MATHEMATICAL SKILLS OF FRESHMEN NORSU BSED MATH STUDENTS: BASIS FOR ENTRANTS' TESTING MATERIAL AND ENHANCEMENT PROGRAM

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ABSTRACT: *This study aimed to assess the mathematical skills of freshmen Bachelor of Secondary Education (BSED) majoring in Mathematics at Negros Oriental State University (NORSU) Main campus and Bayawan-Sta. Catalina campus as a basis for developing an entrants' testing material and an enhancement program. The research focused on the respondents' demographic profile, including sex and senior high school strand, and examined their performance in algebra, geometry, statistics, probability, and calculus using validated testing material. The study also sought to determine if there is a significant difference in mathematical performance based on the respondents' profile, and whether a relationship exists between their performance in the NORSU Online Admission Test (NOAT) and Scholastic Aptitude Test for Teachers (SATT) and their mathematical skills. The results revealed that the overall level of mathematical skills of the respondents in all areas (algebra, geometry, statistics, probability, and calculus) did not meet expectations. The respondents performed better in calculus compared to other areas, with an overall mean score of 76, which was classified as "did not meet expectations." The study further found that there was a slight significant difference in performance based on sex and senior high school strand, with STEM students generally performing better. Additionally, a slight relationship was found between the respondents' mathematical skills and their performance in the NOAT and SATT. The findings suggest that there is a need for a more targeted approach in the development of a testing material and enhancement program to address the identified gaps in the mathematical skills of incoming BSED-Mathematics students.*

Keywords: Mathematical Skills, Mathematics Enhancement Program, Mathematics Testing Material, Algebra, Geometry, Statistics and Probability, Calculus

1. INTRODUCTION

Mathematics plays a crucial role in shaping the foundational competencies of future educators, particularly those pursuing a Bachelor of Secondary Education major in Mathematics (BSED-Mathematics). However, the transition from senior high school to tertiary education presents challenges in mathematical readiness. Studies have shown that disparities in mathematical skills among freshmen are influenced by various factors, including the senior high school strand, socioeconomic background, and the quality of prior mathematics instruction [1; 2]. These challenges can impede students' progress in higher education and affect their long-term academic and professional success.

At Negros Oriental State University (NORSU), the mathematical preparedness of BSED-Mathematics freshmen is of particular concern. Previous research suggests that differences in academic performance between STEM and non-STEM graduates are notable in mathematics-related courses, with STEM graduates often demonstrating stronger skills [1]. Furthermore, the effectiveness of entrance examinations in predicting students' performance in mathematics has been questioned. Entrance exams were predictive of performance in other subjects, their predictive value for mathematics was limited, indicating the need for more precise assessment tools [3].

To address these concerns, this study aims to assess the mathematical skills of freshmen BSED-Mathematics students at NORSU as a basis for developing entrants' testing materials and an enhancement program. By identifying areas of strength and weakness across key mathematical domains—Algebra, Geometry, Statistics, Probability, and Calculus—this research will provide insights into the specific needs of incoming students. This assessment will also consider the varying impacts of senior high school strands on students' mathematical performance, as highlighted by the current data distribution across STEM, ABM, HUMSS, GA, and TVL strands.

Additionally, recent studies emphasize the importance of innovative teaching strategies and competency-based assessments in improving mathematical proficiency. Quispe-Aquise et al. [4] demonstrated the effectiveness of interactive and playful strategies in enhancing mathematical competencies, while Korkmaz and Tutak [5] underscored the relevance of competency-based assessments in predicting academic success. These findings will inform the design of NORSU's testing materials and enhancement program, ensuring they are aligned with best practices in mathematics education.

Ultimately, this research seeks to bridge the gap between secondary and tertiary mathematics education by developing targeted interventions that enhance students' readiness for higher education. By addressing the specific mathematical needs of BSED-Mathematics freshmen, the university aims to support their academic journey and prepare them for future success as mathematics educators. Specifically, it purports to shed light on the following questions:

1. What is the respondents' profile in terms of
   1.1. sex, and
   1.2. senior high school strand?
2. What is the respondents' level of mathematical skills using the validated Testing Material?
3. Is there a difference between the respondents' level of mathematical skills using the validated Testing Material when grouped according to their profile?
4. Is there a relationship between the respondents'
4.1. level of mathematical skills using the validated Testing Material and their profile,
4.2. level of mathematical skills using the validated Testing Material and their level of performance in NOAT
4.3. level of mathematical skills using the validated Testing Material and their level of performance in SATT?

2. REVIEW OF RELATED LITERATURE

Mathematical Competencies of Freshmen Students

The importance of assessing incoming students' mathematical competencies has been highlighted in several studies. Entrance exam results were significant predictors of academic performance, particularly in subjects like English and Science, but less so in Mathematics [3]. This underlines the need for a more targeted assessment of students' mathematical abilities to ensure preparedness for college-level coursework. Similarly, studies like Korkmaz and Tutak [5] stress the role of appropriate assessments in understanding incoming students' knowledge gaps, especially in subjects that involve complex problem-solving, such as mathematics.

In the context of Filipino students, research by Santelices, Banas, and Arcilla [1] also identified low performance in core subjects like calculus and algebra among first-year engineering students. The study recommended an enhancement program that could bridge the knowledge gap in basic mathematics for STEM and non-STEM students.

