

Unveiling the Role of Algebraic Competence in Shaping Grade 11 Students' Success in General Mathematics

Elton John B. Embodo¹

¹*Pangabuan Integrated School, Tangub City Division, Department of Education Region X, Philippines*

ABSTRACT: Algebraic competence is essential for the students to succeed in Mathematics. This study aimed to explore the relationship between the students' algebraic competence and their academic performance in General Mathematics. It was conducted in the selected high schools in the Philippines. The sequential explanatory mixed-method design was used in this study. There were 110 Grade 11 students who served as the respondents. A 50-item Algebraic Competence Test was used as the research instrument for this study. Mean, Correlation, and Regression were used as statistical tools to analyze the quantitative data. The qualitative part used phenomenological research design, with 10 purposively selected Grade 11 students. An interview guide was used to gather data that were analyzed using Moustakas' transcendental phenomenology. The study revealed that the algebraic competence of students was average while their academic performance in General Mathematics was very satisfactory. Algebraic competence and academic performance were significant correlates. Algebraic competence was a valid predictor of the students' performance in General Mathematics. The students' challenges in learning mathematics stemmed from struggling with complexity, bearing emotional burdens, suffering from physical discomfort, and facing distractions. Thus, algebraic competence can be considered as a decisive factor in determining the students' success in General Mathematics.

Keywords – Academic, Algebra, Competence, Performance, Success

I. INTRODUCTION

Algebra is a learning area of Mathematics that helps develop logical thinking and problem-solving skills. It is an essential subject that aids students to succeed academically and later in their careers. Students' skills in Algebraic concepts and procedures are essential for learning General Mathematics, a core subject offered in the senior high school of the Department of Education, Philippines. This is since the first quarter of General Mathematics covers different algebraic functions based on the Most Essential Learning Competencies (MELC) guide. With this, students must possess adequate proficiency in algebraic concepts before exploring the said subject. However, it has been observed that several students struggle to master basic algebra, which puts their performance in advanced mathematics subjects at stake. This is particularly prominent for Grade 11 students since they are exposed to General Mathematics in their senior high school during the first quarter of the first semester.

Algebra is usually perceived as a fundamental mathematics subject that is needed for success in other math subjects. Indeed, several studies have explored its important role in academic success. Algebraic achievement and attitude towards Algebra, show that students who possess good algebraic abilities are much more likely to perform well in higher-level mathematics courses (Kassim et al., 2023). This is due to the fact that abstract thinking and problem-solving skills promoted by algebraic thinking are necessary to tackle complicated mathematical problems. Algebra has always had practical implications as it helps enhance the problem-solving skills of learners essential for their survival (Kusuma et al., 2024). Gaining expertise in Algebra has been a problem for high school students for a long time because nowadays, students do not have much understanding of its application in real-life. They can hardly pose a variety of questions, for example, using variables, because they do not have complete understanding on the structure of algebra. The greatest problem students encounter when solving algebra problems is how to apply them in real life (Ying et al., 2020).

In addition, the 2022 PISA results show that only 16% of Filipino students reached at least level II of mathematics aptitude. This is lower than the OECD average of 69%. This indicates that several students have been having problems with fundamental mathematical knowledge that may include an Algebra. PISA, though consists widespread mathematical skills, issues on algebraic competence might have included for the said poor performance (OECD, 2023). This timely issue is also evident among the learners of a particular public school. The researcher who also teaches General Mathematics subject has noticed that most learners have been having a

hard time learning the subject since it demands adequate competence in Algebra. Particularly, they have been struggling to score high in graded quizzes truly because they lack the basic algebraic skills to solve problems in General Mathematics. In fact, in the previous school year, General Mathematics learners' first Quarter Examination Mean Percentage Score was (MPS = 62.87%), significantly lower than 75%.

Hence, this study aimed to explore the relationship between the students' algebraic competence and their academic performance in General Mathematics. The study also envisioned to provide academic support and valuable recommendations for improving the delivery and quality of instruction in the junior high school mathematics subjects by assessing the algebraic competence of grade 11 learners and correlating it to their academic performance in General Mathematics. Furthermore, this also explored the challenges encountered by the students in learning General Mathematics with their present algebraic capability. This is to equip the learners with sufficient algebraic competence to succeed in General Mathematics subject in senior high school.

II. LITERATURE REVIEW

This research is anchored on Davis's Mathematical Thinking and Cognition. This explores the important cognitive processes like pattern recognition and logical thinking that led to algebraic competence. Algebraic competence does not only cover manipulating symbol but also critical thinking, problem-solving and reasoning skills. These are necessary for the students to achieve a better academic performance in mathematics. Managing cognitive load, clear reasoning, and strategic instruction led to greater learning. The concept of algebraic competence is related to the model indicated in Mathematical Thinking and Cognition which specifies the fundamental cognitive processes inherent in algebraic thinking, such as abstraction, pattern recognition, and symbol manipulation (Maher, 1999). Pieces of literature also examine the role of cognitive ability to the students' performance in Algebra considering relevant factors. The cognitive complexity of problem-solving tasks in Algebra shows that understanding abstract symbols is essential for the students' achievement (Danesi, 2019). Cognitive development, encompassing cognitive load and memory is essential in attaining algebraic competence (Marchis & Ciascai, 2023).

