Foundational Mathematical Skills of Students in Relation to Performance

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ABSTRACT

The study, "Foundational Mathematical Skills of Students in Relation to Mathematics Performance," examined the foundational mathematical skills and mathematics performance of first-year BS Marine Engineering students in a private maritime institution in AY 2025–2026. Using a descriptive-correlational research design, 183 students participated through stratified random sampling. Data were gathered through a researcher-made questionnaire and mathematical skills test covering arithmetic and algebraic skills, geometry and trigonometry, and problem-solving. Results revealed that respondents were predominantly male, mostly came from lower-income families, and represented diverse SHS strands, with the largest proportion from GAS and other strands. Students demonstrated a high level of foundational mathematical skills but achieved a fairly satisfactory mathematics performance. Significant differences were found according to family income, but not sex or SHS strand. No significant relationship was found between foundational mathematical skills and mathematics performance. The study recommends targeted interventions and supportive learning strategies to enhance students' mathematical competence and performance.

Keywords: Foundational Mathematical Skills, Mathematics Performance, Marine Engineering Students, Mathematical Competence, Higher Education

INTRODUCTION

Mathematics plays an important role in developing the analytical reasoning and problem-solving abilities required in technical and engineering fields. In marine engineering, students are expected to apply mathematical principles in areas related to navigation, mechanics, thermodynamics, and other shipboard and engineering operations. Basic mathematical competencies, particularly in arithmetic, algebra, geometry, trigonometry, and problem-solving, serve as important foundations for understanding more advanced engineering concepts. The prescribed curriculum and standards for Bachelor of Science in Marine Engineering programs emphasize the development of competencies necessary for students' technical and professional preparation (Commission on Higher Education [CHED] & Maritime Industry Authority [MARINA], 2021). Thus, having adequate mathematical foundations is important for students as they progress through the academic requirements of the program.

Mathematics performance reflects more than students' ability to perform computations. It also involves their capacity to understand mathematical concepts, reason logically, and apply mathematical knowledge in different situations. The Organisation for Economic Co-operation and Development (OECD, 2023) describes mathematical literacy as the ability to reason mathematically and to formulate, employ, and interpret mathematics when addressing problems in a variety of real-world contexts. This perspective emphasizes that mathematics learning involves not only the acquisition of procedures but also the meaningful application of mathematical knowledge. For students in engineering programs, these competencies are particularly relevant because mathematical reasoning and application are integral to understanding and addressing technical problems.

However, research has shown that students entering higher education may still experience difficulties in mathematics, particularly in courses that serve as foundations for more advanced learning. Wilkins et al. (2021) found that students' experiences and achievement in their first college mathematics course were associated with their likelihood of completing an engineering degree. Similarly, Tossavainen et al. (2021) examined the mathematical performance of first-year engineering students and emphasized the importance of fundamental mathematical reasoning strategies in engineering mathematics learning. These findings suggest that students' mathematical preparation and performance during the early stages of college may influence their ability to cope with mathematics-intensive courses and other academic requirements.

The Programme for International Student Assessment (PISA) has also highlighted continuing concerns regarding students' mathematical proficiency. According to the OECD (2023), a substantial proportion of students who participated in PISA 2022 performed below Level 2 in mathematics, which represents the baseline level of proficiency. At this level, students are expected to demonstrate basic mathematical knowledge and procedures when addressing relatively straightforward problems in familiar contexts (OECD, 2023). The findings indicate that many students continue to encounter difficulties in applying mathematical reasoning, interpreting information, and solving problems effectively. Such concerns emphasize the importance of strengthening mathematical foundations before students progress to more complex academic and technical learning.

Despite the recognized importance of mathematical foundations in engineering education, there remains a need to examine the foundational mathematical skills of students at the beginning of their marine engineering education and determine how these skills relate to their mathematics performance. In particular, assessing students' competencies in arithmetic and algebraic skills, geometry and trigonometry, and problem-solving may provide useful information regarding their strengths and areas requiring further development. Examining the relationship between these foundational skills and mathematics performance may also provide evidence that can guide educators in developing appropriate intervention programs and instructional strategies. Thus, this study aimed to assess the foundational mathematical skills of first-year BS Marine Engineering students in a private maritime institution in Bacolod City during the Academic Year 2025–2026 and determine their relationship with mathematics performance..

