

MODELING THE DETERMINANTS OF STUDENTS' CHOICE OF MATHEMATICS AS A SPECIALIZATION: A BINARY LOGISTIC REGRESSION ANALYSIS

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Keywords:

Mathematics
specialization,
Attitudes,
Logistic Regression,
MTAP

Publication Date:

June 30, 2025

Cite this paper:

Bareng, S., Bernabe
M.H., Miguel M.B.,
Sansano, J (2025).
Modeling the
Determinants of
Students' Choice of
Mathematics as a
Specialization: A Binary
Logistic Regression
Analysis. *Student
Journal of Technology
and Educational
Research*, Vol. 2(1), 54-
64
[https://doi.org/10.6514
1/sjter.v2i1n5](https://doi.org/10.65141/sjter.v2i1n5)

Abstract

This study investigated the factors influencing students' decision to pursue mathematics as their major in the Bachelor of Secondary Education program. It examined the respondents' demographic profiles, academic honors, participation in mathematics-related activities, attitudes toward mathematics, and self-reported motivation, enjoyment, and self-efficacy. The majority of the respondents were female, graduates of public Senior High Schools, and came from the Humanities and Social Sciences strand. Most were recognized with academic honors and had participated in the MTAP Challenge organized by Metrobank Foundation, MTAP, and the Department of Education.

In terms of academic performance, the majority obtained a final grade of 2.00 or higher in Mathematics in the Modern World. Attitudinal measures indicated that students generally viewed mathematics as valuable and enjoyable, though confidence in learning advanced mathematics and class participation remained relatively low. Logistic regression analysis revealed that Attitude Towards Mathematics and MTAP Participation were statistically significant predictors of students' likelihood to choose mathematics as their major. Students with positive attitudes had an odds ratio of 8.68, while MTAP participants were also more likely to choose mathematics, indicating the importance of early exposure and favorable dispositions.

Other variables such as sex, academic strand, type of school, academic honors, and final grades did not show significant influence. The model's predictive performance was stronger in identifying students likely to specialize in mathematics than those who were not. The findings highlight the value of fostering positive attitudes and providing enrichment opportunities to promote mathematics specialization among education students.

INTRODUCTION

As the world continues to advance through technology and innovation, the demand for experts with strong mathematical abilities is growing. Mathematics is more than just a school subject; it is fundamental to various fields, including science, engineering, technology, business, and education. It helps students develop essential life skills such as critical thinking, logical reasoning, and problem-solving (Duma et al., 2024).

Although there are many professional opportunities available, students often perceive mathematics as too difficult or challenging. This negative perception causes mathematics to be a less preferred choice as a college major (Mangkuwibawa et al., 2024). This trend is concerning, especially in a time when mathematical competence is crucial for national development and global competitiveness. To address this issue, it is important to understand the factors that influence students' decision to pursue or avoid mathematics as a college major.

In the Philippines, the Senior High School (SHS) curriculum offers several tracks—STEM, ABM, HUMSS, GAS, and TVL—to help students prepare for college. STEM students are more likely to be exposed to advanced problem-solving, making them more inclined to consider math-related courses in higher education. However, the mere exposure to mathematics in SHS does not always translate to choosing it as a college major. Therefore, this study seeks to examine how various factors—such as sex, strand, course, academic achievement, type of school graduated from, and participation in math-related programs like the Mathematics Teachers Association of the Philippines (MTAP)—are associated with this decision.

Furthermore, research shows that gender plays a significant role in decisions related to mathematics. Male students are statistically more likely than female students to pursue STEM fields, including mathematics. However, this trend is more influenced by confidence and cultural expectations than by actual ability (Else-Quest, Hyde, & Linn, 2010). In addition, students who graduate with honors are often more motivated and open to taking on challenging college programs (Deci & Ryan, 1985; Schunk et al., 2014).

Attitude towards mathematics is another important factor that could affect students' academic decisions. A positive attitude may lead to greater interest and confidence in pursuing mathematics, while a negative attitude may reinforce avoidance. Thus, this study also seeks to explore the role of students' attitudes in influencing their choice of major.