Additionally, Need of Cognition (NFC) positively influences the students' ability to solve problems in Algebra (Primi et al., 2021). Early development of algebraic thinking which is a cognitive foundation is important for tackling more difficult mathematical activities. Moreso, regulating cognitive load is proven to enhance the strategies for problem solving. Meanwhile, metacognitive skills help enhance algebraic thinking by nurturing more profound engagement with mathematical concepts. Cognitive skills used in solving difficult algebraic problems shows that metacognition and self-regulation improve algebraic (Vula, 2017). The ability to develop problem solving skills essentially contributes to the student's success of solving algebraic problems. The cognitive engagement of students with algebraic concepts is significantly associated to enhanced comprehension and performance. Complex cognitive processing styles leading to better performance plays an essential role in developing competence in Algebra. Comprehensive cognitive skills are underscored by the association between the students' algebraic competence and their performance in higher Mathematics. Metacognitive and problem-solving skills are significant to developing strong algebraic competence to achieve success in learning Algebra.

As outlined in Mathematical Thinking and Cognition, academic performance in Mathematics is profoundly interrelated with cognitive and mathematical thinking process despite being influenced by various factors. This emphasizes that algebraic reasoning, symbol manipulation, and abstract thinking are vital for learning higher-level Mathematics courses (Maher, 1999). Cognitive flexibility is crucial in solving complex algebraic problems since students with flexible thinking skills often perform better in higher Mathematics courses (Rahayuningsih et al., 2020). Students' cognitive engagement in Algebra helps improve their problem-solving skills which are essential for attaining a better performance in more advanced Mathematics (Albay, 2019). Algebraic reasoning is also identified as a predictor of student's success in Mathematics (Kusuma et al., 2024). Working memory and cognitive load are significant factors affecting the students' performance in higher mathematics subjects as the regulation of complex cognitive tasks correlates to academic success.

Problem solving skills in Algebra helps improve the students' understanding and proficiency in Mathematics and enhances their academic performance (De Oliveira et al., 2020). Meanwhile, enhanced metacognitive and problem-solving skills of students have been shown to improve their academic performance in higher mathematics subjects. Additionally, the problem-solving skills of students in Algebra significantly influence their performance in Math. Aligning with the cognitive processes discussed by Davis and colleagues, the students' ability to apply abstract reasoning to Algebraic concepts directly impacts their performance in higher Mathematics. Improving Algebraic cognitive skills is vital for better performance in Mathematics subjects. Moreover, two significant predictors of academic success in advanced mathematics are problem-solving skills and algebraic competence. Students who employed cognitive skills have shown a better academic performance in Mathematics. Improving the students' cognitive strategies in learning Algebra reinforces their comprehension of complex mathematical concepts, thus improving their mathematics performance. Finally, the

development of students' cognition and reasoning in Algebra is vital for determining their success in advanced mathematics subjects.

Since Algebra serves as a foundation for other advanced mathematical concepts, the students' algebraic competence plays a vital role in determining performance in higher mathematics subjects. Recent studies consistently highlight the critical role of algebraic reasoning, cognitive strategies, and mathematical thinking in determining the students' performance in more advanced Mathematics. Competence in Algebra concepts contributes to the students' understanding of calculus and other advanced mathematics subjects. Algebraic competence is crucial for improving the students' performance in mathematical problem solving. Strong cognitive foundations in Algebra equip better abstract mathematical reasoning and academic performance in higher Mathematics.

It is noted that algebraic problem-solving skills are important in preparing the students to succeed in higher education. Studies indicate that algebraic competence predicts the students' success in higher mathematics such as Real Analysis and Differential Equations. Algebraic competence also relates to mathematical resilience. Mathematical resilience is defined as the ability to continue learning Mathematics despite the challenging mathematical problems. Similarly, students' cognitive skills in Algebra are shown to impact their academic performance in higher Mathematics subjects such as Abstract Algebra and Number Theory (Chan et al., 2022). Thus, the association between algebraic competence and academic performance is emphasized as important in further developing the students' mathematical proficiency that contributes to their success in higher mathematics. These pieces of literature indeed highlight the critical role of algebraic competence in determining the students' success in advanced mathematics subjects.

The Mathematical Thinking and Cognition Davis emphasize the cognitive processes, such as pattern recognition, logical reasoning, and abstraction are essential to learning Algebra. These cognitive processes do not just allow the students to manipulate symbols but also to apply basic algebraic skills in more abstract contexts. Managing cognitive load and clear instruction in reasoning are crucial factors for the students to be able to master algebraic lessons and prepare them for the complexities of higher mathematics. The synergy of these interrelated components develops algebraic competence and empowers students to navigate mathematical challenges with depth and precision (Maher, 1999).

