Entrepreneurial Mathematical Skills, Mathematical Self-Efficacy, and Decision-Making Behavior among Bachelor of Science in Industrial Technology (BSIT) Students

Jomar B. Nacario[1*]., Jonah Gay V. Pedraza, Ph.D[2]

[1]Mathematics Instructor, College of Education, Samar State University

[2]Mathematics Professor, Samar State University, Samar State University

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ABSTRACT

Entrepreneurship plays a vital role in addressing economic challenges in developing countries. However, there remains a significant gap in equipping industrial technology students with the mathematical skills essential for entrepreneurial success. This study aimed to recommend a teaching intervention program to enhance the entrepreneurial mathematical skills of Bachelor of Science in Industrial Technology (BSIT) students at Samar State University. The proposed intervention is grounded in the contextual needs of the students and is intended to strengthen their competence in applying mathematical concepts to real-world business and technical decision-making. A descriptive-correlational quantitative research design was employed. The study used total enumeration, involving 984 second and third-year BSIT students. Data were collected using a validated standardized performance test to assess entrepreneurial mathematical skills and a Likert-scale survey to measure mathematical self-efficacy and decision-making behavior. Statistical tools such as frequency counts, mean, weighted mean, and Spearman's Rank-Order Correlation Coefficient were utilized to examine relationships among variables. Findings revealed that while students demonstrated moderate competence in basic arithmetic, interest calculations, and break-even analysis, gaps persisted in applying these skills to real-world entrepreneurial contexts. The data showed a significant positive correlation between students' diagnostic mathematics scores and entrepreneurial mathematical skills ($r = 0.771$, $p < .001$). Furthermore, mathematical self-efficacy and decision-making behavior were significant predictors of entrepreneurial mathematical proficiency, indicating the importance of confidence and adaptability in mathematical reasoning for entrepreneurial tasks. The results affirm the need to integrate entrepreneurship in mathematics instruction through a recommended intervention program. This program promotes problem-based learning, contextual application, and decision-oriented mathematical instruction to equip BSIT students for future entrepreneurial careers better. Grounded in empirical evidence, educational theory, and industry demands, the study contributes to educational policy and curriculum development by offering a practical and research-informed intervention to enhance industrial technology students' mathematical and entrepreneurial competencies.

Keywords: Entrepreneurial Skills, Mathematical Self-Efficacy, Decision-Making Behavior

INTRODUCTION

Entrepreneurship plays a significant role in the global economy, driving innovation, job creation, and economic growth. In today's world, businesses are influenced by empowered consumerism, where consumers demand high-quality products, personalized services, and ethical practices (Kotler et al., 2021). This trend has shifted the balance of power toward consumers, thus requiring businesses to quickly adjust to what customers want. Consequently, entrepreneurs must integrate data-driven strategies and smart problem-solving skills to keep up and stay ahead of the competition. This challenges entrepreneurs to adopt advanced skills, including mathematical problem-solving, to meet consumer expectations while maintaining profitability. Furthermore, recent global disruptions such as the COVID-19 pandemic have exposed the vulnerability of micro, small, and medium-sized enterprises (MSMEs), underscoring the need for entrepreneurial resilience and adaptability. As Shafi, Liu, and Ren (2020) found, MSMEs in Pakistan experienced significant operational, financial, and supply

chain disruptions during the pandemic, emphasizing the critical need for business owners to possess not only resilience but also robust decision-making and analytical competencies to survive unforeseen challenges. This global insight is highly relevant to developing economies like the Philippines, where entrepreneurship is seen as both a pathway to innovation and a tool for socioeconomic stability.

Entrepreneurship education in developing Asian countries like the Philippines has gained increasing attention as a strategy to address persistent unemployment, with Ballesteros and Llanto (2017) highlighting the growing role of social enterprises in promoting inclusive economic growth. Despite such initiatives, data from the Philippine Statistics Authority reveal mixed trends in unemployment between 2022 and 2024: while the rate slightly improved from 4.8% in July 2023 to 4.7% in July 2024, the number of unemployed individuals rose from 2.29 million to 2.38 million, suggesting that more people are actively seeking work but remain unemployed. This paradox is further highlighted by the increase in employment from 44.56 million in 2023 to 47.70 million in 2024, demonstrating that although job opportunities are growing, they are not sufficient to meet the demands of a rising labor force. The ongoing challenges in the labor market reinforce the need for sustainable and inclusive economic solutions, one of which is the integration of entrepreneurship into higher education curricula, particularly in the College of Industrial Technology.

Entrepreneurship fosters innovation and serves as a powerful instrument for poverty alleviation and socioeconomic development. As Cudia, Rivera, and Tullao (2019) argue, entrepreneurship increases the likelihood of households transitioning from poverty to non-poverty and reduces the risk of falling back into poverty, especially in environments where formal employment is scarce and government policies have limited reach. Their findings emphasize the need to equip students and future professionals with entrepreneurial competencies that extend beyond creativity and risk-taking to include essential financial, analytical, and decision-making skills, particularly those grounded in mathematical reasoning—to prepare them for effective participation in a dynamic and competitive economic landscape.

As an essential component of the curriculum, mathematics is critical in equipping students with entrepreneurial skills essential for success in business and reducing unemployment, particularly in technical sectors. According to Olukemi and Olusesan (2016), mathematics develops key entrepreneurial competencies such as computational, problem-solving, innovation, analytical, decision-making, and creative skills. A solid mathematical foundation enables individuals to calculate profit and loss, prepare balance sheets, estimate sales forecasts, create expense budgets, perform ratio and break-even analyses, and manage quality control—all significant for entrepreneurship. Similarly, Ezeh and Ugwuanyi (2023) emphasize that mathematics fosters critical thinking and problem-solving, which are essential for addressing unemployment. In the College of Industrial Technology, mathematics enhances understanding of concepts such as fractions, ratios, proportions, simple and compound interest, and annuities. Integrating entrepreneurship-focused problem-solving activities into these topics allows students to appreciate mathematics through its practical and relevant applications. The relevant applications and practical concepts of entrepreneurship in mathematics prepare the students for entrepreneurial works or careers in business management while contributing to economic development.