METHODOLOGY

Research Design

The study employed a descriptive-correlational research design to describe the respondents' profile and levels of foundational mathematical skills and mathematics performance, while examining the relationship between these variables. The descriptive component covered the respondents' sex, average monthly family income, and Senior High School (SHS) strand, as well as their skills in arithmetic and algebra, geometry and trigonometry, and problem-solving. According to Creswell and Creswell (2022), descriptive research systematically presents the characteristics of a population as they naturally occur, while correlational research examines relationships between variables without establishing cause-and-effect relationships. Thus, the design was appropriate for determining the respondents' mathematical status and examining whether foundational mathematical skills were significantly related to mathematics performance.

Subject and Respondents of the Study

The subject and respondents of this study were the First-year BS Marine Engineering Students in one of the private institution in Bacolod City during the school year 2025-2026.

Population and Sample Size

The total population of First-year BS Marine Engineering students is 337. Using Yamane's formula with a 5% margin of error, a sample size of 183 respondents was determined. The study therefore included 183 first-year BS Marine Engineering students as respondents.

Data Gathering Instrument

The primary instrument that was used in this study is a researcher-made multiple-choice test questionnaire designed to assess the respondents' level of foundational mathematical skills. The test is structured in a quiz-type format to objectively measure students' competencies in key mathematical areas, particularly arithmetic, algebra, geometry, trigonometry, and problem-solving.

The questionnaire is divided into two main parts. Part I consists of the respondents' profile, which includes variables such as sex, academic strand, and other relevant background information that may influence mathematical skills. Part II contains items that measure the foundational mathematical skills of the respondents. Each item consists of four options with only one correct answer. The test items are designed to evaluate not only foundational mathematical skills but also conceptual understanding and application of mathematical principles in solving problems related to maritime contexts.

The test uses a dichotomous scoring system, where each correct answer is given one (1) point and each incorrect answer is given zero (0) points. The total score obtained by each respondent represents their overall level of foundational mathematical skills. Higher scores indicate higher levels of skill in mathematics.

Validity and Reliability of the Research Instrument

To establish the validity of the research instrument, the researcher-made test was subjected to face and content validation by five specialists in mathematics education. The validators evaluated the items in terms of clarity, relevance, level of difficulty, and alignment with the objectives of the study. A Table of Specifications (TOS) was prepared to ensure that the test items corresponded to the targeted competencies and learning outcomes.

Content validity was further assessed using Lawshe's Content Validity Ratio (CVR). All five experts considered the 25 test items essential, resulting in a CVR of 1.00 for each item and an overall CVR of 1.00. The comments and recommendations provided by the validators were considered in refining the instrument before its administration to the actual respondents.

The reliability of the instrument was established through pilot testing involving 30 first-year BS Marine Engineering students who were not included in the actual sample. The test was administered twice using the test–retest method to assess the consistency of scores across administrations. The instrument obtained a test–retest correlation coefficient of $r = .529$ ($p = .003$), indicating a moderate positive association between the two administrations. Based on this result, the instrument was considered sufficiently stable for use in the main study.

Data Analyses

The study employed appropriate statistical tools to analyze the collected data in line with its research objectives.

The data gathered in this study were organized, tabulated, analyzed, and interpreted using appropriate descriptive and inferential statistical tools. To determine the profile of the respondents in terms of sex, average monthly income, and Senior High School (SHS) strand, frequency and percentage were utilized. These tools were used to present the number of respondents and the proportion of respondents in each category in relation to the total sample.

Formula for frequency:

f = Number of responses in a category

Where:

f = Frequency

Number of responses = the actual count of respondents belonging to a particular category

To determine the level of foundational mathematical skills of first-year BS Marine Engineering students as a whole and in terms of arithmetic and algebraic skills, basic geometry and trigonometry skills, and problem-solving skills, the mean and standard deviation were employed. The same statistical tool was used to determine the level of mathematical proficiency of the respondents. The mean and standard deviation were used to identify the average score of the respondents.

