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Determinants of Achievement Level in Mathematics in the Modern World among College Students

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ABSTRACT

Various factors can influence students' mathematics achievement. This study examined the factors profile and skills, that could affect students' mathematics achievement. Using a descriptive-correlational design, the study involved a sample of 285 students enrolled in the Mathematics in the Modern World course during the first semester of AY 2023-2024 at Tangub City Global College, selected through cluster sampling. Attitude and self-efficacy scales to measure profile, skills tests computation, comprehension, and logic and validated midterm examination to measure achievement level were used as instruments to collect data. Descriptive statistics, Pearson Correlation Test, and Multiple Regression Analysis served as the main statistical tools. Findings revealed that students generally hold negative attitudes, low self-efficacy and computation skills, with average comprehension, logical skills, and mathematics achievement. Attitude, computation, comprehension, and logical skills significantly predicted achievement, while self-efficacy, though correlated, was not a predictor. It was concluded that students' mathematics achievement is significantly influenced by attitude, comprehension, computation, and logical skills, leading to the development of Learning Activity Sheets to enhance performance. It was recommended that this inquiry be extended by examining identity, knowledge, fixed, and context factors affecting mathematics achievement, as this study is focused solely on profile and skill factors.

INTRODUCTION

Mathematics is an indispensable discipline that supports logical reasoning, quantitative literacy, and problem-solving skills essential in daily life and professional fields. Despite its importance, many college students struggle and perform poorly in mathematics courses, a trend that poses significant challenges not only to individual academic success but also to national development (Hemmings *et al.,* 2010). Students' scholastic performance in mathematics is crucial for their future careers and for sustaining a competent workforce capable of responding to the demands of an increasingly technological and data-driven economy.

Extant literature suggests that a complex interplay of interrelated variables influences students' mathematics achievement, broadly categorized into profile and skill factors (Singh *et al.,* 2002). Among the profile factors, attitude toward mathematics (Balbalosa, 2010; Effandi & Normah, 2009; Guven & Buket, 2012; Mohamed & Waheed, 2011; Villanueva, 2009) and self-efficacy (Williams & Williams, 2010) have consistently been identified as determinants of academic success. On the other hand, skill factors such as comprehension, logical reasoning, and computation skills directly affect how students process, analyze, and solve mathematical problems (Abad, 2020; Macaso & Dagoho, 2022; Morsanyi, 2021; Embodo & Baraquia, 2019).

In the Philippine context, concerns about poor mathematics performance have persisted. Results from the 2019 Trends in International Mathematics and Science Study (TIMSS) revealed that the Philippines ranked last among 58 countries, with only one percent of Filipino students reaching the high benchmark in mathematics (CNN Philippines, 2020). These alarming findings highlight the urgent need to identify and address the determinants of mathematics achievement at the local level.

Within Tangub City Global College (TCGC), recent data mirror these global and national concerns. In the 2nd semester of A.Y. 2023–2024, only 26% of students enrolled in Mathematics in the Modern World passed the midterm examination, while 74% failed. This striking performance gap underscores the need to examine internal factors specifically students' comprehension, logical reasoning, computation skills, attitude toward mathematics, and self-efficacy that may explain variations in achievement.

Although extensive literature exists on mathematics performance, few studies have examined the combined influence of internal factors both skill and profile variables on mathematics achievement levels, especially within the Philippine context. Prior research (Opstad, 2018; Malibiran *et al.,* 2019) explored isolated variables or general mathematics performance without considering how these factors interact. The present study fills this gap by investigating the interplay between comprehension, logical reasoning, computation, attitude, and self-efficacy, thereby offering a localized perspective on the determinants of mathematics achievement among college students in Tangub City Global College.

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Therefore, this study aims to analyze the internal determinants of mathematics achievement among college students in Tangub City Global College, Misamis Occidental. By focusing on both profile and skill factors, it seeks to contribute to the growing body of research on mathematics education and provide localized insights for educators and policymakers. Ultimately, this study endeavors to propose evidence-based strategies to enhance mathematics instruction and improve students' learning outcomes.

LITERATURE REVIEW

Comprehension Skills and Mathematics Achievement

Comprehension in mathematics extends beyond memorizing formulas and applying algorithms; it involves understanding mathematical concepts, their interrelationships, and their application to real-world contexts. According to Öztürk *et al.* (2019), mathematical comprehension is demonstrated when students can interpret problems, assess their structure, and apply suitable solution strategies. Similarly, Nahdi *et al.* (2023) emphasize that comprehension fosters critical evaluation, judgment of solution validity, and effective communication of mathematical ideas.

Empirical evidence supports the positive correlation between comprehension and mathematical performance. Students with strong comprehension skills are better able to apply mathematical principles across contexts, contributing to higher achievement (Abad, 2020; Macaso & Dagoho, 2022). Malibiran *et al.* (2019) further identify comprehension as a key predictor of problem-solving ability, while Anjum (2015) links it directly to academic success in mathematics. Conversely, low comprehension levels often result in misinterpretations, misconceptions, and procedural errors, reducing the likelihood of solving problems correctly (Angateeah, 2017; Dela Cruz & Lapinid, 2014).

Logical Reasoning and Mathematics Achievement

Logical reasoning underpins the structure of mathematical thought. It allows learners to recognize patterns, infer relationships, and draw valid conclusions from data (Wilkinson *et al.,* 2018). Logical reasoning is essential for developing deductive and inductive skills necessary for mathematical proof and argumentation. Morsanyi (2021) asserts that logical skills are foundational to mathematical problem-solving, as they help students construct coherent arguments and evaluate the validity of mathematical statements.