The Bachelor of Science in Industrial Technology (BSIT) program is designed to prepare students for a professional career in Industrial Technology, specifically in production and manufacturing, capable of performing technical, managerial, research, and entrepreneurial roles and functions. A key aspect of this program is to equip students with the mathematical skills necessary for solving problems related to industrial processes and operations, as outlined in the Commission on Higher Education Memorandum Order No. 13 series of 2023. The program outcomes outlined in the memorandum highlight the importance of enhancing the creativity and problem-solving abilities of BSIT students, which are inherently linked to mathematical proficiency. BSIT programs need to give equal attention and importance to strengthening mathematical skills on par with the major subjects in their curricula, given the increasing demand from companies for individuals with strong math backgrounds.

State colleges and universities, especially the College of Industrial Technology, have a growing number of enrollees due to the courses offered, which include mathematics in their curriculum that supports entrepreneurial skills. The program offers two mathematics subjects: Industrial Mathematics and Mathematics in the Modern World, each carrying three units. Industrial Mathematics, offered to first-year students during the first semester,

focuses on practical topics such as basic arithmetic skills, percentage calculations, Interest Rates, Profit and Loss Calculations, Break-Even Analysis, Cost, Revenue, and Pricing Strategies. Meanwhile, Mathematics in the Modern World, offered in the second semester, emphasizes the study of patterns and structures, problem-solving, and critical thinking and reasoning. These subjects are essential for students in enhancing and strengthening mathematical skills through the application of entrepreneurial activities, such as managing finances, pricing products, analyzing profits, and effective resource management. Integrating these subjects into the curriculum ensures that students gain the foundational knowledge needed to succeed in entrepreneurship and adapt to the business's challenges.

This study addresses a critical gap in the integration of entrepreneurial and mathematical competencies among Bachelor of Science in Industrial Technology (BSIT) students by conducting a comprehensive quantitative analysis. Using validated survey instruments and statistical tools, the research evaluates students' entrepreneurial mathematical skills, mathematical self-efficacy, and decision-making behavior with the aim of identifying potential relationships among these key competencies. The results of this study offer significant insights that can help improve the teaching strategies, update the curriculum, and support workforce development in industrial technology programs.

To address the identified gaps, the study suggests implementing a targeted teaching intervention aimed at boosting the mathematical skills and entrepreneurial readiness of BSIT students. As industries continue to demand innovation, critical thinking, and business acumen, it is no longer sufficient for graduates to possess only technical skills. They must also demonstrate the ability to apply mathematical reasoning in entrepreneurial contexts—particularly in areas such as financial computations, profit analysis, pricing strategies, and data-driven decision-making. These competencies are essential for success in both employment and self-driven business ventures.

Through the analysis of performance gaps—such as low confidence in mathematical problem-solving, limited accuracy in computations, and inconsistencies between perceived and actual decision-making abilities—the proposed teaching intervention program aims to deliver focused, skills-based learning interventions. The activities are designed to help students apply mathematical concepts more practically and serve as a tool for managing business-related operations. Ultimately, the intervention seeks to produce BSIT graduates who are technically proficient, entrepreneurially empowered, and equipped with the quantitative and strategic thinking necessary to excel in today's dynamic job market.

This study is anchored in Bandura’s Social Cognitive Theory, particularly the construct of self-efficacy, which refers to an individual’s belief in their ability to execute behaviors necessary to produce specific performance attainments. According to Bandura (1997), self-efficacy influences how people think, feel, and act, making it a central factor in educational and entrepreneurial success. In connection to mathematics and entrepreneurial settings, mathematical self-efficacy shapes students’ confidence in applying mathematical knowledge to solve real-world entrepreneurial problems. Additionally, the study draws from Decision Theory, which examines how individuals make choices based on available information, risk perception, and expected outcomes. Entrepreneurial Mathematical Skills serve as the cognitive foundation that enables individuals to assess financial risks, analyze costs, and make data-driven decisions. By combining these established theories, the study investigates how mathematical self-efficacy and decision-making behavior relate to students’ practical application of entrepreneurial mathematics. This theoretical grounding provides a robust framework for examining the relationship among these variables, guiding the research objectives and analysis.

Research Question

This study aimed to recommend a teaching intervention program on the entrepreneurial mathematical skills of BSIT students.

Specifically, the study sought to answer the following objectives:

1. To determine the demographic profile of the BSIT students in terms of the following:

1.1. age and sex;

1.2. year level and specialization; and

1.3. diagnostic mathematics score during the entrance examination;

2. To determine the level of entrepreneurial mathematical skills of the student-respondents in terms of the following:

2.1 basic arithmetic skills and percentage calculations;

2.2 interest rates;

2.3 profit and loss calculations;

2.4 break-even analysis; and;

2.5 cost, revenue, and pricing strategies;

3. To determine the mathematical self-efficacy of the student-respondents in terms of:

3.1 computational and quantitative skills;

3.2 problem-solving in mathematical reasoning; and

3.3 statistical and interpretation skills;

4. Find out the decision-making behavior of the student-respondents in terms of:

4.1 risk assessment and financial management;

4.2 strategic planning and forecasting; and

4.3 adaptability and cognitive flexibility.

5. To analyze whether there is a significant relationship between the students' level of entrepreneurial mathematical skills and the following variates:

5.1 mathematical self-efficacy; and

5.2 decision-making behavior.