Formula for the mean:

$$\bar{X} = \frac{\sum X}{N}$$

Where:

$\bar{X}$ = mean

X = Raw scores
n = sample size

Formula for the standard deviation:

$$r = \sqrt{\frac{\sum(x - \bar{X})^2}{n - 1}}$$

Where:

r = standard deviation

x = raw score

$\bar{x}$ = mean

n = sample size

The interpretation guide for the level of foundational mathematical skills scores is presented below:

Raw Score	Interpretation	Verbal Description
21-25	Very High Foundational Mathematical Skills	Demonstrates excellent mastery of foundational mathematical skills across all domains.
16-20	High Foundational Mathematical Skills	Shows strong understanding of foundational mathematical skills with minimal errors.
11-15	Moderate Foundational Mathematical Skills	Demonstrates average competence; some difficulty in applying mathematical concepts.
6-10	Low Foundational Mathematical Skills	Shows limited understanding of foundational mathematical skills.
1-5	Very Low Foundational Mathematical Skills	Demonstrates very weak or minimal mathematical competence.

The interpretation of the foundational mathematical skills scores was based on equal five-point intervals across the 25-item test. Since each item was assigned one point for a correct response and zero points for an incorrect response, the total possible score ranged from 1 to 25. The five-point intervals were therefore used to classify the respondents' overall scores into Very High, High, Moderate, Low, and Very Low levels of foundational

mathematical skills. This interpretation was used to determine the level of foundational mathematical skills of BS Marine Engineering students and to classify their foundational skills based on their overall performance in the test. Furthermore, the test is aligned with the competencies prescribed in the Senior High School mathematics curriculum and maritime education requirements to ensure content validity and relevance.

In addition, the mathematics performance of the respondents was determined through the collection of their final grades in Math A. These grades were obtained from the school's Registrar's Office with the necessary permission and approval. The respondents' final grade in Math A served as the measure of their mathematics performance and was used as the secondary variable in analyzing its relationship with their foundational mathematical skills.

The mathematics performance of the respondents in this study was interpreted using the following grading scale. This score range categorizes students' mathematics grades to describe their level of academic achievement in mathematics: The five descriptive categories were based on equal five-point intervals across the 25-item test, providing a consistent basis for classifying the respondents' scores.

Score range	Verbal Interpretation
95–100	Outstanding
88-94	Very satisfactory
80-87	Satisfactory
65-79	Fairly satisfactory
50-64	Passing
Below 50	Did not meet expectations

This interpretation was used to describe and analyze the mathematics performance of the first-year BS Marine Engineering students in relation to their foundational mathematical skills and mathematics performance.

The normality of the data was assessed using the Shapiro–Wilk test. The results indicated that the data did not meet the assumption of normality; hence, non-parametric statistical procedures were used for the inferential analyses. The Mann–Whitney U Test was applied to determine whether a significant difference existed in the foundational mathematical skills of the respondents when grouped according to sex. The Kruskal–Wallis H Test was used to examine differences across the categories of average monthly family income and SHS strand. When a significant Kruskal–Wallis result was obtained, Dunn's pairwise comparison test was performed to identify which groups differed significantly. Finally, Spearman's rank-order correlation was used to determine whether a statistically significant relationship existed between foundational mathematical skills and mathematics performance.

Formula for the Mann–Whitney U Test was presented below:

$$U = n_1 n_2 + \frac{n1(n1+1)}{2} - R_1$$

Where:

n1 = sample size of group 1

n2 = sample size of group 2

R1 = sum of ranks of group 1

The The Kruskal–Wallis H Test was utilized to determine whether significant differences existed when the

respondents were grouped according to average monthly family income and SHS strand. When the Kruskal–Wallis H Test yielded a significant result, Dunn's Pairwise Comparison Test was conducted as a post hoc analysis to identify the specific groups with significant differences.