Empirical studies support the causal relationship between logical reasoning and mathematical achievement. Nunes *et al.* (2010) demonstrated through longitudinal and experimental research that logical reasoning predicts later mathematics performance, even when controlling for working memory. Moreover, students trained in logical reasoning showed greater progress in mathematics compared to those who did not receive such training. These findings emphasize the importance of integrating logical reasoning development into early and higher education curricula.

Computation Skills and Mathematics Achievement

Computation skills the ability to perform mathematical operations accurately and efficiently are foundational for success in higher-level mathematics. As Harris and Di Marco (2017) note, computational proficiency supports understanding of complex mathematical concepts by reducing cognitive load. Strong computation skills allow students to focus on conceptual understanding and problem-solving rather than basic arithmetic processes (Embodo & Baraquia, 2019).

Studies consistently report a strong positive relationship between computation skills and mathematics performance (Embodo & Baraquia, 2019; Wu & Yang, 2022). Conversely, students with poor computational ability often struggle with algebraic and calculus-based problems, impeding their mathematical growth. Research further suggests that computational thinking defined as the logical structuring and automation of problem-solving enhances mathematics achievement, as evidenced by higher scores in international assessments such as TIMSS (Alotaibi & Alyahya, 2019).

Attitude toward Mathematics and Academic Performance

Students' attitudes toward mathematics encompassing beliefs, emotions, and motivations significantly influence their learning outcomes. Positive attitudes foster persistence, curiosity, and confidence, while negative attitudes often lead to anxiety and avoidance (Hwang & Son, 2021). Factors shaping these attitudes include teaching methods, classroom environment, early learning experiences, and cultural perceptions (Quane, 2024; Emata, 2023; Olayinka, 2023).

Empirical research affirms that students with positive attitudes toward mathematics achieve higher performance levels (Capuno *et al.,* 2019; Hwang & Son, 2021). For instance, data from TIMSS (Singapore) showed that students who enjoyed mathematics, recognized its value, and believed in their competence tended to perform better. Hence, educators should cultivate positive mathematical mindsets by designing engaging, supportive, and contextually relevant instruction.

Self-Efficacy and Mathematics Achievement

Self-efficacy the belief in one's capacity to perform specific tasks plays a pivotal role in academic success (Lopez-Garrido, 2023). In mathematics education, high self-efficacy correlates with persistence, resilience, and adaptive problem-solving strategies (Williams & Williams, 2010). Students who believe in their mathematical abilities are more likely to confront challenges confidently and interpret errors as opportunities for growth (Loo & Choy, 2013; Ozkal, 2019).

Cross-national studies affirm the strong reciprocal relationship between self-efficacy and mathematics

performance (Williams & Williams, 2010). Özcan and Kültür (2021) found that mastery experiences and social persuasion were the strongest predictors of mathematics achievement. Conversely, low self-efficacy shaped by emotional, social, and environmental factors negatively affects performance (Hiller *et al.,* 2021; Wang *et al.,* 2023; Yang *et al.,* 2024; Zakariya, 2022). As such, self-efficacy should be intentionally nurtured through constructive feedback, supportive environments, and opportunities for success (Chen & Hsieh, 2023).

Objectives

This study investigated the factors that could affect achievement level in Mathematics in the Modern World among college students during the first semester of academic year 2024-2025 in a selected higher education institution in Tangub City.

Specifically, this study sought to answer the following questions:

1. What is the profile of the college students affecting mathematics achievement in terms of:
    1.1 Attitude; and
    1.2 Self-efficacy?
2. What is the level of skill factors of college students affecting mathematics achievement in terms of:
    2.1 Comprehension;
    2.2 Computation; and
    2.3 Logical?
3. What is the level of mathematics achievement of the college students in terms of their Midterm exam scores in Mathematics in the Modern World??
4. Is there a significant relationship between college students' profile and their mathematics achievement
5. Is there a significant relationship between college students' skill factors and their mathematics achievement?
6. What is the best predictor of the college students' mathematics achievement?
7. Based on the findings, what Learning Activity Sheets (LAS) can be developed to enhance students' achievement in mathematics?

Conceptual Framework

This study is anchored on Elger's (2007) Theory of Performance (ToP), which provides a holistic understanding of performance by examining the interplay of six critical factors: Knowledge, Skills, Identity, Context, Personal Factors, and Fixed Factors. According to ToP, performance is defined as the production of valued results, and the level of performance is determined by the dynamic interaction of these factors. Knowledge Factors reflect the performer's understanding of relevant concepts and information. Skill Factors pertain to the ability to apply knowledge effectively. Identity Factors describe the performer's self-perception in a specific domain. Contextual Factors involve the environment, such as classroom dynamics, group settings, and resource availability (Apple *et al.,* 2016). Personal Factors include internal drivers such as motivation, self-regulation, and perseverance. Fixed Factors encompass unchangeable attributes like sex, innate abilities, and learning styles.

While ToP provides a comprehensive lens, this study narrows its focus to Profile Factors (a subset of Personal Factors) and Skill Factors, omitting Knowledge Factors due to the difficulty of collecting valid data in this area and excluding Contextual and Identity Factors for pragmatic reasons related to time and resource constraints. This study concentrates on two dimensions derived from ToP. The inclusion of Profile and Skill Factors allows for a focused investigation into internal elements affecting academic performance, aligning with the research's overarching goal of understanding the determinants of mathematical achievement. This scope excludes broader contextual and identity dimensions to maintain feasibility while drawing meaningful insights from measurable, quantifiable data.