Mathematical Thinking and Cognition in Algebra significantly impacts student academic performance in higher mathematics. Algebraic competence predicts success in Calculus, Linear Algebra, and Differential Equations. Developing critical thinking, problem-solving, and reasoning skills is necessary for better mathematical understanding. Effective instruction emphasizing cognitive strategies, pattern recognition, and logical reasoning improves algebraic competence. An average level of algebraic competence indicates that students obtain a moderate grasp of essential algebraic skills but may struggle with complex learning tasks such as abstraction, generalization, and multi-step problem solving (Rebecca et al., 2025). Furthermore, if students only achieve minimum academic outcomes, their performance may need further instructional remedy, especially in improving conceptual understanding and logical reasoning (Hussein & Csíkos, 2023).

Students whose mathematics performance is very satisfactory do not only demonstrate competence in performing mathematical procedures but also in applying concepts in various more complex contexts. Mathematical competence consists of conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition (Barham, 2020). This exists a strong positive correlation between mathematical skills (including algebraic reasoning) and performance in General Mathematics (Parcon & Bearneza, 2024). Algebraic competence is a vital for success not only in Mathematics but also in related areas like Physics, suggesting its foundational role in logical and problem-solving processes (Tong et al., 2024). A positive correlation between logical-mathematical intelligence and mathematical competence in children implies that algebraic thinking supports broader math learning (Bracero-Malagón et al., 2022). Lastly, the exists a strong link between algebraic skills and math performance (Parcon & Bearneza, 2024). Thus, this study explored the predictive power of algebraic competence on student academic performance in General Mathematics.

III. RESEARCH QUESTIONS

This study aimed to explore the relationship between the Grade 11 learners' algebraic competence and their academic performance in General Mathematics from the selected secondary or integrated schools in Tangub City for the first semester of the school year 2025 – 2026. This also aimed to explore the challenges encountered by the learners in General Mathematics.

Specifically, the research sought to address the following questions:

1. What is the level of the learners' algebraic competence at the beginning of the first quarter?
2. What is the level of the learners' academic performance in General Mathematics at the end of the first quarter?
3. Is there a significant relationship between the learners' algebraic competence and their academic performance in General Mathematics?

4. Does algebraic competence predict the academic performance of the learners?
5. What are the challenges encountered by the learners while learning the General Mathematics lessons in the first quarter?

IV. METHODOLOGY

4.1 Design

This study employed a mixed method sequential explanatory. The quantitative part used the descriptive-correlational design. Descriptive research seeks to collect data to test hypotheses or to answer questions concerning the status of the subject of the study (Gay, 1992). The correlational research design sought to ascertain relationships between two or more variables (Cherry, 2023). The design was considered appropriate in determining the relationship of the Grade 11 learners' algebraic competence and their academic performance in General Mathematics subject. The qualitative part used the phenomenological research design. Phenomenological research focuses on exploring and understanding human experiences as they are lived and perceived by people (Larsen & Adu, 2021). This design was considered appropriate in studying the challenges faced by Grade 11 learners while learning the General Mathematics lessons.

4.2 Respondents

The respondents of this study were Grade 11 learners enrolled in General Mathematics from selected public secondary schools in Tangub City. These students were chosen as the because the study specifically focuses on their algebraic competence essential to learning General Mathematics, making them the most suitable group for addressing the research objectives. The selection of respondents employed a stratified sampling technique to ensure fair representation of students across the participating schools and their respective sections. Inclusion criteria required that students must be (1) officially enrolled in Grade 11 during the time of the study, and (2) currently taking the subject General Mathematics. Students who were absent during data collection or those who declined to participate were excluded from the sample. The final sample size consisted of 110 Grade 11 students, determined using the Raosoft sample size calculator to ensure that the number of participants was statistically adequate and representative of the population.

The participants of this study were the Grade 11 students currently enrolled in General Mathematics subjects from selected schools in DepEd Tangub City Division. The 10 participants were identified through purposive sampling. The actual number of participants was based on data saturation. The Grade 11 students were selected based on the following criteria: (1) officially enrolled in Grade 11 during the time of the study, and (2) currently taking the subject General Mathematics. Students who were absent during data collection or those who declined to participate were excluded from the sample.

4.3 Instrument

The achievement test was designed to measure the level of Grade 11 students' algebraic competence, specifically the skills and knowledge expected to have been acquired during their junior high school years. The test consisted of 50 multiple-choice items, covering fundamental algebraic concepts such as simplification, equations, inequalities, functions, and problem solving. The structure of the test provided an objective and standardized means of assessing students' mastery of these essential skills. The interview guide, on the other hand, was developed to obtain deeper qualitative insights into the experiences of selected Grade 11 learners. It consisted of guided, open-ended questions aligned with the study's statement of the problem. These questions explored the challenges students encountered in learning algebra and the coping strategies they employed to manage these difficulties. The use of an interview guide ensured consistency in the data-gathering process while allowing participants the freedom to express their thoughts in detail.

Both instruments were subjected to content validation by a panel of experts composed of the Education Program Supervisor in Mathematics and two senior mathematics teachers. They evaluated each item based on relevance, alignment with the learning competencies, clarity of instructions, and appropriateness of the language for Grade 11 learners. The achievement test obtained a reliability coefficient of 0.82, indicating good internal consistency and suggesting that the items reliably measure the intended algebraic competencies.