The formula for the Kruskal–Wallis H is presented below:

$$H = \frac{12}{N\ (N\ +\ 1)} \sum \frac{R_i^2}{n_i} - 3\ (N + 1)$$

Where:

N = total number of observations

Ri = sum of ranks for group I

ni = number of observations in group I

The formula for the Dunn's Pairwise Comparison Test is presented below:

$$Z = \frac{R_i - R_j}{\sqrt{\frac{N(N\ +\ 1)}{12}\left(\frac{1}{n_i} + \frac{1}{n_j}\right)}}$$

Where:

Where:

R_i, R_j = mean ranks of Groups i and j

n_i, n_i = sample sizes of the two groups

N = total sample size

Finally, the Spearman Rank-Order Correlation (Spearman's rho) was used to determine the significant relationship between the respondents' foundational mathematical skills and their mathematics performance.

$$R_s = 1 - \frac{6\ \sum d^2}{n\ (n^2 - 1)}$$

Where:

rs = Spearman's rank correlation coefficient

d = difference between paired ranks

n = number of paired observations

All statistical analyses were performed using a 0.05 level of significance, which served as the basis for accepting or rejecting the null hypotheses of the study.

RESULTS AND DISCUSSION

This chapter details the presentation, analysis, and interpretation of the collected data. The findings are organized using tables and discussions, focusing on the problem of the study.

Level of Foundational Mathematical Skills

The table presents the level of foundational mathematical skills of the respondents. It shows the distribution of students according to their mathematical skill levels, including the overall mean score, standard deviation, and corresponding interpretation.

Table 1. Level of Foundational Mathematical Skills of First-year BS Marine Engineering Students.

Level of Foundational Mathematical Skills	N	Mean	Std. Deviation	Interpretation
Very High	59	16.20	6.60	High
High	52			
Moderate	28			
Low	31			
Very Low	13			
Total	183			

The results reveal that out of 183 respondents, the overall mean score (M = 16.20, SD = 6.60), which was interpreted as High. This indicates that, in general, the respondents possess a high level of foundational mathematical skills. Such a finding suggests that the students have developed adequate competencies in fundamental mathematical areas, including arithmetic, algebra, geometry, trigonometry, and problem solving, which are essential for success in more advanced mathematical learning and overall academic performance.The respondents' high level of foundational mathematical skills may be linked to their prior learning experiences and exposure to mathematical concepts during their basic education. A strong foundation in mathematics allows students to comprehend more complex ideas, perform computations more efficiently, and apply mathematical concepts across different situations. As emphasized by the National Mathematics Advisory Panel (2021), mastery of basic mathematical principles and procedures is essential for success in more advanced mathematics and problem-solving tasks.

This result is further reinforced by recent literature highlighting the importance of foundational mathematical competence in academic achievement. UNESCO (2022) noted that strong foundational learning, including numeracy skills, is crucial for learners to successfully engage with higher-level academic content and lifelong learning. In the same way, the Organisation for Economic Co-operation and Development (OECD, 2023) stressed that mathematical literacy involves not only computation but also reasoning and the application of mathematics in real-life contexts, suggesting that students with stronger foundational skills are more likely to perform better in mathematics.

Nonetheless, the standard deviation of 6.60 indicates that variability exists among the respondents' mathematical abilities. This implies that although many students demonstrate strong foundational skills, some still face challenges in specific areas of mathematics and may require additional instructional assistance and targeted interventions.

Overall, the findings suggest that the respondents have achieved a high level of foundational mathematical skills, which can positively contribute to their performance in mathematics. Since foundational knowledge serves as the basis for more advanced mathematical learning, it is important to continuously strengthen these competencies to further improve students' academic performance and preparedness for more complex mathematical tasks.

Level of Mathematical Performance

Table 2. Level of Mathematical Performance of First-year BS Marine Engineering Students.

Level of Mathematical Performance	N	Mean	Std. Deviation	Interpretation
Outstanding	2	67.19	10.44	Fairly Satisfactory
Very Satisfactory	4			
Satisfactory	20			
Fairly Satisfactory	77			
Passing	80			

The findings reveal that out of 183 respondents, the overall mean score of (M = 67.19, SD = 10.44), which was interpreted as Fairly Satisfactory. This indicates that, in general, the respondents have achieved a moderate level of mathematical perfromance. The result suggests that although students possess basic mathematical knowledge and skills, there is still a need for further improvement in higher-order mathematical processes such as problem-solving, critical thinking, mathematical reasoning, and the application of mathematical concepts in various contexts.