Effectiveness of Entrance Exams in Predicting Success in Mathematics

The relationship between entrance exam performance and future academic success in mathematics is a pivotal topic in educational research. In the case of NORSU, identifying the specific mathematical topics where students excel or struggle will inform the entrants' testing material and provide a foundation for designing enhancement programs that focus on areas of weakness.

Research by Taşdemir [2] also highlights significant factors influencing student performance, including socioeconomic status, school type, and access to educational resources. These factors can provide a broader context, especially when considering how students' profiles, such as their strand in Senior High School (e.g., STEM, ABM, HUMMS), impact their mathematical performance upon entering college.

Mathematical Anxiety and its Impact on Student Performance

A common theme across several studies is the relationship between mathematical anxiety and academic performance. Studies by Kandeel [6] and Quitola [7] suggest that students with high anxiety levels about mathematics tend to perform poorly in subjects like statistics and probability.

Calma, Salvador, and Supan [8] found that senior high school students displayed high anxiety when studying Statistics and Probability, correlating this with poor performance. Therefore, part of the enhancement program should focus on alleviating mathematical anxiety and improving students' attitudes toward challenging subjects like statistics and calculus.

Mathematical Preparedness of Freshmen in Higher Education

The transition from high school to university poses significant challenges for students, especially in mathematics. Research has highlighted gaps in mathematical preparedness among first-year students entering tertiary education, which can impede their academic progress. Santelices, Banas, and Arcilla [1] emphasized the need for enhancement programs to bridge these gaps, particularly between STEM and non-STEM senior high school graduates entering engineering programs. This study underlines the importance of tailored programs that address foundational weaknesses in mathematics before students advance to more complex university-level topics.

Similarly, a study by Fabito, Rodriguez, and Catacutan-Bangit [3] explored the correlation between entrance exam results and academic performance in a Philippine university. Their findings revealed that while English and Science entrance exams had a strong predictive correlation with academic performance, Mathematics did not significantly predict students' general weighted average (GWA). This suggests that current entrance exam instruments might not effectively assess mathematical competencies, necessitating a review and enhancement of testing materials.

Senior High School Strands and Mathematics Performance

The academic background of students, particularly their senior high school strand, plays a crucial role in their mathematical proficiency. In the current study of freshmen Bachelor of Secondary Education (BSED) Mathematics students at Negros Oriental State University (NORSU), the distribution of students across various strands, such as STEM, ABM, HUMSS, GA, and TVL, indicates a diverse mathematical foundation. This diversity can impact their readiness for college-level mathematics. Research by Santelices et al. [1] highlights that STEM graduates generally perform better in mathematics-related courses compared to non-STEM graduates, further emphasizing the need for strand-specific enhancement programs.

Teaching Approaches to Improve Mathematical Skills

Effective teaching strategies are crucial for improving students' mathematical skills, especially in complex areas like calculus and probability. Research by Ozdemir Baki and Kilicoğlu [9] suggests that experienced teachers who are adept at noticing students' thinking can improve student outcomes by providing targeted interventions. Similarly, Son [10] highlights the importance of using context-based learning models, such as CORE RME, to improve students' ability to make mathematical connections.

The effectiveness of cooperative learning and peer tutoring strategies in enhancing mathematical performance has also been supported by several studies. For instance, Gerald and Musonda [11] demonstrated that cooperative learning significantly improved students' attitudes and performance in probability distributions.

Moreover, research by Roman [12] suggests that instructional modules, when paired with direct instruction, can help improve student performance. The study found that students who utilized instructional modules for topics in Statistics performed better, indicating that an instructional module could serve as a valuable tool for enhancing students' mathematical skills.

Curriculum and Instructional Strategies for Math Education

The comparison between old and new curricula plays a significant role in understanding the mathematical competencies of students. The literature suggests that curriculum changes must focus on improving the application of mathematical concepts to real-world problems, especially in subjects like algebra, calculus, and statistics. Research by Son [10] emphasizes the importance of interactive and

contextual learning strategies that not only teach mathematical concepts but also connect these concepts to practical, real-life situations.

Additionally, peer tutoring is a successful strategy in improving students' understanding of Statistics and Probability. Quitola [7] noted that peer tutoring had a significant impact on students' academic performance in Statistics, making it a promising approach to incorporate into enhancement programs.

3. SIGNIFICANCE OF THE STUDY

This study is significant as it addresses the mathematical readiness of Bachelor of Secondary Education major in Mathematics (BSED-Mathematics) freshmen at Negros Oriental State University (NORSU). By evaluating their mathematical skills and identifying areas of weakness, this research will serve as a basis for the development of a targeted entrants' testing material and an enhancement program, thereby contributing to the improvement of mathematics education at the tertiary level.

For Students

The study will benefit freshmen BSED-Mathematics students by identifying their strengths and areas for improvement in key mathematical domains such as Algebra, Geometry, Statistics, Probability, and Calculus. The enhancement program will be designed to bridge any gaps in their knowledge, helping them develop the competencies required for success in their academic journey and future teaching careers.