Given these considerations, this study aims to determine whether students will choose mathematics as their major subject. Specifically, it will identify the demographic profile of students in relation to their decision, examine the influence of their attitudes towards mathematics, and determine which factors are statistically significant in predicting their choice of mathematics as a major. The results of this study will not only inform educational guidance and career counseling practices but will also contribute to the broader understanding of student motivation and decision-making in the field of mathematics.

METHODS

Research Design

This study uses a descriptive-inferential design to investigate the factors that influence students' decision to choose mathematics as a specialization course in college. Specifically, the study uses binary logistic regression approach to determine which variables significantly predict the likelihood of a student choosing mathematics specialization course.

Respondents and Locale of the Study

The respondents of this study were the second-year students of Bachelor of Secondary Education of the College of Education at Isabela State University – Echague Campus. The sample was categorized based on their specialization, whereas, Cochran's formula for finite population was used to determine the number of respondents per specialization.

Research Instrument

A structured questionnaire was used to collect relevant information from the respondents, including their sex, specialization, Senior High School strand, type of SHS, academic achievements in SHS, participation in Mathematics Teachers Association of the Philippines (MTAP) Challenge, and academic performance in Mathematics general education course. Likewise, to measure the attitudes of the respondents toward mathematics, the researchers adopted an instrument devised by Cabanayan (2020).

Data Gathering Procedure and Analysis

In gathering the data, the researchers asked the classroom president of the second-year students of Bachelor of Secondary Education in all majors to reach out their classmates to answer our adapted questionnaire. The survey is given via google form. The data gathering took one week to finish. The responses of the respondents were tallied and evaluated using JASP software.

To interpret the results of the study, appropriate statistical techniques were used, such as:

1. Frequency and Percentages - The researcher used frequency and percentages distribution to summarize the demographic profile of the respondents.
2. Binary Logistic Regression - The primary statistical method to predict students' likelihood of choosing mathematics as their major based on the independent variable set by the researchers.

RESULTS AND DISCUSSION

Profile of the Respondents

Table 1 represents the profile of the respondents in terms of their specialization, sex, Senior High School (SHS) strand, and type of SHS.

It can be noted that the majority of the respondents came from the mathematics specialization program, followed by those from the English specialization program. In terms of sex, the majority of the respondents are female, which is about 83.30% of the total sample.

On the other hand, it can be gleaned from the table that most of the respondents were graduates from the Humanities and Social Sciences strand of SHS. This is followed by those who came from the Science, Technology, Engineering, and Mathematics strand. Meanwhile, there were only 12.50% from the respondents who came from the Accountancy, Business, and Management strand.

Lastly, most of the respondents came from the public Senior High School. This is a representation of 87.50% of the total respondents.

Table 1. Profile of the Respondents

Profile	Frequency (n=96)	Percent
Specialization		
Mathematics	29	30.21
Social Science	19	19.79
English	26	27.08
Filipino	22	22.92
Sex		
Male	16	16.70
Female	80	83.30
Senior High School Strand		
ABM (Accountancy, Business, and Management)	12	12.50
GAS (General Academic Strand)	20	20.80
HUMSS (Humanities and Social Sciences)	40	41.70
STEM (Science, Technology, Engineering, and Mathematics)	24	25.00
Type of Senior High School		
Public	84	87.50
Private	12	12.50

Academic Achievement in Senior High School

Table 2 summarizes the number of respondents who received honors as well as those who did not. as shown from the table, there are at least 72% of the respondents who were recognized with honors in SHS, while 22.90% of the respondents were recognized with high honors. Meanwhile, only 4.2% of the respondents were not able to receive any of these awards.

Table 2. Academic Achievements of the Respondents in SHS

Awards	Frequency (n=96)	Percent
With High Honors	22	22.90
With Honors	70	72.90
Not Applicable	4	4.20

Participation in MTAP Challenge

Table 3 presents the number of respondents who participated in any MTAP Challenge. The table revealed that the majority of respondents participated in any MTAP Challenge organized by the Metrobank Foundation, MTAP, and the Department of Education.

Table 3. Participation in MTAP Challenge

MTAP Participation	Frequency (n=96)	Percent
Yes	58	60.40
No	38	39.60

Performance in Mathematics General Education course in College

Table 4 presents the performance of the respondents in 'Mathematics in the Modern World', a general education course in mathematics in college. As observed from the table, the majority of the respondents obtained a final rating of 2.00, followed by those who obtained a final rating of 1.50. Meanwhile, only one respondent got a final rating of 1.00, the highest rating given to any students in the University.