By examining the relationship between these selected factors and students' academic achievement in Mathematics in the Modern World, this study aims to identify critical areas for support and intervention, enabling targeted strategies to enhance performance outcomes.

Materials and Methods

Research Design

This quantitative study utilized a descriptive-correlational design. The descriptive aspect was used to identify the college students' attitude and self-efficacy, and their level of skills in comprehension, computation, and logical as well as their current mathematics achievement level. The correlational aspect of this study examined the relationships between each factor and mathematics achievement. This approach effectively addresses the study's goal of identifying and analyzing determinants influencing students' mathematics achievement.

Research Setting

The study occurred at Tangub City Global College, previously recognized as Governor Alfonso D Tan College. The institution is in Maloro, Tangub City, part of the Misamis Occidental province in Region X.

Participants

The participants in this study were a sample of 285 first-year college students from a selected higher education institution in Tangub City during the first semester of academic year 2024-2025. Students who were not in first year level were excluded. These students were enrolled in Mathematics in the Modern World course from 6 different sections.

Research Instruments

The study utilized three assessment tools: (1) Questionnaires for profiles Mathematics Attitude Scale (MAS), and Self-Efficacy Scale (SS); (2) a researcher-made test for mathematical skills; and (3) the Midterm Examination for achievement level.

The MAS, adapted from Mullis *et al.* (2016), measures attitudes across three subscales: Like Learning Mathematics (LM), Value Mathematics (VM), and Confidence in Mathematics (CM). LM comprises seven statements, VM has eight, and CM has eight. Responses were rated on a 4-point scale (4 = Agree a lot, 1 = Disagree a lot), with hypothetical mean ranges: Very Positive (3.26–4.00), Positive (2.51–3.25), Negative (1.76–2.50), and Very Negative (1.00–1.75).

The SS, adapted from May (2009), evaluates students' self-efficacy in mathematics through 14 statements using the same 4-point scale. Hypothetical mean ranges were: Very High (3.26–4.00), High (2.51–3.25), Low (1.76–2.50), and Very Low (1.00–1.75).

The researcher-made test, guided by a Table of Specifications (TOS), assessed comprehension, computation, and logic through 90 multiple-choice questions. The comprehension subtest was adapted from LearningExpress (2010), while computation and logic subtests, validated by mathematics experts, showed acceptable reliability (Cronbach's alpha = 0.729 and 0.829, respectively).

Data Gathering Procedure

To maintain the study's integrity, the researcher requested permission from the Office of the college president. Additionally, the researcher requested approval from vice president for academic affairs and dean of the Institute of arts and Sciences to conduct study.

The researcher informed the student participants of the study's significance and goal, reviewed the advantages and disadvantages, enlisted their commitment, and maintained confidentiality, particularly the privacy of their responses and test results. The research participants' informed consent were obtained as part of ethical concerns. Each participant was requested to participate voluntarily. They were asked to engage voluntarily and were not under any duress to do so.

During the first week of the semester, the participants were asked to answer the researcher-made test for skills including comprehension, computation, and logical. They were also given links of the google forms which they needed to self-evaluate on their attitude and self-efficacy in Mathematics. For their achievement level, the Midterm examination questionnaire was then administered to the participants during the Midterm examination schedule of the school.

Statistical Treatment

The study employed Microsoft Excel and JASP for data processing and statistical analysis. To examine the relationship between the identified factors (profile and skill) and Mathematics achievement, the Pearson Correlation Coefficient was utilized. The correlation strength was interpreted using the scale adapted from Embodo and Baraquia (2019):

Table 1: Statistical Treatment

Correlation Coefficient	Correlation Strength
0 – ± 0.29	No Linear Relationship
±0.30 – ±0.49	Weak Linear Relationship
±0.50 – ±0.69	Moderate Linear Relationship
±0.70 – ±0.99	Strong Linear Relationship
±1.00	Perfect Linear Relationship

The statistical significance of the correlation coefficients was evaluated at a 5% level of significance ($p < 0.05$).

To identify the best predictor of the dependent variable, Mathematics achievement, a Multiple Regression Analysis was conducted. This technique was deemed appropriate as it enabled the simultaneous modeling of multiple independent variables and their collective impact on the outcome variable (Ruan, 2024). Independent variables with a p-value less than 0.05 were considered statistically significant predictors of Mathematics achievement.

Results and Discussion

Students' Profile

This part presents the profile of the students. These include their attitude and self-efficacy.

Table 1: Level of Students' Attitude

Indicators	M	SD	Remarks
Learning Mathematics			
1. I enjoy learning mathematics.	2.83	0.89	Positive
2. I learn many interesting things in mathematics.	2.92	0.92	Positive
3. I like mathematics.	2.57	0.85	Positive
4. I like any schoolwork that involves numbers.	2.43	0.83	Negative
5. I like to solve mathematics problems.	2.38	0.80	Negative
6. I look forwards to mathematics lessons.	2.70	0.88	Positive
7. Mathematics is one of my favorite subjects.	2.30	0.87	Negative