For Educators

Mathematics instructors will gain valuable insights into the mathematical preparedness of incoming students. This will allow them to tailor their instructional strategies, ensuring that their teaching addresses the specific needs of their students. Furthermore, competency-based assessments, as discussed by Korkmaz and Tutak [5], will enable teachers to monitor student progress and adjust their methods accordingly to foster better learning outcomes.

For the University

The findings will provide NORSU with evidence-based data to refine its admissions and support programs. The development of an entrants' testing material, as recommended by Fabito, Rodriguez, and Catacutan-Bangit [3], will enhance the university's ability to identify and support students who may struggle with mathematics, thereby improving overall academic performance and retention rates.

For Educational Policymakers

The results of this study can inform policies related to curriculum development and student support programs. By emphasizing the relationship between senior high school strands and mathematical readiness, this research supports the need for policy adjustments in both secondary and tertiary mathematics education to ensure better alignment and continuity between levels.

For Future Researchers

This study will contribute to the growing body of literature on mathematics education, providing a foundation for future research on the effectiveness of enhancement programs and testing materials in improving mathematical competencies. Researchers can build on this work to explore other factors influencing mathematical performance, such as teaching methodologies, student attitudes, and metacognitive skills [13].

In summary, this study will have a broad impact by enhancing the mathematical readiness of BSED-Mathematics students at NORSU, supporting educators in refining their teaching practices, and informing institutional and educational policy decisions aimed at improving mathematics education outcomes.

4. METHODOLOGY

The research followed a structured procedure to ensure the validity, reliability, and accuracy of the findings. Initially, a 55-item test was developed based on the competencies specified in CMO No. 15 s. 2017 and the Teacher Education Council and Research Center for Teacher Quality Compendium of 2020. The test covered key algebra topics, geometry, elementary statistics and calculus.

Following the validation, the test was pilot-tested at Negros Oriental State University-Guihulngan Campus and Siaton Campus using the parallel forms method to evaluate its consistency and applicability in assessing students' mathematical skills. Reliability testing was conducted using the Pearson Product-Moment Correlation Coefficient, yielding a high-reliability score, indicating that the test was a dependable measure of the intended competencies.

The validated and reliable test was then administered to Bachelor of Secondary Education major in Mathematics students across multiple campuses, including NORSU-Main Campus, and NORSU-Bayawan Campus. Data were systematically gathered during the test administration phase to ensure completeness and accuracy. Finally, statistical analysis was performed, including the computation of the mean, standard deviation, and correlation, to analyze the students' performance and identify trends and gaps in their mathematical skills.

RESULTS AND DISCUSSION

Table 1.1: Respondents' Profile in Terms of Sex

Sex	Frequency	Percentage
Male	15	29.4
Female	36	70.6
Total	**51**	**100**

The study involved 51 freshmen BSED Mathematics students at NORSU, with 15 males (29.4%) and 36 females (70.6%). This reflects a higher proportion of females, which aligns with trends seen in education, where female students often outnumber males in teaching-related programs [3]. Gender differences in academic performance, including in mathematics, may be influenced by factors such as societal roles and instructional methods [5]; [13].

Table 1.2: Respondents' Profile in Terms of Strand

STRAND	Frequency	Percentage
STEM	14	27.5
ABM	5	9.8
HUMMS	10	19.6
GA	16	31.4
TVL	6	11.8
Total	**51**	**100**

Understanding this distribution will help in analyzing any potential gender-based differences in mathematical skills and shaping targeted enhancement programs for both male and female students.

The study involved 51 freshmen BSED Mathematics students, distributed across various Senior High School strands. Among the respondents, 27.5% (14 students) came from the STEM strand, which is known for its strong focus on science, technology, engineering, and mathematics, making it the second-largest group in the study. The largest group was from the General Academic Strand (GA), comprising 31.4% (16 students). The HUMMS strand (Humanities and Social Sciences) accounted for 19.6% (10 students), while 11.8% (6 students) were from the TVL (Technical-Vocational-Livelihood) strand. The smallest group came from the ABM (Accountancy,

Table 2.1: Respondents' Level of Mathematical Skills in Terms of Algebra

Topics	No. of Items	Mean Score	Transmutation	Verbal	SD
1.1 The fundamental operations of algebraic expressions	7	3.706	73	Did Not Meet Expectations	1.254
1.2 Special Product	4	2.294	74	Did Not Meet Expectations	1.361
1.3 Factoring	3	1.784	74	Did Not Meet Expectations	0.642
1.4 Algebraic Fractions	5	3.000	75	Did Not Meet Expectations	1.000
1.5 Exponents and Radicals	5	1.823	69	Did Not Meet Expectations	0.973
1.6 Relations and Functions and Their Graphs	2	0.490	66	Did Not Meet Expectations	0.834
1.7 Inequalities	3	0.784	66	Did Not Meet Expectations	0.702
1.8 Systems of Linear Equations and Inequalities	1	0.118	62	Did Not Meet Expectations	0.325
1.9 Word Problems involving one, two, or three Variables	4	1.628	70	Did Not Meet Expectations	0.937
1.10 System of Linear Inequalities	2	0.275	63	Did Not Meet Expectations	0.603
OVERALL			**69**	**Did Not Meet Expectations**	

Business, and Management) strand, comprising 9.8% (5 students). This distribution reflects the diversity of academic backgrounds among the respondents, which provides a well-rounded perspective on the mathematical skills of incoming BSED Mathematics students. The varied representation from different strands allows for a broader analysis of students' mathematical capabilities, thus offering valuable insights for the development of targeted testing materials and enhancement programs aimed at improving the students' foundational skills in mathematics [3].