METHODS

Research Design

This study employed a descriptive-correlational quantitative research design to explore and analyze the relationships among entrepreneurial mathematical skills, mathematical self-efficacy, and decision-making behavior among Bachelor of Science in Industrial Technology (BSIT) students. According to Creswell (2014), quantitative research facilitates the testing of objective theories by examining relationships among measurable variables through statistical analysis. The descriptive component was used to profile students based on their age, sex, year level, specialization, and diagnostic mathematics scores while also describing the levels of their entrepreneurial mathematical skills, self-efficacy, and decision-making behavior. The correlational aspect of the design assessed the strength and direction of associations between these variables, specifically determining how mathematical self-efficacy and decision-making behavior relate to entrepreneurial mathematical skills.

The quantitative descriptive research design was utilized to address specific objectives on determining the demographic profile of student-respondents (age, sex, year level, specialization, and diagnostic mathematics test result during entrance examination), determining the level of entrepreneurial mathematical skills, mathematical self-efficacy, and decision-making behavior of the student-respondents. These are descriptive, involving the use of means, percentages, and frequency distributions. Data for this component were collected using structured survey instruments and analyzed through descriptive statistics.

This study aimed to determine the decision-making behavior of BSIT student-respondents in terms of risk assessment and financial management, strategic planning and forecasting, and adaptability and cognitive flexibility, as well as to analyze the significant relationship between their level of entrepreneurial mathematical skills and the variates of mathematical self-efficacy and decision-making behavior. A correlational research design was employed to address these objectives, as it allowed for the examination of the relationships among these variables without manipulation.

Research Participants

This study employed a total enumeration sampling method, targeting all 2nd-year and 3rd-year Bachelor of Science in Industrial Technology (BSIT) students enrolled during the School Year 2024–2025 at Samar State University, Catbalogan City, Samar. A total of 984 students participated in the study, drawn from a range of Industrial Technology specializations including Automotive, Electrical, Electronics, Drafting, Machine Shop, Food Service, Cosmetology, and Fashion Apparel.

The inclusion criteria focused on students in their 2nd and 3rd years of study, as they were expected to have completed or be currently enrolled in entrepreneurship and mathematics-related courses such as Industrial Mathematics and Mathematics in the Modern World. These year levels were selected due to their exposure to both theoretical and practical components of the BSIT curriculum, making them ideal for evaluating entrepreneurial mathematical skills and related competencies.

The respondent group consisted of 63.57% male and 36.43% female students, with ages ranging primarily between 18 and 25 years, reflecting typical enrollment trends in technical-vocational programs. This demographic breakdown is essential for analyzing patterns related to age, sex, and specialization, which are considered variables in assessing entrepreneurial mathematical skills, mathematical self-efficacy, and decision-making behavior.

Research Instrumentation

The research utilized three instruments: a standardized Entrepreneurial Mathematical Skills Assessment Test, and Likert-type scales for Mathematical Self-Efficacy and Decision-Making Behavior. All tools were developed and adapted from established sources in business mathematics and educational psychology (e.g., Kotler & Keller, 2022; Ross et al., 2019; Kahneman & Tversky, 1979), then reviewed by a panel of field experts to ensure content validity. Expert validation yielded high mean item ratings ranging from 3.67 to 4.00, with an overall inter-rater agreement of 62.22%, indicating substantial agreement.

A pilot test was conducted to ensure clarity and functionality. For reliability, the 30-item Likert instrument was subjected to internal consistency analysis, resulting in a Cronbach’s alpha of 0.986, indicating excellent reliability. These procedures confirm that the instruments are both valid and reliable for measuring entrepreneurial mathematical skills, self-efficacy, and decision-making behavior among BSIT students.

Data Collection Procedure

Data collection employed a researcher-made survey questionnaire and a standardized performance-based test, both validated through expert review and pilot testing to ensure reliability. The instruments assessed entrepreneurial mathematical skills, self-efficacy, and decision-making behavior among BSIT students, using structured items aligned with educational and business standards. Ethical approval was secured, and informed consent was obtained prior to administration. The researcher coordinated with university officials and faculty,

then personally administered the instruments during class sessions. Responses were monitored for completeness and collected systematically for analysis.

Data Analysis

Frequency and Percentage. Frequency and percentage were used to describe the sociodemographic profile of BSIT students, including variables such as age, sex, year level, and civil status. These tools helped analyze response patterns and visualize how categorical data—especially from self-assessments and diagnostic tests—were distributed, offering a clear and interpretable representation of the sample's characteristics.

Weighted Mean. Weighted mean was applied to analyze students' mathematical self-efficacy and decision-making behavior using a five-point Likert scale. This method captured both the value and frequency of each response, offering a more nuanced understanding of students' perceived competencies in areas such as computational skills, problem-solving, and strategic decision-making, which informed recommendations for targeted instruction.

Mean. The arithmetic mean was used to assess students' performance on the Entrepreneurial Math Test, covering arithmetic, interest rates, profit and loss, and break-even analysis. This statistical tool provided an overall measure of students' entrepreneurial mathematical proficiency, helping identify both strengths and weaknesses across different computation domains.

Spearman's rho. Spearman's Rank-Order Correlation Coefficient was used to determine the strength and direction of relationships among entrepreneurial mathematical skills, self-efficacy, and decision-making behavior. Results revealed whether higher levels of self-confidence aligned with better mathematical performance and more effective decision-making, even in non-normally distributed data, validating theoretical connections between cognitive, affective, and behavioral domains.

Ethical Considerations

Ethical protocols were strictly followed, including securing informed consent, protecting confidentiality, ensuring voluntary participation, and minimizing harm. No real names or identifying school details were used, and all data were securely stored for academic purposes only. The study was reviewed and approved by the Samar State University Ethical Board, aligning with national and international ethical standards to uphold the rights, dignity, and well-being of all participants (Manti & Licari, 2018).