Value Mathematics			
1. I think learning mathematics will help in my daily life.	3.06	0.99	Positive
2. I need mathematics to learn other school subjects.	2.69	0.88	Positive
3. I need to do well in mathematics to get the job I want.	2.74	0.93	Positive
4. I would like a job that involves using mathematics.	2.41	0.91	Negative
5. It is important to learn about mathematics to get ahead in the world.	2.80	0.94	Positive
6. Learning mathematics will give me more job opportunities when I am an adult.	2.75	0.90	Positive
7. My parents think that it is important that I do well in mathematics.	2.71	0.89	Positive
8. It is important to do well in mathematics.	2.84	0.90	Positive
Confident in Mathematics			
1. I usually do well in mathematics.	2.42	0.79	Negative
2. Mathematics is easier for me than of my classmates.	2.10	0.80	Negative
3. Mathematics is one of my strengths.	2.18	0.78	Negative
4. I learn things quickly in mathematics.	2.32	0.78	Negative
5. Mathematics makes me calm.	2.09	0.79	Negative
6. I am good at working out difficult mathematics problems.	2.04	0.78	Negative
7. My teacher tells me I am good in mathematics.	2.11	0.80	Negative
8. Mathematics is easier for me than any other subject.	2.13	0.81	Negative
Overall	**2.50**	**0.86**	**Negative**

Scale: 1.00 – 1.75 = Very Negative; 1.76 – 2.50 = Negative; 2.51 – 3.25 = Positive; 3.26 – 4.00 = Very Positive

Table 1 reveals the results in determining the students' attitude. The overall level of attitude of students in mathematics was also observed to be Negative (M = 2.50; SD = 0.86). Considering the range of the deviations, this is relatively high. This implies that students' attitudes are quite spread out, indicating that some students feel positively about mathematics while others may feel negatively about the subject.

Moreover, of the three (3) subcategories, four (4) indicators of Learning Mathematics out of seven (7) accumulated means interpreted as Positive while the other three (3) indicators gathered means interpreted as Negative. Only one (1) out of eight (8) indicators got a mean interpreted as Negative under the Value Mathematics category, and the other seven (7) indicators obtained a mean interpreted as Positive. Lastly, all eight (8) indicators of Confident in Mathematics acquired means interpreted as Negative. Overall, among the three subcategories, it is Confident in Mathematics, in which students scored low and felt a negative attitude.

Students' negative attitudes towards mathematics are shaped by several interconnected factors. Research indicates that as students progress through educational stages, their enjoyment of mathematics often declines, fostering increasingly negative attitudes despite maintaining an appreciation for the discipline (Russo *et al.,* 2023). Adding to factor affecting negative attitude is early childhood experiences as these play a pivotal role, where negative perceptions frequently stem from limited understanding and disengaging learning environments during formative years (Quane, 2024). Additionally, weak foundational knowledge in primary education and a lack of motivation or encouragement from the home environment further contribute to negative attitudes (Olayinka, 2023).

Table 2: Level of Students' Self-Efficacy

Indicators	**M**	**SD**	**Remarks**
1. I feel confident enough to ask questions in my mathematics class.	2.38	0.75	Low
2. I believe I can do well on a mathematics test.	2.37	0.78	Low
3. I believe I can complete all of the assignments in a mathematics course.	2.66	0.84	High
4. I believe I am the kind of person who is good at mathematics.	2.15	0.81	Low
5. I believe I will be able to use mathematics in my future career when needed.	3.13	0.88	High
6. I believe I can understand the content in a mathematics course.	2.71	0.73	High
7. I believe I can get an "1" when I am in a mathematics course.	2.25	0.77	Low
8. I believe I can learn well in a mathematics course.	2.87	0.87	High
9. I feel confident when taking a mathematics test.	2.29	0.81	Low
10. I believe I am the type of person who can do mathematics.	2.40	0.80	Low

11. I feel that I will be able to do well in future mathematics courses.	2.49	0.84	Low
12. I believe I can do the mathematics in a mathematics course.	2.52	0.81	High
13. I believe I can think like a mathematician.	1.94	0.82	Low
14. I feel confident when using mathematics outside of school.	2.60	0.79	High
Overall	**2.48**	**0.81**	**Low**

Scale: 1.00 – 1.75 = Very Low; 1.76 – 2.50 = Low; 2.51 – 3.25 = High; 3.26 – 4.00 = Very High

Table 2 shows the results in determining the students' self-efficacy in mathematics. The overall level of self-efficacy of students in mathematics was also observed to be Low (M = 2.48; SD = 0.81). Looking at the range of deviations, which is relatively high, indicates that students' self-efficacy scores vary considerably around the mean. This means that, while some students may feel confident in their abilities, others feel significantly less so.

In addition, eight (8) indicators of students' self-efficacy out of fourteen (14) garnered means interpreted as Low while the other six (6) indicators posted means interpreted as High.

Low self-efficacy in mathematics among students often results from repeated failures or difficulties in math tasks, which reinforce a belief in their incompetence. Another reason is negative comparisons by parents, such as highlighting siblings' achievements, which can harm self-esteem and motivation (Zakariya, 2022). Cultural pressures to excel academically may also heighten math anxiety, further eroding self-efficacy (Jin *et al.,* 2023). Moreover, a lack of constructive feedback or negative reinforcement from teachers can exacerbate feelings of inadequacy (Yang *et al.,* 2024). Students experiencing high math anxiety are more likely to avoid challenges and perceive themselves as less capable, which perpetuates a cycle of low confidence and poor performance, particularly in test situations (Wang *et al.,* 2023).

Level of Skill Factors and Mathematics Achievement

This part presents the level of skill factors and mathematics achievement among students through their Mean Percentage Scores (MPS) from the test. Such includes the level of students' computation, comprehension, and logical skills and their mathematics achievement.

