truth-Seeking and Open-Mindedness both scored 2.91, indicating moderate tendencies to seek deeper understanding and consider diverse viewpoints. The lowest means were in Critical Thinking Self-Confidence (2.87) and Inquisitiveness (2.85), suggesting that while learners value critical thinking, they may lack confidence in their reasoning and motivation to independently seek new knowledge, pointing to the need for targeted strategies to strengthen these areas.

The findings align with previous research, showing that cognitive maturity, systematic thinking, and analyticity are essential for sound judgment, effective problem-solving, and deep conceptual understanding (Ye, Zhang, & Wong, 2023). Truth-seeking and open-mindedness were also affirmed as core components of critical thinking. Meanwhile, the lower scores in inquisitiveness and self-confidence support studies indicating that learners often struggle with confidence and curiosity without adequate scaffolding, feedback, and engaging learning environments (Phan, 2019).

B. *Mathematics Resilience of the Learners in General Mathematics*

TABLE 2. SUMMARY RESULTS OF THE MATHEMATICS RESILIENCE OF THE LEARNERS IN GENERAL MATHEMATICS

Mathematics Resilience	Overall Mean
Value	3.98
Struggle	3.07
Growth	2.32
GRAND MEAN	**3.12**

Table 2 shows that learners demonstrated an overall high level of mathematics resilience in General Mathematics, with a computed grand mean of 3.12, verbally described as "Agree." Among the three domains, the Value domain obtained the highest mean score of 3.98, interpreted as "Strongly Agree," which indicates that learners highly recognized the importance and relevance of mathematics in their everyday lives and future aspirations. The Struggle domain followed with a mean score of 3.07, described as "Agree," suggesting that learners were generally persistent and willing to endure the challenges encountered in mathematical tasks. On the other hand, the Growth domain received the lowest mean score of 2.32, verbally described as "Slightly Agree," implying that learners showed weaker confidence in their ability to enhance their mathematical skills through sustained effort and the application of effective learning strategies.

The findings are consistent with prior research, highlighting that valuing mathematics enhances students' motivation and persistence, while persistence in the face of challenges strengthens academic resilience (Ramirez et al., 2023). The low rating in the Growth domain aligns with studies showing that learners with a weaker growth mindset are less likely to believe in improvement through effort (Boaler & Dweck, 2021). Nurturing a growth mindset is essential for encouraging learners to embrace challenges and learn from setbacks

C. *Academic Performance of the Learners in General Mathematics*

TABLE 3. DESCRIPTION OF THE ACADEMIC PERFORMANCE OF THE LEARNERS IN GENERAL MATHEMATICS

Grades	Verbal Descriptions	Frequency	Percentage(%)
90 - 100	Outstanding	218	35.68
85 - 89	Very Satisfactory	272	44.52

80 - 84	Satisfactory	101	16.53
75 - 79	Fairly Satisfactory	20	3.27
	TOTAL	**611**	**100**

Table 3 presents the description of the academic performance of the learners in general mathematics. Specifically, 218 students or 35.68% earned grades between 90 and 100, categorized

as Outstanding; 272 learners or 44.52%, achieved grades in the 85-89 range, designated as Very Satisfactory; 101 learners or 16.53% fell within the 80-84 grade range, described as Satisfactory; 20 learners or 3.27%, achieved grades between 75-79 and verbally described as Fairly Satisfactory.

One pertinent study by Alova and Alova (2022) reported that Grade 11 students achieved an average General Mathematics score of 86.49, with a standard deviation of 6.53. This suggests that a significant portion of students performed within the "Very Satisfactory" to "Outstanding" range, aligning with the 80–100 grade distribution observed in the findings.

Another study by Parcon and Bearneza (2024) examined the mathematical skills and General Mathematics performance of Grade 11 students which was found that students demonstrated approaching proficient mathematical skills, their overall performance in General Mathematics which also indicates that despite a strong foundation in mathematical skills, there is room for improvement in applying these skills to more complex problems.