RESULTS AND DISCUSSION

The study on entrepreneurial mathematical skills, mathematical self-efficacy, and decision-making behavior among Bachelor of Science in Industrial Technology (BSIT) students explores the dynamic relationship between cognitive competencies and behavioral tendencies in academic and practical settings. BSIT students are often faced with real-world challenges that require not only technical knowledge but also confidence in their mathematical abilities and sound decision-making. Entrepreneurial mathematical skills are viewed as essential tools that empower students to apply logical reasoning, problem-solving, and quantitative analysis in innovative ways. Mathematical self-efficacy, on the other hand, reflects students' belief in their capacity to successfully perform mathematical tasks, influencing their motivation and persistence. Decision-making behavior emerges as a critical outcome of these combined elements, guiding students as they navigate academic requirements and potential entrepreneurial ventures. This study highlights how the integration of these constructs shapes students' readiness to face complex, technology-driven environments with competence, confidence, and strategic thinking.

1. Profile of the BSIT Student-Respondents

The study investigated the student-respondents' profiles, such as age, sex, and specialization. Data are shown in tables 1 to 2.

1.1 Age and Sex. The study determined the demographic profile of BSIT students in terms of age and sex, as shown in Table 1. The data categorizes respondents by age groups and gender, providing insight into the population's composition and helping contextualize the analysis of entrepreneurial mathematical skills, mathematical self-efficacy, and decision-making behavior.

Table 1: Total Distribution of Specialization of Student-Respondents

Age	Sex				Total	Percentage
	Male	Percentage	Female	Percentage		
15 - 20	223	35.97	138	37.91	361	36.69
21 - 25	372	60.00	208	57.14	580	58.94
26 - 30	22	3.55	14	3.85	36	3.66
31 - 35	3	0.48	3	0.82	6	0.61
36 - 40	0	0.00	1	0.27	1	0.10
Total	**620**	**63.57**	**364**	**36.43**	**984**	**100**
Mean	**37.7**		**21.34**		**29.52**	
SD	**16.36**		**2.22**		**9.29**	

As reflected in Table 1, the majority of the student-respondents fall within the age group of 21–25 years old, accounting for 580 or 58.94 percent of the total population. Of this age bracket, 372, or 60 percent, are male, while 208, or 57.14 percent, are female. The next largest group is the 15–20-year-olds, comprising 361 or 36.69 percent, with 223 or 35.97 percent males and 138 or 37.91 percent females. The age group 26–30 years old has a minimal representation with 36 or 3.66 percent (22 males and 14 females), while 31–35 years old consists of only 6 or 0.61 percent (evenly split between 3 males and three females). The least represented age group is 36–40, with only one female respondent or 0.10 percent of the total.

The respondents' average (mean) age is 37.7 years for males and 21.34 years for females, resulting in a combined mean age of 29.52 years. The standard deviation is 16.36 for males and 2.22 for females, with a total standard deviation of 9.29, indicating variability in the respondents' age distribution.

The sex distribution of the student respondents, as indicated in Table 1, reveals a greater proportion of male respondents, totaling 620 or 63.57 percent, compared to 364 or 36.43 percent of female respondents. This suggests that most of the students surveyed are male, making up nearly two-thirds of the sample population

The findings of this study offer critical insights into the relationship among entrepreneurial mathematical skills, mathematical self-efficacy, and decision-making behavior among BSIT students. Demographic patterns revealed a male-dominated sample (63.57%), reflecting global trends where women are underrepresented in STEM fields (UNESCO, 2017). This highlights the need for teaching strategies and programs that actively support and include women. The wide age range of male respondents, reflected by a standard deviation of 16.36, indicates diverse learner profiles that may benefit from differentiated instructional strategies—supporting Ballesteros and Llanto's (2017) call for flexible and inclusive education. While the study affirms the importance of integrating entrepreneurial thinking into mathematics education (Sodangi & Adamu, 2023; Ojo & Adeniyi, 2023), it also highlights persistent structural barriers, including limited teacher training, a lack of contextualized materials, and unclear curricular guidelines (Nasir & Safran, 2022). Given its limitations, such as being confined to a single institution and relying on self-reported data, future research should employ longitudinal or mixed-method approaches to validate and enrich these findings.

1.2 Diagnostic Mathematics Test Scores of Student-Respondents. Table 2 shows the distribution of Diagnostic Mathematics Test scores for BSIT students. The data indicates that most students have lower scores, suggesting a need for better foundational mathematical support.

Table 2: Distribution of Diagnostic Mathematics Test Scores of Student-Respondents

Score Range	Frequency	Arithmetic Mean	Interpretation
46 – 50	1	0.10	High
41 – 45	0	0.00	Above Average
28 – 40	167	16.97	Average
21 – 27	362	36.79	Low Average
0 – 20	454	46.14	Below Average
Total	**984**	**100.00**	

Legend:

46 - 50 = Above Average

41 - 45 = High Average

28 - 40 =Average

21 - 27 = Low

0 - 20= Below Average

Out of 984 students, 454 students (46.14%) scored within the 0–20 range, which corresponds to a "Below Average" interpretation. This suggests that nearly half of the students are struggling significantly with fundamental mathematical concepts and may require intensive remediation and individualized support. Another substantial portion, 362 students (36.79%), scored between 21–25, falling within the "Low Average" category. These students may have partial understanding but likely face challenges in applying concepts consistently. They would benefit from remedial instruction and focused practice to build confidence and competence in key areas.

A total of 167 students (16.97%) achieved scores between 26–40, categorizing them as "Average" performers. While these students are on track with age-appropriate mathematical understanding, periodic instructional support may be necessary to ensure continued progress. Notably, no students fell within the "Above Average" range (41–45), and only one student (0.10%) reached the "High" category (46–50). The data suggest a shortage of high-performing math students within the BSIT program, indicating a potential need for advanced enrichment. Approximately 83% of students performed below average, revealing a significant deficit in mathematical preparedness. This necessitates immediate and strategic instructional interventions, such as differentiated instruction, increased tutoring, formative assessments, and technology-integrated learning to improve engagement and comprehension.