Table 3: Level of Students' Skill Factors and Mathematics Achievement

Skill	Mean	SD	MPS	Descriptive Equivalent
Comprehension	11.67	4.05	39%	Average
Computation	8.54	5.44	28%	Low
Logical	12.92	4.92	43%	Average
Mathematics Achievement	38.81	20.32	44%	Average

Scale: 96 – 100% = Mastered; 86 – 95% = Closely Approximating Mastery; 66 – 85% = Moving Towards Mastery; 35 – 65% = Average; 15 – 34% = Low; 5 – 14% = Very Low; 0 – 14% = Absolutely No Mastery

Table 3 reveals the mean score of the students from the 30-item comprehension test, which is 11.67. This has an equivalent Mean Percentage Score (MPS) of 39%, which is interpreted as Average based on the given scale. Based on the findings, this means that the students' comprehension skills were average based on their overall performance in the comprehension test.

When students' comprehension skills are lacking, their likelihood of arriving at the correct answers on assessments significantly diminishes, as they often struggle to understand the language of the problems and visualize the concepts involved (Angateeah, 2017). This lack of comprehension can lead to misconceptions, insufficient procedural knowledge, and difficulties in translating word problems into mathematical symbols, ultimately resulting in incorrect answers (Dela Cruz & Lapinid, 2014).

Meanwhile, the mean score of the students from the 30-item computation test is 8.54. This has an equivalent Mean Percentage Score (MPS) of 28%, which is interpreted as Low based on the given scale. Based on the findings, this means that the students' computation skills, based on their overall performance in the computation test, were low.

Students with low computation skills often struggle due to limited number sense, which hinders their ability to manipulate numbers flexibly and accurately (Arjudin *et al.,* 2024). This is compounded by difficulties in reviewing and improving their problem-solving processes, leading to persistent errors. Additionally, ineffective instructional practices and lower engagement, such as poor attendance in computation-based courses, further contribute to these challenges (Ullah *et al.,* 2020). Personal attitude and inadequate study strategies also play a critical role in influencing computation abilities, as seen in studies of at-risk engineering students, where these factors significantly impacted their performance (Medallon *et al.,* 2012).

Without strong computation skills, it will be detrimental for students to understand and solve math problems, resulting in a decline in overall performance (Wu & Yang, 2022).

Additionally, the mean score of the students from the 30-item logical test is 12.92. This has an equivalent Mean

Percentage Score (MPS) of 43%. This is interpreted as Average based on the given scale. Based on the findings shown, the students' logical skill based on their overall performance in the logical test was average.

Cultivating skills in logical reasoning, whether through creating or solving interconnected problems, enhances students' understanding of mathematic problems (Morsanyi, 2021). The critical thinking needed to navigate complex life situations is developed through the logical and mathematical reasoning used to solve multi-step problems. Logical reasoning enables students to approach mathematical challenges methodically, leading to accurate and structured solutions (Agah & Lamido, 2015).

Lastly, the mean score of the students from the 88-point Midterm examination test is 38.81. This has an equivalent Mean Percentage Score (MPS) of 44%, interpreted as Average based on the given scale. Based on the findings, this means that students' overall mathematics achievement in the Mathematics in the Modern World course, based on their Midterm examination performance, is average.

Research supports the idea that achieving higher mathematics competency significantly benefits individual students and broader economic and societal development. Hemmings *et al.* (2010) emphasized that mathematics proficiency is vital, as it supports success in numerous academic fields and professional careers while also contributing to a skilled workforce essential for economic competitiveness. Thus, elevating students from average to high mathematics achievement is a personal and collective gain.

The TIMSS (Trends in International Mathematics and Science Study) findings further emphasize the importance of striving for excellence in mathematics by highlighting how countries that invest in robust mathematics education witness better outcomes in global rankings and individual student performance (Alotaibi & Alyahya, 2019).

Significant Relationship Between Students' Profile and their Mathematics Achievement

This part consists of two tables highlighting the results of the test of significant relationship between students' attitude and their mathematics achievement as well as between students' self-efficacy and their mathematics achievement.

The null hypothesis declaring that there is no significant relationship between the students' attitude and mathematics achievement was tested using the Pearson coefficient of correlation as shown in Table 4.

Table 4: Test of Correlation between Students' Attitude and Mathematics Achievement

Variables	r – value	Remarks	p – value	Remarks
Students' Attitude and Mathematics Achievement	.608	Moderate Linear Relationship	<.001	With Significant Relationship

Scale: 0 – ± 0.29 =No Linear Relationship, ± 0.30 – ± 0.49=Weak Linear Relationship, ± 0.50 – ± 0.69= Moderate Linear Relationship, ± 0.70 – ± 0.99 = Strong Linear Relationship, ± 1=Perfect Linear Relationship

The results showed that there is a moderate positive linear correlation between students' attitude and students' mathematics achievement (Pearson "r" = .608) which means that when the students' attitude is developed to a more positive spectrum, the better they will perform in mathematics. However, if such attitude is weakened to the negative side, the greater the likelihood that they will perform poorly in mathematics. Additionally, a substantial correlation ($p<.001$) was found between the two variables. As a result, the alternative hypothesis which states that there is a strong correlation between students' attitude and their mathematical achievement was accepted, and the null hypothesis was rejected.

Data from the 2019 Trends in International Mathematics and Science Study (TIMSS) supports this finding, demonstrating that students' attitudes are a multifaceted construct that includes their confidence in their mathematical skills, their enjoyment of mathematics, and their perception of its value. The results showed that students' attitudes and their performance in mathematics were positively correlated (Mohamed & Waheed, 2011). Higher achievement in mathematics was specifically more likely to be attained by students who loved learning the subject, recognized its significance for future success, and felt positive in their mathematical skills (Hwang & Son, 2021).

The null hypothesis, declaring that there is no significant relationship between the students' self-efficacy and mathematics achievement, was tested using the Pearson coefficient of correlation, as shown in Table 5.