D. Relationship between the Critical Thinking Disposition of the learners and their Mathematics Resilience

TABLE 4. CORRELATION ANALYSIS BETWEEN THE CRITICAL THINKING DISPOSITION AND MATHEMATICS RESILIENCE OF THE LEARNERS IN GENERAL MATHEMATICS

Critical Thinking Disposition		Mathematics Resilience	
		Value	Growth
Truth-seeking	r	.556**	.499**
	p – value	.000	.000
Open-mindedness	r	.575**	.602**
	p – value	.000	.000
Inquisitiveness	r	.596**	.473**
	p – value	.000	.000
Analyticity	r	.557**	.590**
	p – value	.000	.000
Systematicity	r	.567**	.548**
	p – value	.000	.000
Critical thinking self-confidence	r	.524**	.485**
	p – value	.000	.000
Cognitive Maturity	r	.354**	.702**
	p – value	.000	.000

**. *Correlation is significant at the 0.01 level (2-tailed)*
*. *Correlation is significant at the 0.05 level (2-tailed)*

The correlation analysis revealed strong relationships between the dimensions of Critical Thinking Disposition and the Value and Growth components of Mathematics Resilience. In the Value component, Inquisitiveness (r = 0.596), Systematicity (r = 0.567), and Open-mindedness (r = 0.575) were the strongest predictors, suggesting that curiosity, methodical thinking, and openness contribute to learners' appreciation of mathematics. For the Growth component, Cognitive Maturity (r = 0.702) showed the strongest correlation, followed by Open-mindedness (r = 0.602) and Analyticity (r = 0.590), indicating that reflective judgment, tolerance for ambiguity, and logical reasoning foster confidence in one's ability to improve in mathematics.

In contrast, correlations with the Struggle component were weaker and less consistent. Only Inquisitiveness (r = 0.162), Critical Thinking Self-Confidence (r = 0.117), and Open-mindedness (r = 0.086) demonstrated modest yet significant positive correlations, while other dispositions were not significant. Notably, Cognitive Maturity showed a weak negative relationship with Struggle (r = -0.060), suggesting that higher reflective judgment does not necessarily translate into perseverance in the face of difficulties.

Overall, the findings emphasize that critical thinking dispositions strongly influence learners' valuing of mathematics and their belief in growth, but have limited impact on persistence during struggles. This suggests that while critical thinking supports appreciation and confidence in learning mathematics, factors such as emotional regulation, coping strategies, and mindset may play a more crucial role in overcoming challenges, consistent with previous studies (Chen & Morgan, 2021).

E. Relationship between Critical ThinkingDisposition and General Mathematics Performance of the Learners

TABLE 5. CORRELATION ANALYSIS BETWEEN THE CRITICAL THINKING DISPOSITION AND GENERAL MATHEMATICS PERFORMANCE OF THE LEARNERS

Critical Thinking Disposition		General Mathematics Performance
Truth-seeking	r	.066
	p-value	.105
Open-mindedness	r	.090*
	p-value	.026
Inquisitiveness	r	.069
	p-value	.089
Analyticity	r	.069
	p-value	.087
Systematicity	r	.064
	p-value	.116
Critical thinking self-confidence	r	.038
	p-value	.349
Cognitive maturity	r	.104*
	p-value	.010

*. *Correlation is significant at the 0.05 level (2-tailed)*

Table 5 shows that among the seven dimensions of Critical Thinking Disposition, only Open-mindedness (r = 0.090, p = 0.026) and Cognitive Maturity (r = 0.104, p = 0.010) demonstrated statistically significant positive correlations with learners' General Mathematics performance. This indicates that students who are more receptive to diverse perspectives and who exercise reflective judgment are more likely to achieve better outcomes in mathematics. The remaining dimensions—Truth-Seeking (r = 0.066, p = 0.105), Inquisitiveness (r = 0.069, p = 0.089), Analyticity (r = 0.069, p = 0.087), Systematicity (r = 0.064, p = 0.116), and Critical Thinking Self-Confidence (r = 0.038, p = 0.349)—showed

positive but statistically non-significant correlations, suggesting weak or indirect relationships with mathematics performance.

These findings are consistent with prior studies. Almeida and Franco (2022) and Huang et al. (2019) confirmed the strong link between open-mindedness and mathematics achievement, as students who are open to multiple approaches perform better on conceptual tasks. Similarly, Kumar and Patel (2020) highlighted that cognitive maturity is tied to stronger reasoning, problem- solving, and long-term improvements in mathematics. The non-significant results for the other dimensions align with Dimitrova and Chervenkov (2021), who suggested that while these dispositions contribute to critical thinking overall, their influence on mathematics performance may be indirect or vary by context, with open-mindedness and cognitive maturity being the most consistent predictors of success

F. Relationship between Mathematics Resilience and General Mathematics Performance of the Learners

TABLE 6. *CORRELATION ANALYSIS BETWEEN THE MATHEMATICS RESILIENCE AND GENERAL MATHEMATICS PERFORMANCE OF THE LEARNERS*

Mathematics Resilience		General Mathematics Performance
Value	r	.109**
	p-value	.007
Growth	r	.115**
	p-value	.004
Struggle	r	-.046
	p-value	.260

***. Correlation is significant at the 0.05 level (2-tailed)*

Table 6 shows that two components of mathematics resilience—Value and Growth—have positive and statistically significant correlations with learners' General Mathematics performance. The Value dimension (r = 0.109, p = .007) suggests that students who recognize the importance of mathematics tend to perform better, while the Growth dimension (r = 0.115, p = .004) indicates that those with a growth mindset achieve higher academic outcomes. In contrast, the Struggle dimension yielded a negative but non-significant correlation (r = –0.046, p = .260), suggesting that persistence through challenges alone does not directly predict performance.