Table 2.1 presents the mean score for each topic ranging from 62 to 75, all falling under the category "Did Not Meet Expectations," suggesting that the students struggled to meet the expected proficiency levels in algebra. The overall mean score was 69, which further supports the conclusion that the student's performance in algebraic concepts is below expectations.

Among the topics, "The fundamental operations of algebraic expressions" had the highest mean score (73), indicating a relatively better understanding of basic algebraic operations. However, it still fell short of meeting expectations. Other topics, such as "Exponents and Radicals" (69), "Relations and Functions and Their Graphs" (66), and "Systems of Linear Equations and Inequalities" (62), demonstrated lower scores, suggesting that these areas were particularly challenging for the students. The lowest scores were observed in more complex areas, such as "System of Linear Inequalities" (63), indicating a gap in understanding more advanced algebraic concepts.

These results align with the study by Pramesti and Retnawati [14], which identifies common difficulties in learning algebra, particularly in understanding algebraic expressions, variables, and operations. Their research found that students often struggle with interpreting problems, understanding the meaning of variables, and performing algebraic operations, all of which contribute to errors in solving algebraic problems. These challenges were reflected in the students' performance in this study, particularly in topics such as "Exponents and Radicals," and "Systems of Linear Equations and Inequalities."

Table 2.2: Respondents' Level of Mathematical Skills in Terms of Geometry

Topics	No. of Items	Mean Score	Transmutation	Verbal	SD
2.1 Pythagorean Theorem	2	0.529	66	Did Not Meet Expectations	0.703
2.2 Surface Area	2	1.765	93	Outstanding	0.428
2.3 Angle Measure	5	2.941	74	Did Not Meet Expectations	1.156
2.4. Perimeter	2	1.078	73	Did Not Meet Expectations	0.717
2.5 Isosceles Triangle	2	1.078	73	Did Not Meet Expectations	0.717
2.6 Parallel lines cut by a transversal line	1	0.157	63	Did Not Meet Expectations	0.367
2.7 Two-column Proof	2	0.431	65	Did Not Meet Expectations	0.575
2.8 Mid-point	1	0.509	72	Did Not Meet Expectations	0.505
2.9 Logical Statements	3	1.941	77	Did Not Meet Expectations	0.947
OVERALL			**73**	**Did Not Meet Expectations**	

Table 2.2 shows the data on geometry topics reveals a significant variation in student performance across different areas, suggesting that students face challenges in mastering fundamental geometry concepts. The topic of Pythagorean Theorem, with a mean score of 66, indicates difficulties in interpretation and application, particularly at the visualization level (Van Hiele Level 1), where students struggle to convert geometric problems into solvable mathematical models, as noted by Sulistiowati et al. [15]. In contrast, the Surface Area topic received a high score of 93, categorized as "Outstanding," which may reflect students' better ability to visualize and solve more tangible geometric problems. This aligns with the findings of Facciaroni et al. [16], which suggest that students tend to perform better on tasks that involve direct measurement and tangible concepts.

However, Angle Measure, with a score of 74, indicates that students still struggle, though slightly below expectations.

This may be due to the abstract nature of angle measures and their relationships, which require more complex problem-solving skills. According to Sulistiowati *et al*. [15], students at Van Hiele Level 2 and Level 3 (analysis and deduction) often face difficulties when multiple concepts or theorems need to be applied in problem-solving. Similarly, the Perimeter topic, with a score of 73, reflects a similar struggle, as students may have trouble translating geometric figures into solvable forms, especially when the problems are more abstract, as suggested by Sulistiowati et al. and Zeinul Abdeen et al. [15].

The Isosceles Triangle topic shows a score of 73, indicating that students face similar challenges as with Perimeter. This difficulty may stem from understanding the specific properties of isosceles triangles, such as angle relationships and symmetry. Facciaroni et al. [16] and Sulistiowati et al. [15] highlighted that students often struggle with tasks that require reasoning about specific geometric properties, which likely contributes to the lower performance in this area. The Parallel Lines Cut by a Transversal topic shows the lowest score of 63, which suggests significant difficulty, possibly due to the abstract nature of understanding angle relationships when lines are cut by a transversal. This is consistent with Sulistiowati et al.'s [15] findings that students at lower Van Hiele levels have difficulty interpreting and applying these geometric concepts.

The Two-column Proof topic, with a score of 65, indicates that students struggle with the logical reasoning and structured argumentation required in geometric proofs. This difficulty may be tied to students' challenges in moving beyond basic visualization to more formal reasoning [16]. Similarly, Mid-point, with a score of 72, reflects moderate understanding but suggests that students may lack proficiency in applying this concept in various geometric contexts. Sulistiowati et al. [15] emphasize that difficulties in geometry often stem from students' limited ability to visualize and apply geometric concepts effectively.

