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Factors Affecting the Mathematics Performance of the College Students: A Discriminant Analysis

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Abstract

The study aims to match the different learning factors on the Mathematics Performance of the College Students of Cebu Normal University, SY 2023 – 2024 as basis for thesis dissertation. This study employed a descriptive comparative using discriminant analysis design. This design enables to examine whether significant differences exist among the High Performing Students and Low Performing Students, in terms of the predictor variables, by extension, the accuracy of the classification. The respondents were already grouped accordingly. A focus group discussion was done to elicit the highlights and lowlights of the study. The student's related factor is one of the important aspects of high fail rate in mathematics that plays a vital role in a teaching learning process. Without students' interest in the teaching learning activities there is no possibility to achieve knowledge in subject matter. Student's achievement depends on their need, interest, practices, and seriousness in subject matter. Students related factors include mathematics anxiety, prior knowledge of students and student's labor in learning mathematics. The result of the study reveals that that there is a significant difference between its high and low performing in mathematics on the study habits, learning problem, and mathematics anxiety. Moreover, it found out also that there is no significant difference between its high and low performing in mathematics on the teacher relations, parental attitudes, and learning environment with the discriminant analysis. It is highly recommended that they can utilize Learning Enhancement Programs such as peer mentoring, cooperative learning activities, scaffolding, remediation activities, and other supplementary seminars or webinars that enhance the students' skills in learning mathematics. By this, it will allow the students to be the center of the teaching – learning process so that the low performing students can adopt to the modification of the learning process.

Keywords: Learning Factors in Mathematics, Mathematics Performance, Parental Involvement, Parents Attitudes towards mathematics

1. Introduction

Instructional design is an effective means of alleviating many pressing problems in education. It is an authoritative discipline, a body of knowledge that prescribes instructional actions to enhance desired educational results, such as success and impact on performance. This research was chosen so that the mathematics teachers will become aware of the academic factors that affect the relationship between the students' factors in learning mathematics because most of

them got low scores without considering the factors that contribute. The paper seeks to analyze some factors affecting students' mathematics performance at Cebu Normal University. After teaching mathematics for 3 years at the university, most of the problems that existed were the difficulty of the terminologies and the process itself of how certain solutions and concepts were derived and tackled. Tutorials and other sorts of academic help helped a lot in making learning possible. In this research, we found out the factors that existed in the failure of the respondents in mathematics—not just failing but rather the difficulty of the subject matter. It is therefore an irrefutable fact that the success of learning the subject is contingent on a myriad of reasons. School, student, and teacher factors all impinge on the learning of mathematics. Educators, trainers, and researchers have long been interested in exploring the reasons that effectively contribute to the quality of student achievement. Students envisioned their 'use' of knowledge in daily scenarios, in contrast to their teachers' goals of fostering learners' academic performances (Zhou, Jiming, Zhao, et. al., 2019).

The researchers observed that students are having difficulty with their art of critical thinking and that there may be a lack of comprehension given the mode of learning. Module design, nature of assessment, and submissions delimit the scope of this study. This research evaluates their academic performances in mathematics and gives an analysis of effectiveness in learning mathematics as part of human exploration.

This paper recommends a solution to solve the gap in the difficulty of the art of critical thinking through conducting enhancement programs that allow the students to engage and apprehend mathematics in reality. These enhancement activities may include webinars and seminars, transfer tasks, mathematics tutorials, and enhancement conferences such as seminar workshops.

Objectives of the study

The main purpose of this study is to match the different learning factors on the Mathematics Performance of the College Students of Cebu Normal University, SY 2023 – 2024 as basis for thesis dissertation.