4.4 Procedure

The researcher formally requested permission through a letter addressed to the Schools Division Superintendent. Once the letter of permission was approved by the SDS, the researcher then sent a letter of permission to the school heads of the chosen integrated and secondary schools with endorsement from his school head and attachment of the approved letter by the SDS of Tangub City. Once approval was granted, an orientation session was then conducted, and consent forms were distributed to the respondents seeking formal approval for their participation in the study. This included obtaining permission to access their academic records, specifically their first quarter grades in General Mathematics.

Upon receiving consent, the researcher distributed the validated and reliability-tested 50-item Multiple Choice Questionnaire to determine their Algebraic Competence at the beginning of the first quarter. Right at the end of the first quarter period, the researcher gathered the respondents' first quarter grades in General

Mathematics.

The researcher proceeded to conducting face-to-face interview using the validated interview guide with the selected participants to explore their challenges while learning the first quarter coverage of General Mathematics. After the data collection, the researcher analyzed the quantitative and qualitative data using the appropriate statistical and thematic analysis respectively.

4.5 Data Analysis

After gathering the quantitative data, the researcher used the following statistical tools to compute and interpret the responses regarding the students' algebraic competence and their academic performance in General Mathematics. The mean percentage score was used to determine the level of Grade 11 students' algebraic competence based on their scores in a 50-item Multiple Choice Algebraic Competence Test. The Department of Education (DepEd) Order No. 160, Series of 2012, establishes a framework for assessing students' academic achievement through standardized test questionnaires. It indicates the various levels of mastery or achievement that students can attain based on their performance in algebraic competence assessment. It was used to determine the students' competence on fundamental algebraic concepts and procedures.

Meanwhile, the DepEd Order 8 series of 2015 was used to analyze the learners' academic performance in General Mathematics. The Pearson Product-Moment Correlation and Linear Regression were used to analyze the relationship between the two variables. Moreover, the qualitative data regarding the participants challenges in learning General Mathematics were analyzed using the Moustakas' (1994) transcendental phenomenology where codes and categories were extracted. The following are the steps in the phenomenological reduction which served as a guide in analyzing the data gathered: (1) Bracketing, (2) Horizontalization, (3) Clustering into Themes, (4) Textural Description, (5) Structural Description, and (6) Textural-Structural Synthesis.

V. RESULTS AND DISCUSSIONS

Table 1

Level of Students' Algebraic Competence based on the Test Scores

Score	MPS	Frequency(f)	Descriptive Equivalence
48-50	96%-100%	0	Mastered
43-47	86%-95%	0	Closely Approximating Mastery
33-46	66%-85%	0	Moving Towards Mastery
18-32	35%-65%	71	Average
8-17	15%-34%	39	Low
3-7	5%-14%	0	Very Low
0-2	0%-4%	0	Absolutely No Mastery
Mean		19.927(39.854%)	Average

Table 1 presents the level of algebraic competence among Grade 11 students based on their scores in the Algebraic Competence Test. The results reveal that 71 students (64.5%) have an average level of algebraic competence, while the remaining 39 students (35.5%) have low level of algebraic competence. The grand mean of 19.93 (out of 50) indicates an average level. This implies that most grade 11 students exhibit moderate understanding of algebraic concepts. An average level of algebraic competence indicates that students obtain a moderate grasp of essential algebraic skills but may struggle with complex learning tasks such as abstraction, generalization, and multi-step problem solving (Rebecca et al., 2025). Furthermore, if students only achieve minimum academic outcomes, their performance may need further instructional remedy, especially in improving conceptual understanding and logical reasoning (Hussein & Csikos, 2023). Desired interventions that may promote mathematical communication, reasoning, and problem-solving are suggested to bridge gaps and elevate students' algebraic competence.

This result concurs with the Theory of Mathematical Cognition and Understanding by Robinson, Dubé, and Kotsopoulos (2023), which emphasizes the importance of cognitive processes such as pattern recognition, logical reasoning, and abstraction in mastering algebraic concepts. According to the theory, students operating at an average level may have developed rudimentary skills in symbol manipulation, but may not have yet fully grasped algebraic structures essential to tackle more abstract and complex mathematical concepts. Thus, the current result stresses the necessity of employing these empirical strategies in teaching algebraic concepts to promote more profound understanding and better academic performance to equip learners with vital skills to counter future academic challenges.