Table 4. Performance of the Respondents in 'Mathematics in the Modern World'

Final Rating	Frequency (n-96)	Percent
1.00	1	1.00
1.25	9	9.40
1.50	20	20.80
1.75	14	14.60
2.00	28	29.20
2.25	10	10.40
2.50	13	13.50
2.75	1	1.00

Attitudes toward Mathematics

The results of the descriptive analysis on students' attitudes toward mathematics reveal varying degrees of agreement across the five measured domains.

Table 5. Respondents' Perceived Attitudes toward Mathematics

Indicators	Mean	Qualitative Description
Self-Confidence		
1. I have usually enjoyed studying mathematics at school.	2.792	Agree
2. I like to do new experiments in mathematics.	2.521	Agree
3. I like mathematics.	2.823	Agree
4. I have a lot of self-confidence when it comes to mathematics.	2.531	Agree

	5. I am confident that I could learn advanced mathematics.	2.469	Disagree
	Weighted Mean	2.627	Agree
Enjoyment			
	6. I think studying advanced mathematics is useful.	3.208	Agree
	7. A strong mathematics background could help me in my professional life.	3.125	Agree
	8. I believe studying mathematics helps me with problem-solving in other areas.	3.125	Agree
	9. Mathematics is a fascinating subject.	2.958	Agree
	10. The challenge of mathematics appeals to me.	2.865	Agree
	Weighted Mean	3.056	Agree
Value			
	11. I want to develop my mathematics skills.	3.417	Strongly Agree
	12. Mathematics is vital in everyday life.	3.281	Strongly Agree
	13. Mathematics is one of the most important subjects for people to study.	3.208	Agree
	14. Mathematics helps develop the mind and teaches a person to think.	3.281	Strongly Agree
	15. Mathematics is a very worthwhile and necessary subject.	3.208	Agree
	Weighted Mean	3.279	Strongly Agree
Motivation			
	16. Studying mathematics doesn't make me feel nervous.	2.344	Disagree
	17. Mathematics doesn't make me feel uncomfortable.	2.781	Agree
	18. I always feel at ease in a mathematics class.	2.750	Agree
	19. When I hear the word mathematics, I feel motivated	2.938	Agree
	20. I look forward to doing mathematics experiment	2.667	Agree
	Weighted Mean	696	Agree
Self-Efficacy			
	21. I feel confident enough to ask questions in my mathematics class.	2.490	Disagree
	22. I believe I will be able to use mathematics in my future career when needed.	3.031	Agree
	23. I believe I can understand the content in a mathematics course.	2.760	Agree
	24. I believe I can learn well in a mathematics course.	2.750	Agree
	25. I feel confident when using mathematics outside of school.	2.583	Agree
	Weighted Mean	2.723	Agree

In terms of self-confidence, students generally agreed with positive statements about their enjoyment and interest in mathematics, as reflected in the weighted mean of 2.627. However, the noticeably lower score on their confidence in learning advanced mathematics indicates a specific area where learners feel uncertain, suggesting that while they engage with mathematics, their belief in handling more complex topics remains limited.

For the enjoyment domain, the weighted mean of 3.056 indicates that students find mathematics useful, intellectually stimulating, and enjoyable. They acknowledge the role of mathematics in enhancing problem-solving and recognize its relevance in professional life, reflecting a favorable emotional disposition toward the subject.

The value domain obtained the highest weighted mean of 3.279, with students strongly agreeing that mathematics is vital in everyday life, intellectually enriching, and one of the most important subjects. This demonstrates that students recognize and deeply appreciate the practical and cognitive importance of mathematics in real-world contexts.

Regarding motivation, the results are mixed. While students generally agreed that they look forward to math-related tasks and feel at ease in class (weighted mean = 2.696), lower mean scores in items related to nervousness suggest that math anxiety still affects some students. This reveals an underlying tension between interest and emotional readiness when engaging with the subject.