Specifically, this study answered the following questions:

1. What is the demographic profile of the university students with regard to:

1.1 Age;

1.2 Gender;

1.3 Family income; And

1.4 Parent's educational qualifications.

2. What is the status of the high-performing and low-performing students in mathematics with regard to:

2.1 Study Habits;

2.2 Learning Problem;

2.3 Mathematics Anxiety;

2.4 Teacher Relationship; and

2.5 Parents Attitudes Towards Mathematics;

2.6 Learning Environment.

3. Is there a significant difference between its high and low performing students in Mathematics on the six variables?

4. Which factors can discriminate the students Mathematics Performance?

5. What Mathematics Enhancement Activities can be designed based on the findings of the study?

2. Methodology

The respondents were the college students who were selected as high- and low-performing students. They were selected based on the midterm exam scores given on March 21, 2023. Low-performing students are coming from Class A since they have low scores in the said exam, while high-performing students are coming from Class B since they have high scores in the said exam. Regrouping was not possible since it was already established, and the students were 50 per class. There were 100 students in total, with ages ranging mostly from 18 to 21 years old.

A teacher-made questionnaire was created that comprises two types, namely: (1) the demographic profile of the respondents, and (2) the status of the low and high performers of the respondents. This was used to determine the performance of college students in mathematics.

To determine parental responses and student perceptions regarding their children's mathematics performance. Parents answered each question in a 5-point Likert format: "Strongly Disagree," "Disagree," "Neutral," "Agree," and "Strongly Agree." The results were identified using the weighted mean statistical tool as a 5-point Likert scale from "strongly disagree" to "strongly agree.".

Pre-Data Gathering. The researcher sent a letter to the Dean of the College of Arts and Sciences requesting permission to conduct the study. The researcher also wrote a letter to the department chair, informing her that the selected students were the respondents to this study. After that, the paper was also submitted to the Institution Review Board (IRB) to obtain a certificate of notice to proceed.

Actual data gathering. On the day of the data gathering, the researcher will once again explain the purpose and mechanics of the survey so that the respondents will have an idea about it, and then administer the questionnaires. The instructors will also pinpoint at least an idea of the reason(s) the research was conducted in their classes. Hence, the data on the performance evaluation of the respondents was taken through a standardized questionnaire, including the qualitative data coming from their instructors. Another survey will also be given to the parents through the students telling the same mechanics as mentioned in the class.

Post: Data Gathering. The data gathered were collected, tallied, tabulated, and statistically treated using discriminant analysis to test the significant difference and the identified factors that discriminate in the study. Data analysis followed.

The services of the Institutional Ethics Review Board of the University of the Visayas were utilized. The Institutional Review Board essentially allowed third parties unknown to the researcher to review ethical considerations based on beneficence, respect and justice. In conducting research, ethical consideration was given importance to protect the validity, dignity, and safety of the research participants to strengthen its quality standards. Several ethical

considerations were considered to ensure that the study was conducted in an appropriate manner (Babbie & Mouton, 2001). In compliance with ethical considerations in conducting research to all participant's, written consent was provided to the participants in the conduct of the research study and secured accordingly, and make sure that only those who were permitted to join the conduct of this study were included in the teaching – learning process for this purpose.

Thus, the researcher explained the purpose in conducting this research to the respondents and asked for their honest answers to ensure the success of the study. Respondents were informed ahead of time. All participants used the same questionnaires. Their participation was their generous contribution to the success of the study. Appreciation through words of thanks as driving force for accomplishing the questionnaire was extended by the researcher to the respondents.

Finally, with all the guidelines prescribed by the University, all requirements were fully accomplished before the conduct of the study. Ethical review and approval by the Institutional Review Board (IRB) of the University Ethics Committee was sought. Thus, the principles and standards of the report supported the conduct of this study.

3. Results and Discussion

Personal Background

Personal Background included in this study were the following: (1) Age; (2) Gender; (3) Family Gross Monthly Income; and (4) Parents' Qualifications.