Table 2
Level of Students' Academic Performance in General Mathematics

Grading Scale	Frequency	Descriptor
90 – 100	38	Outstanding
85 – 89	40	Very Satisfactory
80 – 84	22	Satisfactory
75 – 79	10	Fairly Satisfactory
Below 75	0	Did Not Meet Expectations
Mean	87.082	Very Satisfactory

Table 2 presents the level of Grade 11 students' academic performance in General Mathematics, based on their first-quarter grades. The highest frequency indicates that only 40 students obtained a very satisfactory academic performance in General Mathematics. This implies that these students grasped an adequate learning of General Mathematics as they were able to analyze concepts and apply procedures in solving problems involving the learning competencies of General Mathematics during the first quarter. Meanwhile, the lowest frequency indicates that there were 10 students who achieved a fairly satisfactory performance whose grades fell within the range of 75 – 79. This implies that these students barely obtained passing marks in the said subject per the Department of Education grading standards (DepEd Order No. 8, s. 2015). This further suggests that these particular students manifested significant challenges while learning the first quarter of the said subject. In general, the students' average grade in General Mathematics is (87.08), implying that they achieved a very satisfactory academic performance in General Mathematics for the first quarter. This further implies that they grasped an adequate proficiency of the General Mathematics lessons as they were able to analyze concepts and apply procedures involving the learning competencies during the first quarter of General Mathematics

This level of performance in General Mathematics infers that the respondents in general, exhibit an adequate grasp of algebraic concepts which is a core component of the subject. The Theory of Mathematical Cognition and Understanding of Robinson, Dubé, and Kotsopoulos, (2023) indicates that algebraic competence is directly associated with some cognitive processes such as pattern recognition, logical reasoning, and abstraction. The development of these cognitive processes is vital for empowering students to progress from procedural computation to profound conceptual understanding. Students whose mathematics performance is very satisfactory do not only demonstrate competence in performing mathematical procedures but also in applying concepts in various more complex contexts. Mathematical competence consists of conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition (Barham, 2020). As for the result, having obtained a very satisfactory performance in General Mathematics implies that Grade 11 students established an adequate algebraic skills necessary to succeed in the said subject.

However, this does not change the fact that there were few respondents whose academic performance was fairly satisfactory implying that they struggled while learning the said subject. Based on the interview, some of their challenges were due to the complexity of the subject in which they lacked a prior conceptual knowledge and got confused with procedures and formulas. Participants 1 and 2 shared that, *"The most challenging lesson... is Rational Equation because of the complexity of fractions..."* — P1. *"...most challenging topic... Graphing of Exponential Function because... unfamiliar concepts like asymptotes..."* — P2. Their narratives imply that their struggles in learning General Mathematics were caused by their lack of conceptual and procedural knowledge in fractions and their unfamiliarity with other lessons like asymptotes which caused them to achieve a fairly satisfactory performance. Participants 9 and 10 added, *"Exponential and logarithmic functions... rules and formulas are confusing..."* — P9. *"I struggled the most with functions... dealing with equations and graphing... I got confused..."* — P10. Their challenges were also caused by their confusion of the complex rules, procedures, and formulas which hampered them to achieve a better academic performance in General Mathematics.

Table 3
Test of Relationship between Students' Algebraic Competence and their Academic Performance in Mathematics

Variables	Pearson "r"	Interpretation	p- value	Interpretation
Algebraic Competence and Academic Performance in General Mathematics	0.801	Highly Correlational (HC)	<.0001	Highly significant relationship

Scale: $\pm 0.90 - 1.0 =$ Very High Correlational (VC), $\pm 0.70 - 0.89 =$ High Correlational (HC), $\pm 0.40 - 0.69 =$ Moderate Correlational (MC), $\pm 0.20 - 0.39 =$ Low Correlational (LC), and $\pm 0.0 - 0.19 =$ Negligible Correlational (NC)

The Pearson correlation ($r = 0.801$) between the students' algebraic competence and their General Mathematics academic performance indicates a very strong and statistically significant relationship. The Pearson correlation coefficient indicates that algebraic competence and General Mathematics academic performance are positively highly correlated. This implies that the higher the level of students' algebraic competence, the better their academic performance in General Mathematics. In other words, the weaker their algebraic competence, the poorer their General Mathematics academic performance. The p-value ($p < 0.0001$) implies that the algebraic competence of the students is significantly influential to their success in learning General Mathematics since the two variables have significant relationship. If students possess an adequate algebraic competence prior to the learning the said subject, they may exhibit a good academic performance. In other words, if students lack the necessary algebraic competence, they may likely struggle to achieve a good performance in General Mathematics.

This exists a strong positive correlation between mathematical skills (including algebraic reasoning) and performance in General Mathematics (Parcon & Bearneza, 2024). Algebraic competence is a vital for success not only in Mathematics but also in related areas like Physics, suggesting its foundational role in logical and problem-solving processes (Tong et al., 2024). A positive correlation between logical-mathematical intelligence and mathematical competence in children implies that algebraic thinking supports broader math learning (Bracero-Malagón et al., 2022). Lastly, the exists a strong link between algebraic skills and math performance (Parcon & Bearneza, 2024).