The level of mathematics performance observed among the respondents may be shaped by their prior learning experiences, foundational mathematical competencies, and exposure to mathematics instruction. As explained by the Organisation for Economic Co-operation and Development (OECD, 2023), mathematics performance is not limited to performing calculations; it also involves the ability to reason mathematically and to formulate, apply, and interpret mathematical concepts in solving real-world problems. This suggests that students with stronger foundational mathematical skills are more likely to achieve higher levels of performance in mathematics.

This finding is supported by recent literature emphasizing the importance of early mathematical learning. UNESCO (2022) highlighted that the development of strong foundational numeracy skills plays a vital role in improving learners' academic achievement and their capacity to engage with more complex mathematical content. In addition, Mullis et al. (2024), through the Trends in International Mathematics and Science Study (TIMSS) 2023 report, emphasized that mathematics achievement is strongly linked to students' mastery of basic mathematical concepts, problem-solving skills, and access to effective learning opportunities.

However, the standard deviation of 10.44 indicates that there is variation in the respondents' mathematics performance. This implies that while some students achieved outstanding and very satisfactory levels, a larger proportion remained at the fairly satisfactory and passing levels. Hence, there is a need for targeted instructional support and continuous strengthening of foundational mathematical skills to improve overall performance.

Overall, the findings suggest that the respondents attained a fairly satisfactory level of mathematics performance. Although they have developed essential mathematical competencies, further enhancement of foundational knowledge and higher-order thinking skills is necessary to achieve better academic outcomes in mathematics..

Foundational Mathematical Skills when grouped according to Sex

The table presents the difference in the foundational mathematical skills of the respondents when grouped according to sex. The table shows the results of the statistical analysis conducted to determine whether a significant difference exists between male and female respondents in terms of their foundational mathematical skills.

Table 3. Difference in the Level of Foundational Mathematical Skills of First-year BS Marine Engineering students when grouped according to Sex.

Sex	N	Test Statistics (U)	P-value	Decision for Ho	Interpretation
Male	174	601.500	0.241	Failed to Reject Ho	Not Significant
Female	9				
Total	183				

The result of the Mann-Whitney U test showed a test statistic value of (U = 601.500, p = 0.241). Since the p-value is greater than the 0.05 level of significance, the null hypothesis was not rejected. This indicates that there is no significant difference in the foundational mathematical skills of male and female respondents. The findings suggest that sex does not significantly influence the students' ability in fundamental mathematical areas such as arithmetic, algebra, geometry, trigonometry, and problem solving.

The lack of a significant difference between male and female students suggests that mathematics achievement is influenced more by factors such as instructional quality, learning experiences, student motivation, and access to educational resources rather than biological sex. The Organisation for Economic Co-operation and Development (OECD, 2023) reported that gender differences in mathematics performance are generally minimal across many education systems, with achievement being more closely related to learning environment, socioeconomic background, and student engagement.

Similarly, UNESCO (2022) emphasized that providing equal access to quality education and learning opportunities helps reduce achievement gaps between male and female learners. When both groups are given comparable instructional support and educational resources, differences in academic performance, including in mathematics, tend to diminish.

Nevertheless, this result does not imply that all students have identical levels of mathematical ability. Variations in prior knowledge, learning approaches, study habits, and attitudes toward mathematics may still lead to differences in foundational mathematical skills. For this reason, mathematics instruction should remain responsive to the diverse needs of learners, regardless of sex.

Overall, the findings indicate that sex does not significantly influence the foundational mathematical skills of the respondents. This implies that both male and female students have similar opportunities to develop mathematical competence, and efforts to improve mathematics learning should focus on enhancing instructional practices and strengthening foundational understanding for all students.

Foundational Mathematical Skills when grouped according to Average Family Income

The table presents the difference in the level of foundational mathematical skills of first-year BS Marine Engineering students when grouped according to their average family income. The statistical analysis was conducted to determine whether students from different income groups significantly differ in terms of their foundational mathematical skills.