Table 1. Demographic Profile of the Respondents

Age Bracket	f	%
13 – 19	90	90.00
20 – 29	10	10.00
Sex		
Female	78	78.00
Male	22	22.00
Family Gross Monthly Income		
Between P11,690.00 - P23,381.00	32	32.00
Between P23,381.00 - P46,761.00	16	16.00
Between P46,761.00 - P81,832.00	14	14.00
Less than P11,690.00	38	38.00
Parents' Qualification		
Basic Education	37	37.00
Postgraduate Studies	10	10.00
Undergraduate Degrees	47	47.00
Vocational Courses	6	60.00

Table 1 shows the demographic profile of the respondents who answered the standardized questionnaire, with 100 respondents from the low- and high-performing classes. It identified that between the ages of 13 and 19 years old, about 90% of the respondents answered the

survey, and about 10% of the respondents between the ages of 20 and 29 years old answered the survey. Moreover, about 78% of the respondents are female, and about 22% are male. Regarding the family gross monthly income of the respondents, there are about 32% of the respondents with a monthly gross family income of between P11,690.00 and P23,381.00; about 16% of the respondents with a monthly gross family income of between P23,381.00 and P46,761.00; about 14% of the respondents with a monthly gross family income of between P46,761.00 and P81,832.00; and about 38% of the respondents with a monthly gross family income of less than P11,690.00. For the parents' qualifications of the respondents, there are about 37% who finished basic education alone; about 10% of the respondents who finished their postgraduate studies; about 47% of the respondents finished their undergraduate studies; and about 60% of the respondents finished the vocational courses.

Dela Cruz (2017) stated that Asians are often stereotyped as good problem solvers, but Filipino students seem to have difficulty learning and solving mathematics problems. The Trends in Mathematics and Science Study (TIMSS) current result was that the Philippines had been outsmarted by our neighbouring Asian countries that got the highest ranks. According to Jalmasco (2014), even though the science high schools in the country participated in the Advanced Mathematics Category, the Philippines still ranked lowest among the 10 countries. This implies that Filipino students and teachers need to go hand in hand to develop higher cognitive demands. This shows that students need to improve their critical and analytical thinking skills to improve their academic performance and be globally competitive. Furthermore, the data shown in the table was the result of the intensive analysis of the college students who reviewed the study.

Status of the Respondents in Mathematics

Many of the respondents are female and between the ages of 13 and 19 years old. The basis of the status of the respondents as low- and high-performing classes is the results of the midterm examination. In the succeeding presentations, it was found that the high-performing class had a better mean result compared with the low-performing class in terms of study habits, learning problems, mathematics anxiety, teacher relationships, parents' attitudes, and learning environment.

Study Habits of the Students in Mathematics

This part shows the results of the respondents in mathematics. The table shows the overall factor mean of 3.05 for the low-performing class and about 4.17 for the high-performing class, with an overall standard deviation of 1.08 for the low-performing class and about 0.85 for the high-performing class. This means that the respondents were interpreted as satisfactory in the low-performing class and very satisfactory in the high-performing class. The data suggests that the respondents' study habits improved more in the high-performing class. Given the nature of their study habits, this can be considered one of the reasons for their high mathematics performance.

Table 2. Study Habits of the Students in Mathematics

Indicators	Low Performing Students (n = 50)			High Performing Students (n = 50)		
	Mean	*SD*	DE	Mean	*SD*	DE

I only study during exam days/weeks.	3.94	1.00	A	4.36	0.88	SA
I study every day.	4.14	1.28	A	4.30	1.13	SA
I study monthly.	3.92	0.90	A	1.86	0.97	D
I study in case of emergency.	3.66	1.10	A	1.64	0.90	SD
I do not study.	3.16	1.28	N	1.46	0.86	SD
I do my assignments regularly.	3.62	0.99	A	4.60	0.76	SA
I exert more effort when I do difficult assignment.	3.18	1.24	N	4.32	0.89	SA
I spend my vacant time in doing assignments or studying my lesson.	3.30	1.05	N	3.94	0.98	A
I study the lessons I missed if I was absent from the class.	3.06	1.06	N	4.48	0.65	SA
I study and prepare for the quizzes and tests.	3.66	0.69	A	4.66	0.48	SA
I study harder to improve my performance when I get low scores.	3.38	0.99	N	4.58	0.61	SA
During school time, I spend less time with friends to concentrate more on my studies.	3.20	1.28	N	4.32	0.91	SA
I prefer to finish my studies and homework first before watching any TV shows etc.	3.28	1.25	N	4.22	0.84	SA
I see to it that extracurricular activities do not hamper my studies.	3.14	1.25	N	4.44	0.70	SA
I have specific place of study at home which I remain clean and orderly.	3.58	0.84	A	4.26	1.14	SA
Factor Mean	3.05	1.08	Satisfactory	4.17	0.85	Very Satisfactory