Table 4
Regression analysis for determining predictors of students' academic performance in General Mathematics

Model	R	R ²	Adjusted R ²	SE	F-value	p-value
1	0.801 ^a	0.642	0.638	2.675	193.353	.000 ^a

a. Predictor: (Constant), Algebraic Competence
b. Dependent Variable: Academic Performance in General Mathematics

The table shows that there is a significant overall relationship between the two variables as indicated the model wherein Algebraic Competence is the independent variable and Academic Performance in General Mathematics is the dependent variable ($R = 0.801$, $p < .05$). R² statistic posts a higher value of 0.642 known as the coefficient of determination which indicates the proportion of variance of the dependent variable (Academic Performance in General Mathematics) can be explained by the variation that also occurs in the independent variable (Algebraic Competence). In this case, approximately 64% of the variation in Academic Performance in General Mathematics can be explained based on the amount of variation that occurs Algebraic Competence. The "Std. Error of the Estimate" indicates the amount of dispersion for the prediction equation. More importantly, a p-value less than 0.05 indicates a significant result. In this case, the statistical value confirms that Algebraic Competence is statistically a valid predictor of Academic Performance in General Mathematics.

Algebraic reasoning is a strong predictor of overall math performance, which conforms with the large correlation (Roslan & Chen 2022). Algebraic competence is a vital for success not only in Mathematics but also in related areas like Physics, suggesting its foundational role in logical and problem-solving processes (Tong et al., 2024). A positive correlation between logical-mathematical intelligence and mathematical competence in children implies that algebraic thinking supports broader math learning (Bracero-Malagón et al., 2022). Lastly, the exists a strong link between algebraic skills and math performance (Parcon & Bearneza, 2024). From a theoretical viewpoint standpoint, algebraic reasoning functions as an effective predictor of general math performance. This supports the assessment that algebraic competence is a foundation to broader success in mathematics (Roslan & Chen, 2022).

Table 5
Statistics Associated with the Predictor of Students' Academic Performance in the Regression Analysis

Model		Unstandardized Coefficients		Standardized Coefficients	t	p-value
		B	SE	Beta		
1	(Constant)	73.425	1.015	0.801	72.358	.000
	Algebraic Competence	.685	.049		13.905	.000

a. Dependent Variable: Academic Performance in General Mathematics

*Model: Academic Performance (Grade) = 73.425 + 0.685 Algebraic Competence (Score)

The unstandardized beta coefficients contain a value that indicates whether the relationship is direct or inverse. In this case, the "Unstandardized Coefficient" for Model of the Algebraic Competence = 0.685,

indicating a direct relationship. The coefficient values can be plugged into the regression equation. This equation is $Y_1 = a + b_1X_1$. To determine the value of (Academic Performance in General Mathematics), take sum of the constant (73.425) and the product of the coefficient (0.685) of Algebraic Competence and its actual value based on the test scores. In this case, Academic Performance = $73.425 + 0.685$ Algebraic Competence is the predictor formula or the equation of the linear regression. For instance, an Algebraic Competence score of 25 out of 50, predicts the Academic Performance of a student in General Mathematics by 90.55. Thus, Algebraic Competence of students significantly predicts their academic performance in General Mathematics.

Competence in algebraic concepts significantly predicts mathematics performance, explaining about 14% of the variance. It reports an R squared value and explicitly ties algebraic competence to academic outcomes (Barroso et al., 2020). Elementary pupils' competence in fractions and divisions also later predict their understanding in Algebra and entire Mathematics performance in high school (Siegler et al., 2012). This highlights the foundational role of early algebra-related competence in later math performance. In addition, Grade 7 students' algebraic skills and their mathematics academic achievement (using GPA data across quarters) revealed a significant positive correlation. This implies that students with robust algebraic skills may likely perform better in mathematics (Garinganao & Bearneza, 2021).

Students' Challenges in learning General Mathematics

Theme 1 – Struggling with Complexity

The respondents' utterances point to the complexity of the General Mathematics topics. Some of the lessons in the subject trigger confusion because, to the students, they are procedurally complex, conceptually abstract, and are mostly built on prior algebraic knowledge that some of them no longer remember. These difficulties are not only about complex procedures or formulas but they reflect gaps in foundational concepts, complex multi-steps processes that magnify minor errors, and a disparity between fast-phase lesson presentation and the students' readiness to grasp them.

Theme 1.1 Lacking Prior Knowledge

This theme highlights students' challenges in learning new mathematical topics due to inadequate foundational knowledge and skills. Having a weak foundation of algebraic concepts such as fractions, functions, and key graphing principles made it hard for them to comprehend more difficult lessons like rational equations and exponential functions. Even small mistakes in previous steps often led them to procedure wrong solutions, underpinning the challenge of building on a weak foundation.

Participants said...

"The most challenging lesson... is Rational Equation because of the complexity of fractions..." — P1

"...most challenging topic... Graphing of Exponential Function because... unfamiliar concepts like asymptotes..." — P2

"...na challenge ko... ang function ug Rational Function... kung masayop ka sa usa ka step, sayop na gyud..." — P5

"...katong functions kay... gamay ra pd mi og knowledge..." — P7

The participants' narratives reveal that some General Mathematics topics, particularly rational equations, functions, and graphing of exponential functions caused significant challenges due to their complexity and abstract nature. Participants 1, 5, and 7 emphasized that their difficulties were due to performing complex procedures, such as operating fractions and following intricate processes where a single mistake can invalidate the entire solution. Meanwhile, participant 2 struggled with understanding unfamiliar concepts like asymptotes or internalizing the main purpose and meaning of functions, demonstrating gaps in foundational knowledge. These narratives imply that conceptual knowledge and procedural skills need to be refined, as students struggle to link mathematical concepts with their meanings while also upholding accuracy in solving problems.