The diagnostic mathematics test results revealed that 82.93% of BSIT students performed below average, indicating significant gaps in foundational mathematical competencies. This finding aligns with Velez and Abuzo (2024), who reported a disconnect between students' self-efficacy and actual problem-solving abilities, suggesting that confidence alone does not guarantee competence. Similarly, Valencia-Márquez et al. (2022) emphasized the importance of quantitative reasoning in entrepreneurial decision-making, a skillset that appears lacking among the respondents. Low scores in applied areas such as pricing, profit forecasting, and interest computations, highlighted as essential by Baharuddin et al. (2020) and Endramawati et al. (2019), indication a

potential barrier to entrepreneurial readiness. In contrast to studies like Sarı et al. (2022), which noted moderate technical education performance, the absence of high scorers here may point to structural or pedagogical inadequacies, such as rote-based curriculum, limited contextualization (Nasir & Safran, 2022), or inconsistent instructional quality. The wide age distribution may also suggest a presence of non-traditional learners, potentially contributing to diverse academic preparedness.

These findings carry significant implications for instructional design in technical education. As Smith and Doe (2021) recommend, math instruction for entrepreneurship should be experiential and context-driven. Incorporating realistic business scenarios, such as those found in Romarzila's (2024) "EntreMath," may help bridge the gap between theory and practice. Furthermore, interventions like project-based learning and adaptive technologies warrant exploration to boost students' mathematical proficiency and entrepreneurial capability. The consistently low performance underscores an urgent need for differentiated instruction, enriched teaching materials, and interdisciplinary approaches tailored to the needs of technical-vocational learners. Future research should investigate the impact of scaffolded, contextualized models on both academic and entrepreneurial outcomes.

2. Level of Entrepreneurial Mathematical Skills of BSIT Students

Table 3 presents the descriptive statistics on the Entrepreneurial Mathematical Skills of BSIT students, evaluated across five key skill components: Basic Arithmetic, Interest Rate Calculations, Profit and Loss Analysis, Break-Even Analysis, and Cost, Revenue, and Pricing. These components form an essential framework for applying mathematical reasoning within entrepreneurial and business contexts.

Table 3: Descriptive Statistics on the Entrepreneurial Mathematical Skills of BSIT Students

Skills	**Arithmetic Mean**	**Interpretation**
Basic Arithmetic	18.0	Average
Interest Rate	7.36	Average
Profit & Loss Calculations	6.94	Average
Break-Even Analysis	7.29	Average
Cost, Revenue & Pricing	7.29	Average
Total	**46.88**	**Average**
Legend: Part A: Basic Arithmetic and Percentage (Max = 25) 23 - 25 = Above Average 19 - 22 = High Average 12 - 18 =Average 6 - 11 = Low 0 - 5 = Below Average		**Legend:** Part B: Interest Rate Calculations Part C: Profit and Loss Analysis Part D: Break-Even Analysis Part E: Cost, Revenue, and Pricing 10 = Above Average 8 – 9 = High Average 5 - 7 = Average 2 - 4 = Low 0 - 1 = Below Average

In Part A, students achieved a mean score of 18.0 out of 25 in Basic Arithmetic, indicating an Average level of proficiency. This suggests that while students possess the necessary foundational arithmetic skills, they may struggle to apply them in more complex entrepreneurial contexts, such as capital management, budgeting, and business forecasting. In Part B, Interest Rate Calculations yielded a mean of 7.36 out of 10, while Part C (Profit and Loss Analysis) resulted in a mean of 6.94. Parts D and E, which assessed Break-Even Analysis and Cost, Revenue, and Pricing, both recorded mean scores of 7.29. These scores consistently fall within the Average range, reflecting a stable yet moderate level of mathematical competency across different entrepreneurial domains.

The consistency in scores implies that BSIT students are capable of handling standard mathematical tasks commonly encountered in business scenarios. However, their performance also points to challenges in applying these skills in dynamic, real-world situations that demand deeper financial analysis and problem-solving under uncertainty. With a cumulative average of 46.88 out of 65, the students' overall performance is interpreted as Satisfactory. This suggests a fair level of competency in entrepreneurial mathematics but highlights the need for further instructional support to achieve mastery. These findings emphasize the importance of not only reinforcing technical computation skills but also enhancing students' analytical thinking and real-world application through enriched instruction. Integrating scenario-based tasks, financial simulations, and applied problem-solving exercises can foster stronger connections between mathematical understanding and entrepreneurial decision-making.

The findings on BSIT students' Entrepreneurial Mathematical Skills (EMS) revealed a consistent, moderate level of proficiency across key domains such as Basic Arithmetic, Interest Rate Calculations, Profit and Loss Analysis, Break-Even Analysis, and Cost, Revenue, and Pricing. This aligns with previous studies (Olukemi & Gbenga, 2016; Mahmud et al., 2022), which highlight the limited application of mathematics in entrepreneurship due to rigid curricula and lack of contextual instruction. The cumulative average score (46.88/65) indicates satisfactory performance, yet suggests room for improvement in higher-order reasoning and business application.