Note. DE is Descriptive Equivalent. 1.00 to 1.80 is Strongly Disagree (SD); 1.81 to 2.60 is Disagree (D); 2.61 to 3.40 is Neutral (N); 3.41 to 4.20 is Agree (A); and 4.21 to 5.00 is Strongly Agree (SA).

Mathematical concepts mostly involve computations and problem-solving, which need to be practiced by the students not only in school but also at home. For this reason, teachers often give students tasks to practice skills. However, if students are busy with other activities, they have limited or no time to practice the skills they are learning.

Sakirudeen and Sanni (2017) found that study habits such as note-taking, library usage, and allocation of study time influenced students' academic performance. They also recommended organizing group counseling sessions in schools initiated by school guidance

counselors to create awareness about practical study habits and the provision of a functional library in secondary schools, which could lead to better student performance in mathematics.

Learning Problems of the Students in Mathematics

This part shows the results of the respondents' learning problems in mathematics. The table shows the overall factor mean of 3.20 for the low-performing class and about 3.42 for the high-performing class, with an overall standard deviation of 1.04 for the low-performing class and about 0.71 for the high-performing class. This means that the respondents interpreted the learning problem as high for the low-performing class and moderate for the high-performing class. The data suggests that the learning problems of the respondents in the low-performing class need to be improved as compared with the high-performing class. Given the nature of the learning problem, this can be considered one of the reasons for the moderate mathematics achievements of the high-performing class.

Table 3. Learning Problems of the Students in Mathematics

Indicators	Low Performing Students (n = 50)			High Performing Students (n = 50)		
	Mean	*SD*	DE	Mean	*SD*	DE
Lack of Study Habits	3.34	0.92	N	4.18	0.63	A
Teacher Factor	3.10	1.22	N	2.64	0.66	N
I hate Math	2.90	1.16	N	2.72	0.78	N
Peer Pressure	3.32	1.27	N	3.64	0.72	A
Family Problem	3.32	1.02	N	3.28	1.01	N
I can acquire what is being imparted in class this year.	3.68	0.94	A	4.60	0.57	SA
I can solve anything if I try hard enough.	3.54	1.11	A	4.06	0.55	A
If I practiced every day, I could develop almost any skill.	3.44	0.95	A	4.30	0.54	SA
Once I have decided to achieve something that is important to me, I keep trying to achieve it, even if it is harder than I thought.	3.74	0.88	A	3.84	0.74	A
I am assured that I will accomplish the areas that I set for myself.	3.56	0.91	A	3.88	0.87	A
Factor Mean	3.20	1.04	High	3.42	0.71	Moderate

Note. DE is Descriptive Equivalent. 1.00 to 1.80 is Strongly Disagree or Very High; 1.81 to 2.60 is Disagree or High; 2.61 to 3.40 is Neutral or Moderate; 3.41 to 4.20 is Agree or Low; 4.21 to 5.00 is Strongly Agree or Very Low.

The nature of the learning problem can be considered one of the reasons for the moderate mathematics performance of the high-performing class. In any academic activity, intrinsic mechanisms play a crucial role in the learning process. In mathematics, in particular, students' academic performance is strongly influenced by their drive and motivation to learn

the subject. Intrinsic motivation is categorized by students' awareness of the learning process and their satisfaction with it. This concept sheds light on how students' drive to excel in mathematics is closely linked to their academic achievements (Martin & Marsh, 2021).

Batool (2019) found that students who performed well academically were more likely to achieve the objectives of the curriculum compared to those who did not perform well. Similarly, Okwelle (2020) found that students who performed poorly academically had a lower likelihood of achieving the intended learning outcomes of the curriculum. These suggest that mathematics performance is a key predictor of curriculum effectiveness.