On a more positive note, the Logical Statements topic, with a score of 77, shows that students are more comfortable with reasoning tasks, though still not meeting expectations. The ability to understand logical connections is crucial in geometry, and students' lower scores may indicate a struggle with abstract reasoning, which is consistent with findings from Facciaroni et al. [16] and Sulistiowati et al. [15]. Overall, the overall score of 73, categorized as "Did Not Meet Expectations," suggests that students face substantial challenges in most geometry topics. These difficulties are likely due to issues in interpretation, applying theorems, and problem-solving abilities at varying Van Hiele levels. The studies by Sulistiowati et al. [15] and Zeinul Abdeen et al. [17] highlight the importance of improving teaching methods, such as adopting active learning approaches, to enhance student engagement and understanding of core geometric principles. This approach could help bridge the gap in students' performance, leading to better outcomes in geometry.

Table 2.3 reveals that students' performance across key statistical topics—Measures of Central Tendency, Probability, and Hypothesis Testing—did not meet expectations, with an overall transmutation score of 73.

Table 2.3: Respondents' Level of Mathematical Skills in Terms of Statistics and Probability

Topics	No. of Items	Mean Score	Transmutation	Verbal	SD
3.1 Measures of Central Tendency	2	1.43	82	Did Not Meet Expectations	0.671
3.2 Probability	2	0.882	71	Did Not Meet Expectations	0.711
3.3 Hypothesis Testing	2	0.628	67	Did Not Meet Expectations	0.564
OVERALL			**73**	**Did Not Meet Expectations**	

For Measures of Central Tendency, students achieved a mean score of 1.43 out of 2 items, corresponding to a transmutation score of 82, yet their performance was still classified as "Did Not Meet Expectations". Despite scoring higher in this area, difficulties in distinguishing between mean, median, and mode, as highlighted by Saidi and Siew [18], could explain their challenges in fully grasping these concepts.

In Probability, students recorded a mean score of 0.882, with a transmutation score of 71, also failing to meet expectations. This aligns with Roman's [12] assertion that Probability remains one of the most challenging areas for students, particularly when learning is limited to self-directed methods.

Hypothesis Testing presented the lowest performance, with a mean score of 0.628 and a transmutation score of 67. This topic demands higher-order reasoning and procedural understanding, which many students struggle with [18].

Table 2.3 : Respondents' Level of Mathematical Skills in Terms of Calculus

Topics	No. of Items	Mean Score	Transmutation	Verbal	SD
4.1 Limits	2	1.392	80	Did Not Meet Expectations	0.777
4.2 Derivatives	2	1.000	72	Did Not Meet Expectations	0.721
OVERALL			**76**	**Fairly Satisfactory**	

Table 2.3 highlights the performance of students in two fundamental topics of Calculus: Limits and Derivatives. On the topic of Limits, students obtained a mean score of 1.392, translating to a transmuted score of 80, but the verbal rating did not meet expectations suggesting that the level of understanding was insufficient. This aligns with findings from Tarmizi [19], who identified that many students struggle with conceptualizing functions and visualizing problem-solving strategies, which is critical for understanding limits. Additionally, McKinney & Dibbs [20] highlighted that students often face challenges in adapting to calculus concepts, and these struggles can impact their performance on related topics.

In the Derivatives section, students scored a mean of 1.000, with a transmuted score of 72, which also falls under the did not meet expectations category. This underperformance might reflect difficulties in grasping the process-oriented nature of derivatives, a finding consistent with Tarmizi [19], who noted that students often lack a deep conceptual