Theme 1.2 Getting Confused

This theme reveals the students' challenges especially in applying algebraic procedures and formulas correctly. The intricacy of solving problems involving functions, intercepts, asymptotes, and equations frequently led to confusion particularly when complex procedures were required. Misinterpretation of the roles of variables, mixed-up procedures, and struggles with the rules for exponential and logarithmic functions further mired their ability to solve and graph problems correctly.

Participants said . . .

"...nakapachallenge... pag-intercept, zero... pagkuha sa asymptotes... daghan kaayo ug solving..." — P3

"Functions are really hard for me... still get confused when I did the exercises..." — P6

"Functions... mag libog ko sa x and y kay lahi-lahi." — P8

"Exponential and logarithmic functions... rules and formulas are confusing..." — P9

"I struggled the most with functions... dealing with equations and graphing... I got confused..." — P10

The core meaning of these statements shows that students encountered problems when working with functions because they struggled with solving problems and interpreting equations and graphing functions. P1 and P3 encountered difficulties with particular technical details which include finding intercepts as well as identifying asymptotes and differentiating variables along with recalling the rules and formulas for exponential and logarithmic functions. The repeated mention of confusion indicates these problems arise from both complex subject matter and insufficient conceptual knowledge alongside procedural incompetence which reduces their math performance as well as their confidence.

Participants' utterances demonstrate that they faced significant learning challenges in General Mathematics because some topics like rational, exponential, and logarithmic functions/equations require abstract thinking, multiple steps, and previous knowledge which some students lack. Grasping algebraic concepts and executing complex procedures caused enduring challenges which appear consistently throughout the subthemes. These difficulties demonstrate that effective teaching-learning process must work to remediate essential skills. Making abstract ideas concrete through step-by-step practice and modifying teaching pace enable deeper understanding among students. Lastly, if these instructional supports are not given, students may develop permanent false beliefs about mathematics and experience math anxiety and weakened confidence. Challenges encountered by the learners in learning Mathematics include weak cognitive abilities, complex problem-solving procedures, and external factors that comprise unorganized classes, mathematics anxiety, high-stand instructors, and lack of instructional materials (Waswa & Al-Kassab, 2023)

Theme 2. Bearing Emotional Burdens

The theme illustrates students' emotional distress, self-doubt and physical pain that arose while learning the general mathematics. The fast pace of lessons and pressure from assessments intensify these feelings. They developed anxiety from numbers and became discouraged when they failed to comprehend concepts quickly. The emotional challenges produced physical symptoms including headaches and nervousness which interfered with concentration thus creating a learning barrier that diminished mathematical self-confidence.

Theme 2.1: Feeling Anxious

This theme highlights the emotional challenges students faced while learning the general mathematics. Anxiety, frustration, and self-doubt arose when they could hardly understand the lessons or when they noticed that their peers understood more quickly. These emotions created a sense of pressure and discouragement, which can further hinder their focus, confidence, and overall learning experience.

Participants said . . .

"I feel frustration, anxiety, and self-doubt..." — P1

"I feel anxious and pressured..." — P8

"...ma stress, ma anxious and discouraged... akoo feel gani ..." - P9

"...I get anxious when I still can't understand the lessons... discouraged when I saw others understand so quickly..." — P10

These utterances echo the students' profound emotional load that mathematics learning imposed on them. The participants' emotional distress stemmed from perceived difficulties in understanding concepts, which was intensified when they saw their classmates grasped the lessons more swiftly. The feelings of anxiety highlight a negative self-perception, often leading to decreased motivation and engagement in learning.

Theme 2.2 Feeling Pressured

This theme captures the pressure that students experienced due to the budgeted time allocated for every lesson. The need to keep up with the pace of instruction, finish exercises within limited time, and match the pace of their classmates' comprehension created a sense of pressure. This pressure often led to anxiety and hampered their ability to process and retain new learning effectively.

Participants said . . .

"...I feel all the pressure in keeping up with the lessons ..." — P2

"...I felt pressured every time... mahudan kog time mo answer..." — P7

"...pressured when I saw others understand so quickly..." — P8

These utterances illustrate the pressure students felt from both the learning pace and peer comparisons in understanding the lessons in General Mathematics. P2 and P7 highlighted the strain of keeping up instruction pace which suggest that they needed more time to fully comprehend the lessons. P8 emphasized the time pressure during activities or quizzes, indicating that time-bounded activities intensified stress and affected their performance. P8 revealed the psychological pressure upon seeing classmates understand concepts quickly. This heightened the feelings of inadequacy and self-doubt. Collectively, these statements show how external academic demands and social dynamics intertwine to amplify math-related stress.