Finally, in the domain of self-efficacy, students agreed that they are capable of learning and applying mathematics (weighted mean = 2.723), particularly in future career contexts. However, their lower confidence in asking questions during class implies a hesitation to actively participate, which may limit deeper learning and classroom engagement. These findings highlight the need to strengthen students' self-assurance and classroom interaction in mathematics instruction.

Model Fit Measure

Table 4 shows that the logistic regression model used in the study fits the data well and is statistically significant. The overall model test resulted in a chi-square value of $\chi^2(7) = 36.0$ with a p-value less than .001, meaning there is strong evidence that the model as a whole is meaningful and not due to random chance. In other words, the variables included in the model significantly help in predicting the outcome. For example, if this model was used to predict students' likelihood of succeeding in math based on attitudes or motivation, the findings suggest that these predictors are genuinely helpful for understanding and anticipating student outcomes.

Table 6. Model Fit Measures

Model	Deviance	AIC	R^2_{McF}	R^2_{CS}	R^2_N	Overall Model Test		
						χ^2	df	p
1	81.7	97.7	0.306	0.312	0.442	36.0	7	<.001

The model's Akaike Information Criterion (AIC) is 97.7 and the Deviance is 81.7—both of which are measures of model fit. While technical in nature, lower values on these indicators suggest that the model describes the data reasonably well without being overly complex.

More importantly for interpretation, the pseudo R-squared values ($R^2_{\text{McF}} = 0.306$, $R^2_{\text{CS}} = 0.312$, and $R^2_{\text{N}} = 0.442$) indicate that the model explains between 30.6% and 44.2% of the variation in the outcome variable.

Predictors of Students' Choice of Mathematics as Specialization Course

As shown in the table above, the logistic regression analysis was conducted to examine the effects of different predictors on the likelihood that a student would choose mathematics as their major. The results indicate that only two predictors were found to be statistically significant: Attitude Towards Mathematics and MTAP Participation.

Students who have a more positive attitude towards mathematics are significantly more likely to choose it as their major, with an odds ratio of 8.68 (95% CI [2.08, 36.18], $p = 0.003$). This means that as students' attitude towards math improves, their likelihood of selecting math as a major increase notably.

Table 7. Model Coefficients (All variables)

Predictor	Estimate	SE	Z	p	Odds ratio	95% Confidence Interval	
						Lower	Upper
Intercept	-10.447	3.982	-2.624	0.009	2.90e-5	1.18e-8	0.0712
Sex:							
0 - 1	-1.434	0.837	-1.714	0.087	0.238	0.0462	1.2291
Strand:							
1 - 0	1.179	0.637	1.851	0.064	3.250	0.9327	11.3244
Type of School:							
0 - 1	-0.161	0.881	-0.182	0.855	0.852	0.1514	4.7900
Acad Achievement:							
0 - 1	2.100	1.430	1.469	0.142	8.167	0.4955	134.6142
MTAP:							
0 - 1	1.460	0.694	-2.104	0.035	0.232	0.0596	0.9051
Attitude towards Math	2.161	0.728	2.966	0.003	8.677	2.0811	36.1775
MMW	0.818	0.807	1.014	0.311	2.265	0.4662	11.0042

Note. Estimates represent the log odds of "Course2 = 0" vs. "Course2 = 1"

Similarly, students who participated in MTAP were also found to be significantly more likely to choose math as their major, with an odds ratio of 0.23 (95% CI [0.06, 0.91], $p = 0.035$). Although the odds ratio is less than 1, the interpretation suggests that not participating in MTAP reduces the odds of choosing math as a major, so participation is linked to a higher likelihood.

Other predictors such as sex, strand, type of school, academic achievement, and MMW Flipped did not show statistically significant effects, as their p -values were above 0.05.

Therefore, these variables do not have a strong or clear influence on whether a student will pursue a mathematics major based on this model.