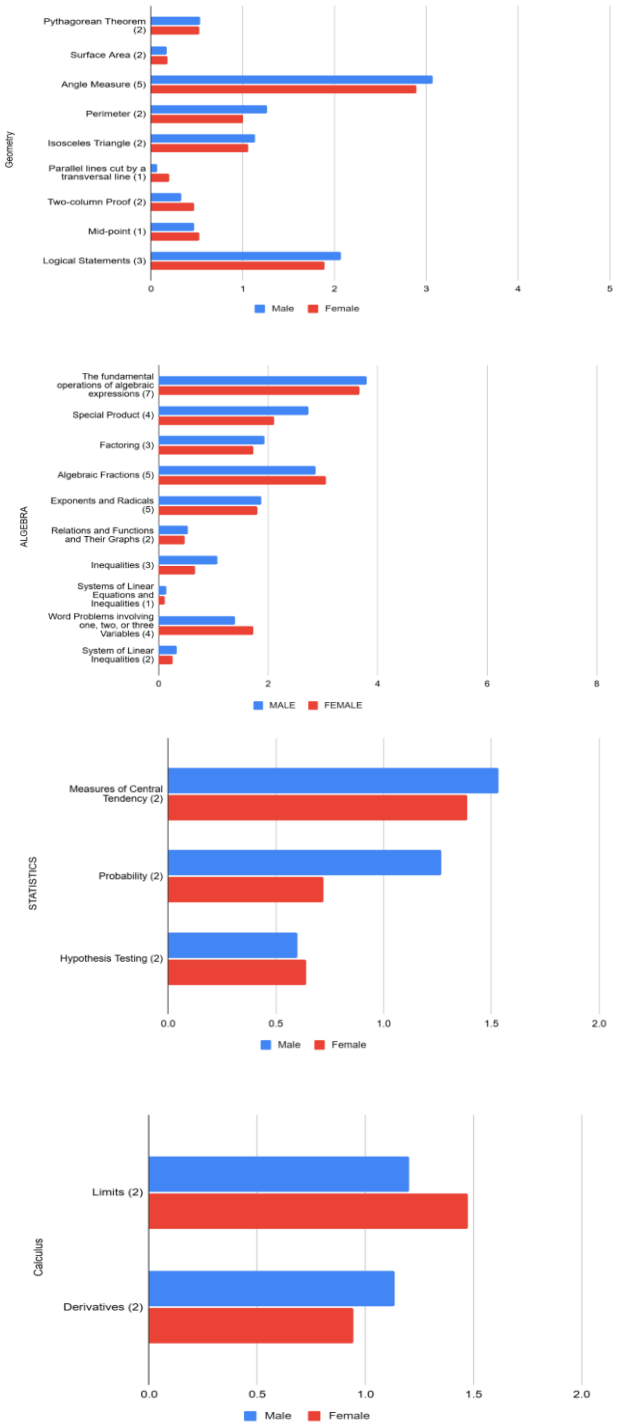


Figure 1: Difference between the respondents' level of mathematical skills using the validated Testing Material when grouped according to Sex

yield success. The study suggests that students need to engage more actively with the logic behind the procedures rather than just following steps mechanically.

Despite these challenges, the overall mean score of 76, which is rated as fairly satisfactory, suggests that students performed somewhat adequately across the topics as a whole. However, the underperformance in specific areas like Limits and Derivatives indicates that additional support is needed to strengthen students' conceptual understanding. McKinney & Dibbs [20] recommend reviewing teaching strategies to improve student performance, particularly in foundational calculus topics, which is critical for ensuring success in more understanding of mathematical operations like derivatives, focusing instead on procedural methods that may not always be advanced courses. Interventions such as focused tutorials and enhanced problem-solving techniques could help address these gaps in understanding.

The graphical representation showcases male and female students' performance across four mathematical domains: Algebra, Geometry, Statistics, and Calculus.

In Algebra, both genders exhibit notable strengths in The Fundamental Operations of Algebraic Expressions and Algebraic Fractions, with males slightly leading. However, females demonstrated stronger performance in Word Problems Involving One, Two, or Three Variables, while Relations Functions and Systems of Linear Equations and Inequalities posed significant challenges for both groups.

Geometry shows a mixed trend. Females excel in Angle Measure, while males perform better in Logical Statements and Mid-point. Both groups struggle with Two-column Proof and Parallel Lines Cut by a Transversal Line.

In Statistics, male students show stronger proficiency in Measures of Central Tendency and Probability, aligning with findings from studies emphasizing the impact of foundational statistical knowledge on overall performance [4]. Female students perform comparably in Hypothesis Testing, though slightly lower.

Calculus performance reveals a close margin between genders. Males perform slightly better in Limits, while females show comparable results in Derivatives. This performance trend reflects broader findings that suggest early exposure to advanced mathematical concepts could enhance outcomes across genders [1].

These patterns underscore the importance of targeted interventions to address specific areas of weakness and build on students' strengths, emphasizing differentiated instruction and contextual learning.

The bar graph highlights the mathematical performance of students from various Senior High School strands—STEM, ABM, HUMMS, GA, and TVL—in four key areas: Algebra, Geometry, Statistics and Probability, and Calculus.