Table 5: Test of Correlation between Students' Self-Efficacy and Mathematics Achievement

Variables	r – value	Remarks	p – value	Remarks
Students' Self-Efficacy and Mathematics Achievement	.419	Weak Linear Relationship	<.001	With Significant Relationship

Scale: 0 – ± 0.29 =No Linear Relationship,± 0.30 – ± 0.49 = Weak Linear Relationship, ± 0.50 – ± 0.69 = Moderate Linear Relationship,± 0.70 – ± 0.99 = Strong Linear Relationship,± 1 = Perfect Linear Relationship

The results showed that there is a weak positive linear correlation between students' self-efficacy and students' mathematics achievement (Pearson "r" = .419) which implies that students with high efficacy, although weak, will still likely perform better or will have a better Mathematics achievement. While students with low self-efficacy skills will likely struggle to have a good achievement in Mathematics compared to those with high self-efficacy. Additionally, a substantial correlation ($p<.001$) was found between the two variables. As a result, the alternative hypothesis which states that there is a strong correlation between students' self-efficacy and their mathematical achievement was accepted, and the null hypothesis was rejected.

A comprehensive study examined the relationship between various sources of mathematics self-efficacy and achievement among high school seniors, providing insights relevant to the present findings. Results revealed that as students' self-efficacy scores increased, their performance in mathematics courses and on tests improved accordingly. These findings emphasize the critical role of self-efficacy in bolstering mathematics achievement, suggesting that confidence in one's math abilities positively impacts performance (Özcan & Kültür, 2021).

Significant Relationship between Skill Factors Among Students and their Mathematics Achievement

This part consists of three tables showcasing the results of the test of significant relationship between students' comprehension, computation and logical kills and their mathematics achievement.

The null hypothesis declaring that there is no significant relationship between the students' comprehension skill and mathematics achievement was tested using the Pearson coefficient of correlation as shown in Table 6.

Table 6: Test of Correlation between Students' Comprehension Skill and Mathematics Achievement

Variables	r – value	Remarks	p – value	Remarks
Students' Comprehension Skill and Mathematics Achievement	.574	Moderate Linear Relationship	<.001	With Significant Relationship

Scale: 0 – ± 0.29 =No Linear Relationship,± 0.30 – ± 0.49 = Weak Linear Relationship, ± 0.50 – ± 0.69 = Moderate Linear Relationship,± 0.70 – ± 0.99 = Strong Linear Relationship,± 1 = Perfect Linear Relationship

The results revealed a moderate positive linear correlation between students' comprehension skills and their mathematics achievement (Pearson r = 0.574). This indicates that as students' comprehension skills become more developed, their mathematics achievement tends to improve. On the other hand, when comprehension skills are underdeveloped, students are likely to struggle with achieving satisfactory results in mathematics. These findings accentuate the importance of fostering strong comprehension skills as a vital component of supporting students' overall success in mathematics. Further, a significant relationship was established between the two variables ($p<.001$). As a result, the alternative hypothesis—which states that there is a substantial correlation between the students' achievement in mathematics and their understanding skills—was accepted, and the null hypothesis was rejected.

A strong foundation in mathematics comprehension equips students to face mathematical challenges with confidence, allowing them to apply their knowledge effectively and solve problems encountered along the way (Nahdi *et al.,* 2023). With well-developed comprehension skills, students are better prepared to interpret and understand mathematical concepts, enabling them to tackle real-world applications and complex problem-solving scenarios. These skills are vital not only for mathematical success but also for related fields where critical thinking and analytical abilities are required (Abad, 2020; Macaso & Dagoho, 2022).

The null hypothesis, declaring that there is no significant relationship between the students' computation skills and mathematics achievement, was tested using the Pearson coefficient of correlation, as shown in Table 7.

Table 7: Test of Correlation between Students' Computation Skill and Mathematics Achievement

Variables	r – value	Remarks	p – value	Remarks
Students' Computation Skill and Mathematics Achievement	.553	Moderate Linear Relationship	<.001	With Significant Relationship

Scale: 0 – ± 0.29 =No Linear Relationship,± 0.30 – ± 0.49 = Weak Linear Relationship, ± 0.50 – ± 0.69 = Moderate Linear Relationship,± 0.70 – ± 0.99 = Strong Linear Relationship,± 1 = Perfect Linear Relationship

The results showed a moderate positive linear correlation between students' computation skills and mathematics achievement (Pearson "r" = 0.553). This indicates that as students' computation skills strengthen and develop, their achievement in mathematics tends to improve. Conversely, students with weaker computation skills are more likely to experience lower mathematics achievement. These findings suggest that targeted efforts to enhance computation skills could be a key strategy in supporting overall success in mathematics. Besides, a significant

relationship was established between the two variables (p<.001). As a result, the alternative hypothesis which states that there is a substantial correlation between the students' mathematical achievement and their computation skills was accepted, and the null hypothesis was rejected.

The results of this study indicating a significant relationship between computation skills and mathematics achievement are consistent with findings from Embodo and Baraquia (2019) who found a positive correlation between computation skills and mathematics achievement, with students who possess strong computational abilities typically demonstrating better performance in mathematics. This is further supported by the findings of Alotaibi and Alyahya (2019) that higher computational thinking levels are associated with better success on the TIMSS mathematics test.

The null hypothesis, declaring that there is no significant relationship between the students' logical skills and mathematics achievement, was tested using the Pearson coefficient of correlation, as shown in Table 8.