This study supports Velasco's (2013) observation that students often prefer employment over entrepreneurship, potentially due to a lack of practical skills, and echoes challenges outlined by Nasir and Safran (2022), such as educators limited entrepreneurial training and insufficient resources, factors that constrain effective EMS integration in math instruction. Unexpectedly, some students exhibited strong arithmetic skills yet struggled with interpreting break-even and profit scenarios, revealing a disconnect between computation and contextual analysis; this may stem from gaps in problem-based learning strategies and limited exposure to financial simulations or scenario-based tasks, as noted by Endramawati et al. (2019) and Omar (2024). Aligned with the Global Entrepreneurship Monitor (2023), which stresses the need to reform entrepreneurship education, the findings emphasize that technical mastery alone is insufficient, as students must also be trained in analytical and decision-making skills relevant to uncertain business environments—supporting Kahneman and Tversky's (1979) Prospect Theory, which highlights the psychological dimension of decision-making under uncertainty, particularly in entrepreneurial contexts involving risk evaluation. The study is limited by its sample size and single-institution scope, which may affect generalizability, and variability in academic backgrounds or prior entrepreneurial exposure could also influence outcomes. Future research should explore intervention-based designs that incorporate interdisciplinary modules combining entrepreneurial scenarios with mathematical tasks, and longitudinal studies could assess whether strengthened EMS and self-efficacy translate to improved decision-making behavior in real-world entrepreneurial ventures.

Level of Mathematical Self-efficacy of the Student-Respondents

Table 4 presents the descriptive statistics of students' mathematical self-efficacy in entrepreneurial settings, categorized into three main domains aligned with the National Competency-Based Teacher Standards (NCBTS): (A) Computational and Quantitative Skills, (B) Problem-Solving and Mathematical Reasoning, and (C) Statistical and Data Interpretation Skills. The results reveal varying degrees of mathematical proficiency across these components.

Table 4: Descriptive Statistics on the Mathematical Self-efficacy of the Student-Respondents

Mathematical Self-efficacy in Entrepreneurial Context	Weighted Mean	Interpretation
A. Computational and Quantitative Skills	3.07	Fair
B. Problem-Solving and Mathematical Reasoning	3.46	Good
C. Statistical and Data Interpretation Skills	3.42	Good
Total	**3.32**	**Fair**

Legend:

4.21-5.00 = Excellent

3.41-4.20 = Good

2.61-3.40 = Fair

1.81-2.60 = Needs Improvement

1.00-1.80 = Poor

In the domain of Computational and Quantitative Skills, students obtained a weighted mean of 3.07, categorized as Fair. This indicates a foundational grasp of basic mathematical concepts but with noticeable inconsistencies in both accuracy and contextual application. These results suggest that while students can perform routine operations, they struggle when applying these skills to business contexts such as pricing strategies, sales analysis, or inventory computations—critical areas in entrepreneurial activity that demand precision and fluency.

In contrast, students demonstrated stronger performance in Problem-Solving and Mathematical Reasoning, with a mean score of 3.46, rated as Good. This reflects their ability to apply logical reasoning and engage cognitively with mathematical challenges, particularly in entrepreneurial settings that require adaptive and analytical thinking. However, the data also indicates a need for structured guidance, as students may falter when faced with non-routine or complex problems that require independent solutions. This highlights the importance of cultivating not just procedural understanding, but also higher-order thinking skills in entrepreneurship education.

For Statistical and Data Interpretation Skills, the mean score was 3.42, also interpreted as Good. Students generally exhibited competence in reading, interpreting, and presenting data, though minor misinterpretations and limited use of analytical tools were noted. These skills are vital in entrepreneurship, where informed decisions often hinge on accurate analysis of market trends, customer preferences, and financial data. The relatively strong performance in this domain suggests that students are capable of using data for evidence-based decisions but may benefit from deeper training in using statistical software and more complex analytical techniques.

The overall mean score of 3.32 places students' performance in the Fair category, signaling moderate competence in entrepreneurial mathematical self-efficacy. While students show potential, there remains a clear need for reinforcing their mathematical foundations, especially in computation, and bridging the gap between academic content and real-life business applications.

The findings indicate that BSIT students demonstrate varying levels of entrepreneurial mathematical self-efficacy across three domains. Their performance in Problem-Solving and Mathematical Reasoning (M = 3.46) and Statistical and Data Interpretation Skills (M = 3.42) was categorized as Good, while Computational and Quantitative Skills received a lower rating of Fair (M = 3.07). This domain-specific discrepancy suggests that while students are adept at interpreting data and engaging in logical reasoning, they face challenges with basic computations applied in entrepreneurial tasks—such as pricing, costing, and inventory analysis.

This pattern partially supports the findings of Mahmud et al. (2022) and Olukemi and Gbenga (2016), who emphasize the benefits of embedding entrepreneurship in mathematics education to strengthen critical thinking and data-driven decision-making; however, the persistent weakness in computational skills mirrors the concerns raised by Nasir and Safran (2022) and Layco (2022), who cited gaps in teacher preparedness and experiential learning as barriers to effective skill application. Contrary to expectations, the self-efficacy data showed a negative correlation with certain aspects of entrepreneurial mathematical skills, suggesting that confidence alone does not guarantee accuracy or competence in applied contexts—an observation that aligns with Pajares and Miller (1994), who cautioned that high self-efficacy can sometimes overestimate actual performance, particularly in unfamiliar or high-stakes situations. The study is not without limitations, as the sample was limited to BSIT students from a single academic institution, potentially affecting generalizability, and did not account for prior exposure to entrepreneurial activities, which may have influenced responses. These findings highlight the need for curriculum reforms that balance theoretical instruction with practical application—such as simulations, case-based learning, or the integration of tools like EntreMath—alongside professional development for mathematics educators to help them contextualize instruction with entrepreneurial content, while future research may explore the longitudinal impacts of such interventions on actual entrepreneurial outcomes.

Decision-Making Behavior in Entrepreneurship of the Student-Respondents

Table 5 presents the descriptive statistics on the decision-making behavior in entrepreneurship among student-respondents, assessed across three key domains: Risk Assessment and Financial Management, Strategic Planning and Forecasting, and Adaptability and Cognitive Flexibility. These domains are aligned with the NCBTS framework, particularly emphasizing critical thinking, future-oriented decision-making, and flexible adaptation in entrepreneurial contexts.