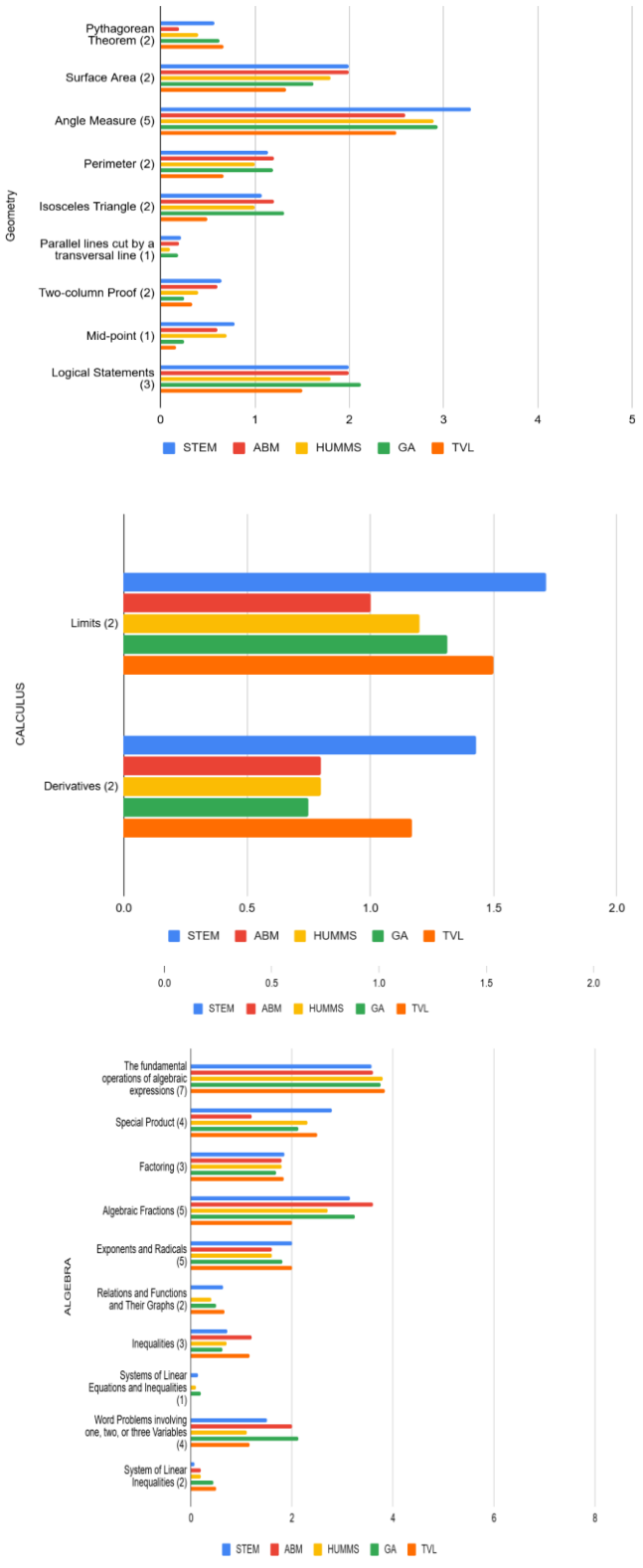


Figure 2 : Difference between the respondents' level of mathematical skills using the validated Testing Material when grouped according to Strand.

The results reveal significant differences in mathematical competencies across strands, aligning with findings from multiple studies in the user's references

Algebra

STEM students show superior performance in algebraic topics such as The Fundamental Operations of Algebraic Expressions, Algebraic Fractions, and Word Problems Involving One, Two, or Three Variables. This dominance is expected due to the STEM curriculum's emphasis on mathematical rigor, as supported by Santelices, Banas, and Arcilla [1], who noted that STEM students generally have stronger foundational skills, especially in algebra and calculus, compared to non-STEM students. Conversely, TVL and HUMMS students struggle in algebraic areas, particularly Systems of Linear Equations and Inequalities, which may result from the lesser focus on mathematics in their curricula, necessitating enhancement programs to address these gaps [1].

Geometry

STEM students excel in Pythagorean Theorem, Angle Measure, and Logical Statements, indicating their strong geometric reasoning abilities. This finding aligns with Quispe-Aquise et al. [4], who emphasized that focused educational programs significantly improve students' mathematical reasoning and spatial awareness. ABM and GA students perform moderately well, while HUMMS and TVL students exhibit lower scores in complex topics like Two-column Proof and Parallel Lines Cut by a Transversal Line. This discrepancy mirrors the observations of Son [10], who highlighted the effectiveness of contextualized learning models, such as CORE RME, in improving students' ability to make mathematical connections, which may be lacking in the curricula of non-STEM strands.

Statistics and Probability

STEM students outperform their peers in Measures of Central Tendency, Probability, and Hypothesis Testing, reflecting their analytical strength and alignment with data-driven approaches. This supports findings by Korkmaz and Tutak [5], who suggested that a strong mathematical background is crucial for success in exams emphasizing problem-solving and data analysis. However, the relatively lower performance of HUMMS, ABM, and TVL students indicates a need for targeted interventions to improve their statistical reasoning, a recommendation also emphasized by Santelices et al. [1] in their call for enhancement programs bridging the gap in mathematical competencies.

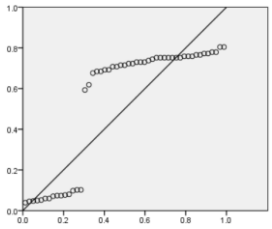
Calculus

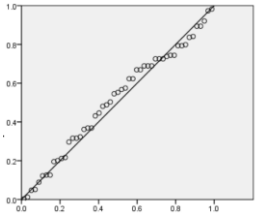
The strong performance of STEM students in Limits and Derivatives highlights their preparedness for advanced mathematical concepts, consistent with Santelices et al. [1], who found that STEM students are better equipped for higher-level mathematics courses like Calculus. In contrast, GA, HUMMS, ABM, and TVL students struggle in these areas, supporting the call for additional calculus support and review classes, as recommended by Santelices et al. [1], to prepare students from non-STEM backgrounds for higher mathematics.

Table 3.1 : Relationship Between the Respondents' Level of Mathematical Skills Using the Validated Testing Material and Their Profile

Profile vs Scores	Rho-Value	Degree of Relationship
Sex	-0.125	Very Low or Negligible Relationship
Strand	0.231	Slight Relationship

*Adapted from Calmorin



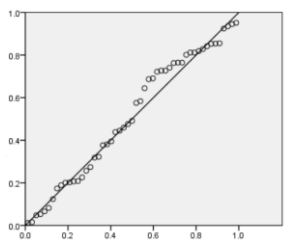


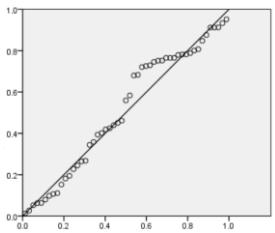
The Spearman Rho value of -0.125 indicates a very low or negligible relationship between the respondents' sex and their mathematical performance. This suggests that gender differences do not significantly impact mathematical proficiency, supporting the findings of Taşdemir [2], who reported minimal differences in mathematical achievement based on gender. While societal perceptions may suggest otherwise, these results indicate that gender is not a strong determinant of mathematical ability among the surveyed respondents.