Table 4. Difference in the Level of Foundational Mathematical Skills of First-year BS Marine Engineering students when grouped according to Average Family Income.

Average Family Income	N	Test Statistics (U)	P-value	Decision for Ho	Interpretation
Below ₱15,000: Low Income	95	12.314	0.031	Reject Ho	Significant

15,001 – ₱25,000: Lower Middle Income	56				
25,001 – ₱40,000: Middle Class	20				
40,001 – ₱60,000: Upper Middle Income	4				
60,001 – ₱80,000: Upper Income	5				
Above ₱80,000: High Income	3				
Total	183				

The results show that the computed test statistic value was (H = 12.314, p = 0.031. Since the p-value is less than the 0.05 level of significance, the null hypothesis was rejected. This indicates that there is a significant difference in the level of foundational mathematical skills of first-year BS Marine Engineering students when grouped according to average family income. The finding implies that students' socioeconomic backgrounds may influence their mathematical preparedness and mastery of fundamental mathematical concepts.

The observed significant difference may be explained by variations in students' access to educational resources, learning materials, technology, tutorial assistance, and supportive learning environments across different income groups. Students from higher-income families are more likely to have greater access to academic support and enriched learning experiences that strengthen their foundational mathematical skills. In contrast, those from lower-income households may face limitations in resources and learning opportunities, which can negatively affect their mathematics learning.

This result is supported by the Organisation for Economic Co-operation and Development (OECD, 2023), which reported that socioeconomic status is strongly linked to academic achievement, including mathematics performance. Students from more advantaged socioeconomic backgrounds generally benefit from better access to educational resources and learning conditions that promote improved academic outcomes.

In the same way, UNESCO (2022) highlighted that socioeconomic inequalities continue to affect learners' access to quality education, learning materials, and academic support. These disparities can result in unequal learning conditions that influence students' academic achievement and development of foundational competencies.

Furthermore, findings from the Trends in International Mathematics and Science Study (TIMSS) 2023 reported by Mullis et al. (2024) show that mathematics achievement is influenced by home environment factors such as availability of learning resources and academic support systems. These factors contribute to differences in students' mastery of essential mathematical skills.

Overall, the results suggest that average family income plays a significant role in shaping the foundational mathematical skills of first-year BS Marine Engineering students. This implies that educational institutions may need to provide targeted academic interventions, learning support programs, and additional resources to assist students from economically disadvantaged backgrounds.

Pairwise Comparison of Average Family Income

Table 5. Pairwise Comparison of Average Family Income

Average Monthly Income		Test Statistic	P-value	Interpretation
Below ₱15,000: Low Income	15,001 – ₱25,000: Lower Middle Income	-10.403	.243	Not Significant
	25,001 – ₱40,000: Middle Class	-4.728	.716	Not Significant
	40,001 – ₱60,000: Upper Middle Income	13.597	.614	Not Significant

	60,001 – ₱80,000: Upper Income	68.747	0.005	Significant
	Above ₱80,000: High Income	-38.319	.217	Not Significant
15,001–₱25,000: Lower Middle Income	25,001 – ₱40,000: Middle Class	5.675	.680	Not Significant
	40,001 – ₱60,000: Upper Middle Income	24.000	0.381	Not Significant
	60,001 – ₱80,000: Upper Income	79.150	.001	Significant
	Above ₱80,000: High Income	-27.917	.373	Not Significant
25,001–₱40,000: Middle Class	40,001 – ₱60,000: Upper Middle Income	18.325	.527	Not Significant
	60,001 – ₱80,000: Upper Income	73.475	.005	Significant
	Above ₱80,000: High Income	-33.592	.305	Not Significant
40,001–₱60,000: Upper Middle Income	60,001 – ₱80,000: Upper Income	55.150	.120	Not Significant
	Above ₱80,000: High Income	-51.917	.199	Not Significant
60,001–₱80,000: Upper Income	Above ₱80,000: High Income	-107.067	0.006	Significant