The results indicated a moderate positive linear correlation

Table 8: Test of Correlation between Students' Logical Skill and Mathematics Achievement

Variables	r – value	Remarks	p – value	Remarks
Students' Logical Skill and Mathematics Achievement	.679	Moderate Linear Relationship	<.001	With Significant Relationship

Scale: 0 – ± 0.29 =No Linear Relationship,± 0.30 – ± 0.49 = Weak Linear Relationship, ± 0.50 – ± 0.69 = Moderate Linear Relationship,± 0.70 – ± 0.99 = Strong Linear Relationship,± 1 = Perfect Linear Relationship

between students' logical skills and their mathematics achievement (Pearson r = 0.679). This suggests that as students' logical skills become more developed, their mathematics achievement tends to improve. On the contrary, students with underdeveloped logical skills are likely to face challenges in achieving satisfactory results in mathematics. These findings feature the importance of strengthening logical reasoning abilities as a critical factor in enhancing students' overall success in the subject. Additionally, a substantial correlation (p<.001) was found between the two variables. As a result, the alternative hypothesis—which states that there is a substantial correlation between the students' logical abilities and their mathematical achievement—was accepted, and the null hypothesis was rejected.

Research highlights a strong causal link between logical reasoning and mathematical learning, suggesting that a significant portion of mathematical knowledge is rooted in an understanding of fundamental logical principles (Nunes *et al.,* 2010). This finding highlights the critical importance of cultivating logical reasoning skills to boost mathematical achievement, particularly from a young age.

Best Predictor of Mathematics Achievement

This part contains the regression analysis of students' attitude, self-efficacy, comprehension, computation, and logical skills, and mathematics achievement. Using the multiple regression analysis, Table 9 presents which model best predicted students' mathematics achievement. The data show that there is a significant overall

Table 9: Regression Analysis for Determining Predictors of Students' Mathematics Achievement

Model	**R**	**R2**	**Adjusted R2**	**SE**	**F-value**	**p-value**
1	.609[a]	.370	.366	16.181	82.895	<.001
2	.815[b]	.664	.660	11.847	184.883	<.001
3	.855[c]	.731	.726	10.640	151.380	<.001

Scale: a. Predictors: (Constant), Profile-Attitude, Self-efficacy; b. Predictors: (Constant), Skill Factors-Comprehension, Computation, Logical Skills; c. Predictors: (Constant), Profile, Skill Factors; d. Dependent Variable: Mathematics Achievement

relationship of the model wherein the profile attitude and self-efficacy are the independent variables, and students' mathematics achievement is the dependent variable (R=.609, p<.001). Additionally, another significant overall relationship of the model is found comprising the skill factors—comprehension, computation, and logical skills, as the independent variables (R=.815, p<.001). Lastly, there is also a significant overall relationship of the model consisting of both profile and skill factors as the independent variables and mathematics achievement as the dependent variable (R=.855, p< .001).

Considering the R2 statistic, "Model 3" the best model among the three in predicting students' mathematics achievement with five predictors because it accumulated the highest value of 0.731 known as the coefficient of determination which indicates the proportion of variance of the dependent variable (mathematics achievement) that can be explained by the variation that also occurs in all independent variables (profile and skill factors). In this case, approximately 73% of the variation in mathematics achievement can be explained based on the amount of variation that occurs among the five predictors, collectively, F(5,279)=151.380, p<.001. The "Std. Error of the Estimate" indicates the amount of

dispersion for the prediction equation. More notably, a significant result has been established. In this case, the statistical value confirms that mathematics achievement can be accounted for by the five predictors—attitude, self-efficacy, comprehension, computation, and logical skills as a whole.

Table 10: Regression Analysis for Determining Predictors of Students' Mathematics Achievement

Model		Unstandardized Coefficients		Standardized Coefficients	t	p-value
		B	SE	Beta (β)		
1	(Constant)	–9.794	4.205		–2.329	.021
	Attitude	18.088	1.937	.580	9.337	<.001
	Self-efficacy	1.360	1.988	.042	0.684	.495
2	(Constant)	–14.202	2.451		–5.796	< .001
	Comprehension Skill	1.796	.191	.358	9.391	< .001
	Computation Skill	1.287	.141	.344	9.152	< .001
	Logical Skill	1.630	.169	.395	9.644	< .001
3	(Constant)	–29.332	3.054		–9.605	< .001
	Attitude	8.765	1.381	.281	6.348	< .001
	Self-efficacy	0.797	1.313	.025	0.607	.544
	Comprehension Skill	1.690	0.172	.337	9.803	< .001
	Computation Skill	1.122	0.128	.300	8.758	< .001
	Logical Skill	1.156	0.162	.280	7.127	< .001

a. Dependent Variable: Mathematics Achievement

**Model: Mathematics Achievement = -29.332 + 8.765 Attitude + 1.690 Comprehension Skill + 1.122 Computation Skill + 1.156 Logical Skill*

Looking at the unique individual contributions of the predictors, the results show that attitude (B=8.765, t=6.348, p<.001), comprehension skills (B=1.690, t=9.803, p<.001), computation skills (B=1.122, t=8.758, p<.001), and logical skills (B=1.156, t=7.127, p<.001) positively predict or are directly related to mathematics achievement based on the "Unstandardized Coefficient" for Model 3. It can be observed that one independent variable, which is self-efficacy, has no contribution individually or is not a unique significant predictor of mathematics achievement (p=.554).