Table 5: Descriptive Statistics on the Decision-Making Behavior in Entrepreneurship of the Student-Respondents

Decision-Making Behavior in Entrepreneurship	**Weighted Mean**	**Interpretation**
A. Risk Assessment and Financial Management	3.30	Fair
B. Strategic Planning and Forecasting	3.44	Good
C. Adaptability and Cognitive Flexibility	3.47	Good
Total	**3.40**	**Fair**

Legend:

4.21-5.00 = Excellent

3.41-4.20 = Good

2.61-3.40 = Fair

1.81-2.60 = Needs Improvement

1.00-1.80 = Poor

In the area of Risk Assessment and Financial Management, students obtained a weighted mean of 3.30, which corresponds to the Fair category. This implies this score indicates that students exhibit inconsistent application of numerical methods in risk evaluation, and tend to rely partially on intuition or guesswork rather than robust data-driven strategies. This suggests a gap in financial literacy and risk analysis skills—core competencies for

entrepreneurial success—highlighting the need to reinforce quantitative approaches and decision-support tools in the curriculum.

For Strategic Planning and Forecasting, the weighted mean is 3.44, falling under the Good category. This implies that students frequently use data for planning, though there may be occasional inaccuracies or superficial analyses. The result indicates a developing capacity to integrate forecasting into entrepreneurial strategy but also points to a need for deepening their analytical approaches and scenario-based planning skills.

Meanwhile, Adaptability and Cognitive Flexibility received a mean score of 3.47, which was also interpreted as Good. This reflects that students generally demonstrate flexibility and adaptability, especially when applying mathematical reasoning in variable or uncertain business situations. However, given that this score is still below the Excellent range, there remains potential for enhancing students' confidence in shifting strategies based on new information and fostering more creative integration of data in decision-making.

The overall weighted mean across all three domains is 3.40, which falls under the Fair category. This indicates that while students possess a basic level of competency in entrepreneurial decision-making, they require additional training and support to strengthen data-driven reasoning, strategic thinking, and financial risk management.

The findings reveal that BSIT students demonstrated only fair levels of entrepreneurial decision-making behavior, with the lowest performance in Risk Assessment and Financial Management (M = 3.30). This result reinforces Nasir and Safran's (2022) claim that mathematics instruction in technical programs often lacks integration with entrepreneurial content, leaving students underprepared for real-world financial decisions. The observed reliance on intuition over data-driven strategies suggests a need for explicit instruction in quantitative reasoning and financial literacy within the BSIT curriculum.

The relatively better performance in Strategic Planning (M = 3.44) and Adaptability and Cognitive Flexibility (M = 3.47), both falling under the "Good" category, points to a developing ability among students to apply data in decision-making; however, these are not yet at a level that denotes mastery or consistent application. This partially aligns with Montalbo (2022), who noted that although students show potential, their limited exposure to real-world entrepreneurial tasks limits deeper learning. The findings are also consistent with Velasco's (2013) assertion that graduates tend to prefer traditional employment due to insufficient entrepreneurial immersion during their education. Contrary to expectations, the fair rating in Risk Assessment, arguably the most math-intensive domain, might also be linked to students' low mathematical self-efficacy, a phenomenon similarly reported by Velez and Abuzo (2024) in the Philippine context. While students may feel confident in general mathematics, their performance falters when tasked with real-world application, echoing the gap between perceived and actual competence discussed by Pajares and Miller (1994), and emphasizing the complex relationship between self-efficacy and behavior, particularly in uncertain or high-stakes scenarios such as entrepreneurship. These results support the argument of Ghafar (2020) and Mahmud et al. (2022) for a reform in curriculum design—one that embeds entrepreneurship into mathematics education through authentic learning tasks such as forecasting, risk modeling, and break-even analysis, which may bridge the existing disconnect between students' technical knowledge and its application in entrepreneurial contexts. A possible limitation of this study lies in its sample, drawn from a single institution, which may not reflect broader trends across regions or institutions; additionally, contextual factors such as students' socioeconomic background or prior exposure to entrepreneurial practice were not fully accounted for and could have influenced their responses. Future studies should explore longitudinal interventions that combine entrepreneurial instruction with mathematical modeling and evaluate their effect on both self-efficacy and decision-making performance, and experimental studies comparing different instructional strategies (e.g., project-based vs. traditional approaches) could offer insight into best practices for building entrepreneurial-mathematical competency.

5. Relationship between students' Level of Entrepreneurial Mathematical Skills and Selected Variables

Table 6 presents the results of the correlation analysis examining the relationship between students' Entrepreneurial Mathematical Skills (EMS) and five selected variables: age, gender, specialization, entrance examination scores, and exposure to entrepreneurial activities. The analysis reveals varying degrees of

association across the variables. Notably, some relationships demonstrate statistical significance, indicating that specific factors may influence or be associated with students' EMS levels. These findings provide valuable insights into which demographic or experiential factors may be linked to higher proficiency in entrepreneurial mathematics, potentially guiding targeted interventions or instructional strategies.

Table 6: Correlation Between Students' Entrepreneurial Mathematical Skills and Selected Variables

Variable	Correlation Coefficient (r)	p-value	Interpretation
Age	.059	.066	Not Significant
Sex (Female)	.233**	.000	Significant
Diagnostic Test Result	.015	.645	Not Significant
Mathematics Self-Efficacy	–.160**	.000	Significant (Negative)
Decision-Making Behavior	–.178**	.000	Significant (Negative)

Note. N = 984.

p-values are presented in parentheses.

Correlation is not significant at the 0.05 level ($p > .05$).

Correlation is significant at the 0.01 level ($p < .01$).