The results reveal that not all income groups significantly differed in their foundational mathematical skills. Significant differences were observed between the low-income group (below ₱15,000) and the upper-income group (₱60,001–₱80,000) with a p-value of 0.005, between the lower middle-income group (₱15,001–₱25,000) and the upper-income group (₱60,001–₱80,000) with a p-value of 0.001, between the middle-class group (₱25,001–₱40,000) and the upper-income group (₱60,001–₱80,000) with a p-value of 0.005, and between the upper-income group (₱60,001–₱80,000) and the high-income group (above ₱80,000) with a p-value of 0.006. These findings indicate that students belonging to certain income levels differ significantly in their foundational mathematical skills, particularly those belonging to the upper-income category compared with other income groups.

On the other hand, no significant differences were found among the remaining income group comparisons, as all obtained p-values were greater than the 0.05 level of significance. This suggests that students from these income categories possess relatively comparable levels of foundational mathematical skills.

The observed differences among certain income groups may be explained by variations in socioeconomic resources, access to quality educational materials, learning technologies, private tutoring, and supportive home environments. Students from families with greater economic capacity often have more opportunities to access academic resources that contribute to stronger mathematical foundations. According to the Organisation for Economic Co-operation and Development (OECD, 2023), students from higher socioeconomic backgrounds generally demonstrate better educational outcomes because they have greater access to learning resources and favorable conditions that support academic achievement.

Similarly, the UNESCO (2022) emphasized that socioeconomic inequalities can create disparities in educational opportunities, including access to quality instruction and learning materials, which may be associated with students' academic development and achievement. In the context of mathematics education, differences in family resources and learning support may contribute to variations in students' mastery of foundational mathematical skills.

Furthermore, the Trends in International Mathematics and Science Study (TIMSS) 2023 reported by Mullis et al. (2024) highlighted that home educational resources and supportive learning environments are associated with

students' mathematics achievement. Learners who have greater access to educational materials and learning support tend to perform better in mathematics compared with those with fewer resources.

Overall, the pairwise comparison indicates that significant differences in foundational mathematical skills exist only among specific income categories, particularly involving the upper-income group. This suggests that average family income may be associated with students' access to educational opportunities that help strengthen their mathematical foundations, although students from several income groups may still exhibit comparable levels of mathematical competence.

Foundational Mathematical Skills when grouped according to Strand

The table presents the difference in the level of foundational mathematical skills of first-year BS Marine Engineering students when grouped according to their Senior High School (SHS) strand. The analysis was conducted to determine whether a significant difference exists in the students' foundational mathematical skills based on their academic strand

Table 6. Difference in the Level of Foundational Mathematical Skills of First-year BS Marine Engineering students when grouped according to Strand.

Strand	N	Test Statistics (U)	P-value	Decision for Ho	Interpretation
STEM	49	3.266	0.352	Failed to Reject Ho	Not Significant
ABM	16				
HUMSS	53				
GAS	65				
Total	183				

The results indicate that the computed test statistic value (H= 3.266, p = 0.352). Since the p-value is greater than the 0.05 level of significance, the null hypothesis was not rejected. Therefore, there is no significant difference in the level of foundational mathematical skills of first-year BS Marine Engineering students when grouped according to strand. This finding suggests that students from STEM, ABM, HUMSS, and GAS strands possess relatively comparable levels of foundational mathematical skills.

The absence of a significant difference may indicate that regardless of students' previous academic strands, they were able to develop the fundamental mathematical competencies necessary for college-level learning. This may be attributed to the shared mathematics curriculum in basic education, individual learning experiences, and students' adaptation to the mathematical demands of their chosen degree program.

The finding is supported by the Organisation for Economic Co-operation and Development (OECD, 2023), which emphasized that mathematical literacy is developed through continuous learning experiences, reasoning, and the application of mathematical knowledge in different contexts. This implies that students' mathematical abilities are not solely determined by their academic background but also by their engagement, learning opportunities, and exposure to mathematics instruction.

Similarly, UNESCO (2022) emphasized that quality and equitable learning opportunities enable students to develop essential competencies regardless of their educational background. When students are provided with effective instruction and appropriate learning support, differences in prior academic preparation may become less evident.