The coefficient values can be plugged into the regression equation used to plot the line of regression. This equation is Y1 = a + b1X1 + b2X2 + b3X3 + b4X4. By using the formula, Mathematics Achievement = –29.332 + 8.765 Attitude + 1.690 Comprehension Skill + 1.122 Computation Skill + 1.156 Logical Skill. For an Attitude Score of 3.5, Comprehension Score of 20, Computation Score of 10, and Logical Score of 25, Mathematics Achievement = –29.332 + 8.765(3.5) + 1.690(20) + 1.122(10) + 1.156(25), predicts mathematics achievement score of 75.266. Thus, attitude, comprehension, computation, and logical skills significantly predict their Mathematics achievement.

The results of the multiple regression analysis indicate that attitude, comprehension skills, computation skills, and logical skills are significant predictors of mathematics achievement. These align with the research studies showing that students with positive attitudes tend to perform better academically. For instance, Hwang and Son (2021) found that students who enjoy learning mathematics and recognize its importance are more likely to achieve higher scores in the subject. Additionally, comprehension skills have been identified as critical predictors of both problem-solving performance (Malibiran *et al.,* 2019) and overall mathematics achievement (Anjum, 2015). Angateeah (2017) emphasized that low comprehension skills can significantly impede students' ability to understand and effectively tackle mathematical problems. This underscores the necessity of fostering strong comprehension abilities, as enhancing these skills is vital for improving students' mathematical performance. Furthermore, the significance of computation skills as a predictor of mathematics achievement is supported by Embodo and Baraquia (2019), who established a strong correlation between computational proficiency and mathematical performance. Their findings suggest that students with robust computation skills are better equipped to tackle various mathematical challenges, thereby enhancing their overall achievement. Lastly, the significant contribution of logical skills is reinforced by Nunes *et al.* (2010), who identified a strong causal link between logical reasoning and mathematical learning. This emphasizes that students who possess strong logical reasoning abilities are more likely to excel in mathematics, as these skills underpin the understanding of mathematical concepts and problem-solving.

In the meantime, studies show that while self-efficacy can play a role in shaping students' attitudes and behaviors regarding mathematics, it is not a definitive predictor of achievement. Self-efficacy's role as a predictor of mathematics achievement is complicated

by the possibility of interactions with other factors like teaching quality, resource availability, and social support, which also significantly affect performance (Lavasani & Amani, 2010). In the findings of Özcan and Gümüş (2019), the only noncognitive factor that directly impacted mathematical performance was metacognitive experience, excluding self-efficacy among the noncognitive factor. This disconnect arises because self-efficacy may be inaccurate; academically stronger students may underestimate their abilities, while weaker students may overestimate theirs (Talsma *et al.,* 2018). This variability highlights the complexity of self-efficacy as a predictor, suggesting it is not solely sufficient to determine mathematics achievement.

According to Elger's Theory of Performance, the findings of this study confirm the important role that skill and profile play in performance. Comprehension, computation, and logic are directly impacted by skills, which are the operational competencies needed to carry out tasks efficiently in this study. A person's involvement and adaptability in reaching desired objectives are influenced by profile such as attitude. These two factors work together to influence achievement, confirming Elger's claim that success is mostly determined by internal factors. The findings confirm that skill and profile are fundamental to understanding performance in the context under study, even though other factors from the theory were left out.

Learning Activity Sheets to Enhance Mathematics Achievement

Since the results of the study show that comprehension, computation, and logical skills and attitude significantly predict students' Mathematics achievement, Learning Activity Sheets (see appendix I) focusing on these factors were developed to help improve mathematics achievement. The LAS, adapted and modified from Llego (2020), aimed to improve students' mathematics achievement through carefully designed various activity tests that centered around enhancing comprehension tests, honing computation skills, developing logical skills, and self-reflection tests for attitude. The first part, a comprehension activity, consisted of a 10-item crossword challenge in which students identify terms based on the provided definitions and a 15-item multiple choice test that assesses students' ability to comprehend passages and interpret information from literary works. The second part, a computation activity, comprised of a 15-item matching type test focused on algebraic knowledge and an 8-item problem solving test on geometric prowess. The third part, a logical activity, contained of a 10-item supply test which students need to identify the next figure in the pattern and a 10-item multiple choice on abstract reasoning. The last part, an attitude-centered activity, included self-reflection prompts encouraging students to evaluate their perceptions of mathematics and introspective questions identify and address personal challenges in learning mathematics. Each activity in the LAS ensures a targeted approach to developing the key factors influencing mathematics achievement. By integrating comprehension, computation, logical skills, and attitude-focused exercises, the LAS provides a holistic tool to support and improve students' overall achievement in mathematics.

CONCLUSION

Based on the findings of the study, the researcher concluded that various factors significantly affect college students' mathematics achievement. Both profile, such as attitude and self-efficacy, and skill factors including comprehension, computation, and logical skills, were found to correlate positively with mathematics achievement. Among these, attitude, comprehension, computation, and logical skills were identified as significant predictors of achievement, contributing uniquely to students' success in mathematics. However, self-efficacy, while correlated with achievement, did not significantly predict individual success when considered alongside other factors. To address these findings, Learning Activity Sheets (LAS) focusing on these factors were developed to improve students' mathematics achievement.

It is therefore recommended that educators and institutions may implement strategies to improve students' attitudes toward mathematics, fostering positive engagement and better achievement. Teachers may design activities and assessments that target computation, comprehension, and logical skills, offering lots of practice and feedback to enhance these abilities. Additionally, researchers are encouraged to measure mathematics achievement through both midterm and final examinations for a more comprehensive analysis. Future studies may explore factors influencing achievement in other subjects and academic levels, including identity, knowledge, fixed, and contextual factors other than profile and skills.

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