Table 8. Model Coefficients of the Significant Predictors

Predictor	Estimate	SE	Z	p	Odds ratio	95% Confidence Interval	
						Lower	Upper
Intercept	-8.41	2.019	4.16	< .001	4476.598	85.5017	234380.411
MTAP:							
1 - 0	1.23	0.588	-2.08	0.037	0.293	0.0926	0.929
Attitude towards Math	2.25	0.648	-3.47	< .001	0.105	0.0295	0.375

Note. Estimates represent the log odds of "Course = 1" vs. "Course = 0"

The significant predictors appeared in Table 7 were used to rerun the model so that the logistic regression model is described as:

$$\text{logit}(p) = \ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2$$

where

β_0 = intercept

β_1 = MTAP Coefficient

β_2 = Attitude toward Math coefficient

X_1 = MTAP Participation (1=Yes; 0=No)

X_2 = Attitude toward Math (Likert Scale=1-4)

Thus, the log-odds equation can be described as:

$$\text{logit}(p) = -8.41 + 1.23 X_1 + 2.25 X_2$$

To convert the logit model to a probability model,

$$P(\text{Choose Math}) = \frac{1}{1 + e^{-(-8.41 + 1.23 X_1 + 2.25 X_2)}}$$

Model Simulation

As shown in Table 9, the simulated probabilities further illustrate the effect of MTAP participation and mathematics attitude on the likelihood of choosing mathematics as a specialization. Student 1, who participated in MTAP and has the highest possible attitude score of 4, shows the highest probability of choosing mathematics specialization at 86.06%. This demonstrates how the combination of prior exposure through MTAP and a strong positive attitude toward math significantly increases the likelihood of selecting mathematics as a major.

Student 2, who also participated in MTAP but has a slightly lower attitude score of 3, has a noticeably lower probability of 39.41%. This drop indicates that even with MTAP involvement, the student's personal attitude toward the subject remains a strong influencing factor.

On the other hand, Student 3 and Student 4, who did not participate in MTAP and have lower attitude scores (2 and 1 respectively), show very low probabilities of choosing

mathematics specialization (1.96% and 0.21%). This clearly suggests that the absence of MTAP participation and a poor attitude toward math greatly decrease the likelihood of pursuing mathematics further.

Table 9. Simulation of the Model

Student	MTAP Participation (0=Did not participate 1=Participated)	Mathematics Attitude (Likert scale: 1-4)	Probability of choosing Mathematics Specialization
Student 1	1	4	86.06%
Student 2	1	3	39.41%
Student 3	0	2	1.96%
Student 4	0	1	0.21%

Accuracy of the Model

The confusion matrix in Table 10 presents the performance of the probability model in predicting students' choice of specialization in the Bachelor of Secondary Education program. Specifically, the model correctly predicted 58.60% of the respondents who did not choose mathematics specialization, and 85.10% of those who did choose mathematics specialization.

Table 10. Confusion Matrix of the Model

Observed	Predicted		% Correct
	0	1	
0	17	12	58.60
1	10	57	85.10

This indicates that the model performs better at identifying students who are likely to take mathematics as their specialization, compared to those who are not. While the prediction accuracy for mathematics specialization is relatively high, the lower accuracy for non-math specializations suggests some room for improvement in the model's ability to distinguish these cases.

CONCLUSION

The findings of the study reveal important insights into the factors influencing students' decision to pursue mathematics as their major. Demographically, most respondents were female, graduates of public Senior High Schools, and came from the Humanities and Social Sciences strand. A significant portion had been recognized with academic honors and had participated in mathematics enrichment programs such as the MTAP Challenge.

In terms of academic performance, the majority attained satisfactory to high ratings in the general education course Mathematics in the Modern World. Respondents demonstrated positive attitudes towards mathematics, recognizing its value, enjoying the subject, and acknowledging its importance in everyday life and professional contexts. However, lower self-confidence in learning advanced mathematics and hesitation in classroom participation reflect areas where further support is needed, particularly in building mathematical self-efficacy.

The logistic regression model used in the study proved to be statistically significant and well-fitted to the data, identifying Attitude Towards Mathematics and MTAP Participation as significant predictors of choosing mathematics as a major. Students with more favorable attitudes towards mathematics and those who participated in MTAP were notably more likely to specialize in the subject. Other variables such as sex, strand, type of school, and academic honors were not statistically significant predictors.

The model's predictive capability was stronger in correctly identifying students likely to choose mathematics specialization than those who did not, suggesting its practical utility in educational guidance, although refinements may improve accuracy further. Overall, the study highlights the critical role of positive attitudes and early engagement in mathematics-related activities in shaping students' academic choices.

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