These results are consistent with previous studies indicating that valuing mathematics enhances engagement, motivation, and achievement, while a growth mindset significantly supports improvement in mathematics performance (Johnston-Wilder et al., 2020; Boaler et al., 2021). Additionally, research has shown that the Value and Growth components of resilience are more strongly linked to performance than Struggle, which helps explain the weaker results observed for the latter in this study

G. Critical Thinking Disposition and Mathematics Resilience as Predictors General Mathematics Performance of the Learners

TABLE 7. REGRESSION ANALYSIS PREDICTING GENERAL MATHEMATICS PERFORMANCE OF THE LEARNERS

Model	Predictors	Unstandardized Coefficients		Standardized Coefficient	t-value	p-value
		B	Std. Error	Beta		
General Mathematics Performance	(Constant)	85.186	1.152		73.964	.000
	Critical Thinking Disposition	0.481	0.450	0.057	1.070	.285
	Mathematics Resilience	0.421	0.503	0.045	.839	.402

R^2 = 0.009, Adjusted R^2 = 0.005, F = 2.644, p < 0.072

Table 7 shows that critical thinking disposition and mathematics resilience are not significant predictors of learners' General Mathematics performance. The regression model explained only 0.9% of the variance (R^2 = 0.009, Adjusted R^2 = 0.005) and was not statistically significant (F = 2.644, p = 0.072). Individually, critical thinking disposition (B = 0.481, β = 0.057, p = 0.285) and mathematics resilience (B = 0.421, β = 0.045, p = 0.402) both showed weak, non-significant positive effects on performance, indicating that while they are associated with mathematics achievement, neither strongly predicts outcomes on their own.

These findings are consistent with prior studies. Nieto and Valero (2020) noted that critical thinking skills, while valuable, influence academic performance indirectly through other factors such as prior knowledge, motivation, and instructional quality. Similarly, Phan (2019) and Martin and Marsh (2018) found that resilience supports persistence and engagement but does not directly boost scores unless combined with cognitive and emotional support systems. Mathematics resilience shapes attitudes toward learning but does not ensure higher performance without strong conceptual understanding and effective teaching. Collectively, these results suggest that both critical thinking disposition and mathematics resilience play supportive roles in learning but are insufficient as sole predictors of mathematics achievement

IV. CONCLUSIONS

1. Learners demonstrated a generally favorable critical thinking disposition in General Mathematics, with strengths in cognitive maturity, systematicity, and analyticity, reflecting their ability to exercise reflective judgment, organized thinking, and logical reasoning.
2. Mathematics resilience among learners was found to be moderately high, with a strong appreciation for the value of mathematics and persistence in overcoming challenges. Nonetheless, the relatively low score in the growth domain indicates that many learners lack confidence in their ability to improve through effort, highlighting the need for growth mindset interventions.
3. Learners' academic performance in General Mathematics was generally satisfactory to outstanding, with the majority achieving grades between 85 and 100. This performance pattern indicates that learners possess a solid foundation in mathematics, though there remains room for

improvement in applying mathematical skills to complex tasks.

4. Critical thinking disposition was strongly correlated with mathematics resilience, particularly in the domains of value and growth. This suggests that learners who are more inquisitive, open-minded, and cognitively mature are better able to appreciate the importance of mathematics and believe in their potential to grow academically.

5. Among the dimensions of critical thinking disposition, only open-mindedness and cognitive maturity showed significant positive relationships with academic performance, suggesting that learners who are receptive to diverse approaches and reflective in their judgments are more likely to excel in mathematics.

6. The value and growth dimensions of mathematics resilience were positively associated with academic performance, demonstrating that students who value mathematics and believe in their ability to improve tend to achieve higher outcomes. Conversely, persistence in struggle alone did not directly predict success.

7. Neither critical thinking disposition nor mathematics resilience significantly predicted General Mathematics performance when considered together in the regression model. This indicates that while both constructs support learning, they function more as complementary factors rather than direct predictors of achievement, with other elements such as prior knowledge, instructional quality, and motivation likely exerting stronger influence.

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