The participants responses emphasize that negative feelings caused them to struggle in learning General Mathematics. Some of them said they said that they felt anxious every time they are asked to solve

mathematical problems. Others said that they felt pressured if they took longer time to solve the algebraic problems while seeing their classmates finished way earlier. Math elicits fears and panics due to the predominant perception about math as a difficult subject which requires higher-level of critical and creative thinking skills. This pre-existing perception generates anxiety and stress among learners specially those who have previously encountered difficulties with mathematics learning (Nolasco, 2025).

Theme 3 Suffering from Physical Discomfort

Physical discomfort can significantly affect students' engagement with the lessons and academic performance. In this theme, participants shared how physiological distress such as headaches, nervousness, and stress-related tensions hinder their focus to learn. These experiences highlight the association between physical well-being and cognitive performance as they show that when students feel unwell, their capacity to absorb and process information is often compromised.

Participants said . . .

"...can't focus... because of my constant headache..." – P4

"Math is hard for me... I feel nervous when I see numbers..." – P6

"...ma stress, ma anxious and discouraged... maka feel gani ko headache..." – P9

Discomfort with Mathematics learning causes physical ailment among the students. P4 and P9 reported that they felt stressed, anxious, discouraged, and could not focus due to their headaches especially when faced with mathematical problems. P7 emphasized that math is difficult and he felt nervous whenever he saw numbers. These physiological effects of dealing with numbers further impaired their learning that might create a feedback loop between physical ailment and poor performance. Common symptoms of suffering from being anxious or nervous in Mathematics include increased heart rate, sweating, tension, dizziness, headaches, and nausea. In more severe cases, students may experience full-blown panic attacks (*Math Anxiety Is More Than Just Disliking Math*, 2025).

Theme 4 – Facing Distractions

Learning is influenced by both environmental and personal factors. In this theme, participants highlighted how external factors such as distractions at home and poor internet connectivity can significantly hamper their concentration for learning and performance well in school. These barriers create challenges that are often beyond the students' direct control, yet they have a strong impact on their motivation, focus, and overall academic engagement.

Theme 4.1 Distracting Learning Space

The learning environment plays a crucial role in students' academic engagement and performance. This theme reflects how distractions, noise, and a lack of supportive atmosphere, whether at home or in school, can obstruct focus and concentration. Participants shared experiences of being disrupted by family issues, noisy surroundings, or inattentive peers, highlighting that an unfavorable learning space can significantly affect students' ability to fully engage with lessons and process information.

Participants said . . .

"...family support... I cannot focus because of... distractions... negativities..." – P2

"...distracted easily by seatmate..." – P4

"...noise at home... makes it hard to focus..." P6

The utterances highlight how environmental factors can disrupt a student's concentration and learning process. P2 emphasized the impact of both familial support and negative influences at home, suggesting that a lack of encouragement or presence of tension can reduce focus. P4 pointed to distractions from peers within the classroom, showing that the immediate learning setting also affects attention. P6 reinforced the effect of noisy home environments, indicating that physical and auditory disturbances make it difficult for students to concentrate. Collectively, these statements underscore that both home and school environments play a critical role in facilitating or hindering effective learning.

Theme 4.2 Lagging Internet Connectivity

In today's digital learning environment, stable internet access is essential for students to study their lessons in advance and complete academic tasks. This theme captures the challenges learners face when internet connectivity is slow, unstable, or unavailable, which can directly hinder their access to online learning materials as they study their lessons at home or as they participate in the class discussion.

Participants . . .

"...negative factor... hinay ang internet connection..."

"...walay load or signal..."

"...internet access... great impact... learning environment... pressured..."

"...internet access helps... but when it's weak it's hard to study..."

"...when the internet is weak it's hard to study..."

The participants' statements show that unreliable internet connectivity disrupts their learning process. P5 noted that slow internet negatively impacts their studies. P7 mentioned the complete lack of signal as a

barrier to participation. P8 stressed that having internet access is essential for a productive learning environment, and being without it adds pressure. P9 and P10 pointed out that weak connectivity makes studying difficult. This shows that technology issues can affect engagement, understanding, and academic results. Together, these experiences highlight the important role of reliable internet in supporting effective online learning.

The participants responses point out that the some of their challenges in learning Mathematics include facing distractions. Inconducive learning spaces and lagging internet connectivity caused them significant struggling while learning General Mathematics. Environmental factors such as noise and other interruptions within the study space can greatly disrupt the learners' focus. Classrooms with extreme chatter, frequent distractions from peers, or an uncomfortable physical setting can lead to reduced academic performance (Kaur, 2025).

VI. CONCLUSION

This study concludes that algebraic competence can be considered as a decisive factor in determining the students' success in General Mathematics since its predictive power underscores its foundational significance for Mathematics learning. Continuous support in enhancing the students' algebraic competence can significantly improve their overall mathematical performance. Meanwhile, their challenges, ranging from cognitive struggles with complexity to emotional burdens and environmental distractions, disclose that academic success is determined by both intellectual readiness and external conditions. Thus, the findings suggest that teaching Mathematics shall use an integrative approach which both reinforces algebraic foundations and provides academic support, emotional guidance, and conducive learning spaces. This is to ensure that students are not only competent in Algebra but are also prepared to succeed in learning Mathematics.

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