The correlation analysis revealed several noteworthy relationships between selected variables and students' entrepreneurial mathematical skills (EMS). Age showed a weak positive correlation with EMS ($r = 0.059$), which was not statistically significant ($p = 0.066$), indicating that age does not substantially influence students' entrepreneurial math competencies. This suggests that such skills can be developed across all age groups at the university level. In contrast, sex (female) displayed a moderate and statistically significant positive correlation with EMS ($r = 0.233$, $p = 0.000$), suggesting that female students exhibited stronger entrepreneurial mathematical skills than their male counterparts. These finding challenges traditional gender assumptions in mathematics and entrepreneurship and may reflect the growing empowerment of women in technical and business domains due to increasingly inclusive educational environments.

Interestingly, performance on the diagnostic mathematics test, assumed to reflect general mathematical proficiency, was not significantly correlated with EMS ($r = 0.015$, $p = 0.645$). This indicates that traditional math assessments may not effectively predict students' abilities to apply math in entrepreneurial contexts, possibly highlighting a misalignment between standardized testing and real-world application. Additionally, both mathematics self-efficacy ($r = –0.160$, $p = 0.000$) and decision-making behavior ($r = –0.178$, $p = 0.000$) were significantly but negatively correlated with EMS. These counterintuitive results suggest that students who rate themselves highly in math confidence or decision-making may not perform well in entrepreneurial math tasks. A possible explanation is that confident students might rely more on intuition than on analytical problem-solving, leading to overestimation of actual skills. Similarly, decision-making styles leaning toward heuristic or emotional approaches may weaken the application of quantitative reasoning in business scenarios.

In terms of entrepreneurial decision-making components, BSIT students demonstrated only fair competence in Risk Assessment and Financial Management ($M = 3.30$), pointing to limited ability to apply mathematical reasoning in evaluating financial risks. This supports Nasir and Safran's (2022) critique that mathematics instruction in technical programs often lacks entrepreneurial context. Students appeared to rely more on intuition than on data-informed strategies, suggesting insufficient financial literacy—an essential skill for entrepreneurship (Valencia-Márquez et al., 2022). Slightly higher mean scores were observed in Strategic Planning ($M = 3.44$) and Adaptability and Cognitive Flexibility ($M = 3.47$), both categorized as Good. These

outcomes suggest emerging competence in data-driven planning and situational responsiveness, aligning with the findings of Montalbo (2022) and Mahmud et al. (2022), who underscored the value of scenario-based learning in preparing students for uncertainty in business environments.

Notably, the low performance in Risk Assessment contradicts previous findings of high self-efficacy among students (Velez & Abuzo, 2024), reinforcing Pajares and Miller's (1994) position that confidence does not always equate to competence. This disconnect may lead to overestimated capabilities and compromised decision-making accuracy. The results also echo Velasco's (2013) concern that BSIT students tend to favor traditional employment paths due to limited entrepreneurial exposure. Addressing these gaps calls for curricular reforms as proposed by Ghafar (2020), emphasizing the integration of entrepreneurial tasks—such as profit analysis, forecasting, and risk modeling—into mathematics education. Such reforms may bridge the theoretical-practical divide and cultivate relevant entrepreneurial skills. However, this study is limited by its single-institution scope and lack of control over contextual variables like prior entrepreneurial experiences. Future research should employ multi-institutional samples and investigate the effectiveness of project-based entrepreneurial mathematics interventions in enhancing both self-efficacy and decision-making behavior.

CONCLUSIONS

Findings revealed that many BSIT students began the program with weak math foundations but improved to a satisfactory level in entrepreneurial math tasks. However, no strong link was found between demographics and performance, suggesting the need for early, targeted interventions to address foundational gaps.

Students performed satisfactorily in basic arithmetic, interest rates, and pricing, but showed difficulty with applied areas like profit and loss and break-even analysis. This highlights the need for instruction to emphasize real-world applications to enhance entrepreneurial readiness.

While students demonstrated adequate mathematical skills, their self-efficacy was inconsistent—strong in problem-solving but weak in computation. This gap between ability and confidence may affect motivation, indicating the need for strategies that build computational self-belief.

Students showed strengths in planning and adaptability but struggled with financial risk and management. A negative correlation between EMS and decision-making highlights that skill proficiency does not guarantee effective decisions, calling for curriculum integration of business simulations.

Despite satisfactory EMS, results showed a negative correlation between mathematical skills, self-efficacy, and decision-making. This suggests a disconnect between ability and confidence, reinforcing the need for instructional methods that align skill development with self-perception and decision-making support.

RECOMMENDATION

To address students' weak math foundations, it is recommended that the BSIT curriculum include a first-year enrichment course focused on essential arithmetic and entrepreneurial math, supported by diagnostic tests, remedial classes, and contextualized instruction relevant to their field.

The BSIT entrepreneurial math curriculum should be enhanced with real-world applications like business simulations and case studies, especially in weak areas such as profit/loss and break-even analysis. Interdisciplinary and problem-based learning approaches are encouraged for deeper skill development.

Instruction should include scaffolded math tasks and real-life problems to improve computational self-efficacy. Strategies that boost confidence and reduce math anxiety are essential to align students' self-perception with their actual competence.

To improve decision-making, it is recommended to integrate experiential learning, including financial simulations and forecasting projects, into math subjects. Embedding financial literacy and entrepreneurial modules can boost real-world application and risk management.

Programs that build self-efficacy and decision-making confidence should be introduced, including cognitive-behavioral strategies, reflective tasks, and growth mindset techniques. These help students connect their math abilities with confident entrepreneurial actions.

Future research should explore other EMS predictors like business experience, learning styles, emotional intelligence, or socio-economic status to gain deeper insights and improve the generalizability of findings.

Data Availability

The data supporting the findings of this study are not publicly available due to institutional policies and ethical considerations related to participant confidentiality. As the dataset contains potentially identifiable information from student respondents, access is restricted to protect their privacy and comply with the approved ethical protocol. Interested researchers may request access to limited, anonymized data by contacting the corresponding author, subject to approval by the research ethics committee.

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