However, although the findings show no significant differences among strands, this does not mean that all students have identical mathematical strengths and weaknesses. Individual differences in prior knowledge, study

habits, motivation, and exposure to mathematical concepts may still influence their performance. Hence, mathematics instruction should continue to provide opportunities for students from different academic backgrounds to strengthen their foundational mathematical skills.

Overall, the findings suggest that Senior High School strand does not significantly influence the foundational mathematical skills of first-year BS Marine Engineering students. This indicates that students from different strands have developed comparable mathematical competencies, allowing them to cope with the mathematical requirements of their maritime engineering program.

Foundational Mathematical Skills and Performance

The table presents the relationship between the foundational mathematical skills and mathematical performance of first-year BS Marine Engineering students. The table shows the results of the statistical analysis employed to determine whether a significant relationship exists between students' foundational mathematical skills and their mathematical performance.

Table 7. Relationship Between the Foundational Mathematical Skills and Mathematical Performance of First-year BS Marine Engineering Students.

Variables	Test Statistic (rs)	p-value	Decision for Ho	Interpretation
Foundational Mathematical Skills Vs Mathematical Performance	0.058	0.438	Failed to Reject Ho	Not Significant

The results revealed that there was no statistically significant relationship between the foundational mathematical skills and mathematical performance of first-year BS Marine Engineering students, (rs= .058, p = .438). Since the obtained p value was greater than the .05 level of significance, the null hypothesis was not rejected. The Spearman correlation coefficient of .058 indicates a very weak positive relationship between the two variables. This suggests that although an increase in foundational mathematical skills was associated with a slight increase in mathematical performance, the relationship was too weak to be considered statistically meaningful. Therefore, the findings do not provide sufficient evidence to conclude that students with higher foundational mathematical skills tend to have significantly higher mathematical performance in this study.

The absence of a significant relationship suggests that mathematics performance may be influenced by various factors beyond foundational mathematical skills. These may include students' learning strategies, motivation, study habits, classroom engagement, instructional quality, and attitudes toward mathematics. According to the Organisation for Economic Co-operation and Development (OECD, 2023), mathematics achievement is a multidimensional construct influenced by students' cognitive abilities, learning opportunities, socio-emotional characteristics, and educational environments.

Similarly, the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2022) emphasized that students' academic achievement is affected by multiple factors, including the quality of teaching, availability of learning resources, and the overall learning environment. Thus, having adequate foundational knowledge alone may not guarantee higher levels of mathematical performance without the support of effective learning conditions and positive educational experiences.

The findings may also be explained by differences in students' approaches to learning and their ability to apply mathematical concepts in complex situations. Mullis et al. (2024), in the TIMSS 2023 International Results in Mathematics and Science, emphasized that mathematics achievement is associated with a combination of factors such as students' confidence in mathematics, instructional practices, home learning resources, and opportunities to engage in meaningful mathematical activities.

Overall, the findings indicate that although foundational mathematical skills are essential for learning mathematics, they did not show a statistically significant relationship with the mathematical performance of the respondents in this study. Therefore, improving mathematics performance requires a comprehensive approach

that considers not only foundational skills but also students' motivation, learning behaviors, and educational experiences.

CONCLUSION

Based on the findings, the following conclusions are drawn: The respondents were predominantly male, generally came from lower-income households, and represented diverse Senior High School strands, with GAS/Other comprising the largest group. The respondents demonstrated a high level of foundational mathematical skills but attained only a fairly satisfactory level of mathematics performance based on their final grades in Math A. Significant differences in foundational mathematical skills were found according to average monthly family income, particularly among selected income groups, while no significant differences were observed according to sex and Senior High School strand. Furthermore, no significant relationship was found between foundational mathematical skills and mathematics performance, indicating that higher foundational mathematical skills did not necessarily correspond to higher mathematics grades among the respondents. Overall, the findings suggest that although the students possessed strong foundational mathematical skills, these skills alone were not sufficient to explain their mathematics performance. Other factors, such as learning strategies, study habits, engagement, motivation, and educational support, may contribute to variations in students' academic achievement.

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