The Spearman Rho value of 0.231 shows a slight relationship between the respondents' Senior High School strand and their mathematical performance. This implies that the strand a student comes from has some influence on their mathematical skills, with STEM students generally performing better than their peers from other strands. This finding aligns with Santelices, Banas, and Arcilla [1], who emphasized the significant advantage STEM students possess due to the math-intensive nature of their curriculum. Similarly, the research by Korkmaz and Tutak [5] highlights the importance of curriculum content in shaping students' mathematical competence, suggesting that strands emphasizing mathematical rigor better prepare students for higher-level mathematics.

Table 3.2 : Relationship Between the Respondents' Level of Mathematical Skills Using the Validated Testing Material and Their Level of Performance in NOAT, and SATT

	Rho-Value	Degree of Relationship
NOAT vs Score	0.218	Slight Relationship
SATT vs Score	0.206	Slight Relationship





The Spearman Rho value of 0.218 indicates a slight relationship between the respondents' scores on the NOAT and their performance in the validated Testing Material. This suggests that while there is a weak correlation between NOAT performance and mathematical skills, students who perform slightly better on the NOAT also tend to score marginally higher on the mathematical tests. This aligns with findings from Fabito, Rodriguez, and Catacutan-Bangit [3], who identified a positive correlation between entrance exam performance and academic outcomes. However, the slight correlation indicates that other factors, beyond initial test scores, contribute to students' mathematical competencies, as seen in their research on entrance exams.

Similarly, the Spearman Rho value of 0.206 suggests a slight relationship between the SATT scores and the respondents' mathematical performance. This indicates that there is a weak but positive correlation, where students who perform better in the SATT tend to have slightly better mathematical skills. As Korkmaz and Tutak [5] discuss, high school entrance exams may not fully predict a student's performance in subjects like mathematics, particularly when the exam's focus differs from the subject's specific content. Therefore, while the SATT does provide some indication of mathematical readiness, the relationship with actual mathematical skill is weak, reinforcing the need for more comprehensive assessments that align closely with the curriculum and expected outcomes in mathematics.

CONCLUSIONS

The study on the Mathematical Skills of Freshmen NORSU BSED Math Students has revealed several important insights into the students' competencies in Algebra, Geometry, Statistics, and Calculus. The results show that while students perform within the "Did Not Meet Expectations" to "Fairly Satisfactory" range in various mathematical areas, there is a need for further intervention and support, particularly in Algebra and Geometry. The relatively low performance in Algebra indicates a potential gap in foundational skills, which may hinder students' understanding of more advanced mathematical concepts. The moderate performance in Calculus further emphasizes the need for a more comprehensive approach to teaching and assessment.

The analysis of the relationship between students' profiles (such as their strand in Senior High School) and their mathematical skills suggests that these factors may influence students' preparedness for college-level mathematics. The slight relationships observed between performance in entrance exams (NOAT and SATT) and mathematical skills reinforce the need for an effective entrance testing system that can accurately assess students' strengths and weaknesses in mathematics before they begin their academic journey in the BSED Math program.

Given the findings, it is clear that there is a significant need for an enhancement program that focuses on the areas where students struggle the most. This program could help bridge the gaps in mathematical proficiency and improve overall academic performance.

RECOMMENDATIONS

Development of a Comprehensive Entrants' Testing Material

Based on the findings of this study, it is recommended to develop a more detailed and targeted entrance exam for incoming BSED Mathematics students. This test should focus on core mathematical areas such as Algebra, Geometry, Statistics, and Calculus. The test should not only assess students' abilities but also identify specific weaknesses that can be addressed through an enhancement program.

Curriculum Adjustments

The findings suggest that students' proficiency in Algebra and Geometry needs to be strengthened. It is recommended to review and potentially adjust the curriculum to provide more focus on these foundational areas. Ensuring that students have a solid understanding of basic mathematical principles is crucial for their success in more advanced topics like Calculus and Statistics.

Mathematical Enhancement Program

An enhancement program should be introduced for students who score below a certain threshold on the entrance exams. This program could include remedial classes, peer tutoring, and hands-on activities designed to improve students' understanding of key mathematical concepts. Special emphasis should be placed on interactive learning, real-life applications, and problem-solving techniques to improve student engagement and retention.

Continuous Assessment and Feedback

To monitor the progress of students and identify areas for improvement, continuous assessment should be implemented throughout the academic year. Frequent formative assessments can provide timely feedback to both students and instructors, allowing for early identification of struggling students and offering the necessary support.

Professional Development for Teachers

It is important to ensure that instructors are equipped with the necessary pedagogical skills to teach mathematical concepts effectively. Teacher training and professional development programs should be implemented to enhance their ability to identify and address gaps in students' understanding.

Collaborative Learning Approaches

Encouraging students to engage in collaborative learning can foster a deeper understanding of mathematical concepts. Peer study groups, collaborative problem-solving sessions, and group discussions can be incorporated into the enhancement program to promote active learning and the exchange of ideas.

Follow-up Studies

Future studies should explore the long-term impact of enhancement programs on student performance, particularly in the context of the Licensure Examination for Teachers (LET). Further research could examine the correlation between the improvement in mathematical skills and success in the LET to assess the effectiveness of the intervention strategies.

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