Mathematics Anxiety of the Students

This part displays the outcomes of the mathematics anxiety of the respondents. The table shows the overall factor mean of 3.60 for the low-performing class and about 4.09 for the high-performing class, with an overall standard deviation of 0.86 for the low-performing class and about 0.84 for the high-performing class. This means that the respondents interpreted the mathematics anxiety of the low- and high-performing classes as low. The data suggests that the mathematics anxiety of the respondents needs to be improved for the low- and high-performing classes. Given the nature of mathematics anxiety, it can be considered one of the reasons for the poor mathematics performance of the respondents.

Table 4. Mathematics Anxiety of the Students

Indicators	Low Performing Students (n = 50)			High Performing Students (n = 50)		
	Mean	*SD*	DE	Mean	*SD*	DE
I prepare for mathematics.	3.60	0.88	A	4.32	0.51	SA
I listen carefully to my mathematics teacher’s lectures.	3.40	0.95	N	4.34	0.66	SA
I actively participate in discussions, answering exercises and/or clarify things that I have not understand.	3.70	0.81	A	4.10	0.81	A
I want to get good grades in exams, tests, assignments and projects.	3.76	0.87	A	4.28	0.90	SA
I get frustrated when the discussion is interrupted.	3.46	0.86	A	4.06	0.84	A
I think hard work pays off.	3.44	0.97	A	3.98	0.87	A
My abilities grow with effort.	3.46	1.01	A	4.06	1.06	A
I be certain of that the intellect can be established like a muscle.	3.54	0.89	A	4.02	0.91	A
I believe that you can significantly change.	3.86	0.67	A	3.84	0.89	A
I can significantly change my base skill level.	3.80	0.64	A	3.92	0.92	A
Factor Mean	3.60	0.86	Low	4.09	0.84	Low

Note. DE is Descriptive Equivalent. 1.00 to 1.80 is Strongly Disagree or Very High; 1.81 to 2.60 is Disagree or High; 2.61 to 3.40 is Neutral or Moderate; 3.41 to 4.20 is Agree or Low; and 4.21 to 5.00 is Strongly Agree or Very Low.

This section exhibits the results of the data gathered regarding the mathematics anxiety of the respondents. Generally, the overall factor mean of 3.60 and 4.09 for low and high-performing classes, respectively, and a standard deviation of 0.86 and 0.84, respectively, mean that the respondents had low assurance in learning mathematics. Due to the difficulty of the subject, students find it hard to learn mathematics. Therefore, their confidence in learning the subject is affected. It is important to build their confidence in learning the subject so that their attitude towards it also improves.

Disregarding this level of anxiety among the students when learning mathematics could have a bad impact on their performance. Therefore, educators need to find strategies to improve the confidence of students in learning mathematics. In the study of Mohamed and Waheed (2018) on secondary students who were asked to answer a questionnaire regarding the students' confidence in math and its usefulness, they found that there was a moderately positive attitude of the respondents towards mathematics. Evaluate the perception of respondents about the value of mathematics in their lives, showing their anxiety about the subject.

The students articulated that mathematics is important in their lives as they can smear these concepts in some of their regular actions. However, these positive thoughts still need to be improved to make them understand that, regardless of the situation of the person, mathematics is valuable no matter what the person's status in life is. Therefore, learning mathematics is important, as it is one of the necessary skills that everyone needs in their life now and in the future.

Teacher Relationship with the Students in Mathematics

This part presents the results of the teacher-student relationship among the respondents in the subject of mathematics. The table shows the overall factor mean of 3.96 in the low-performing class and about 4.05 in the high-performing class, with an overall standard deviation of 0.63 in the low-performing class and about 0.58 in the high-performing class. This means that the respondents interpreted the teacher relationship as positive for both low- and high-performing classes. The data suggests that the teacher-student relationship somehow improved for the low- and high-performing classes. One of the reasons for this can be considered to be the nature of the teacher-student relationship among the respondents' best performers in mathematics.

Table 5. Teacher Relationship of the Students in Mathematics

Indicators	Low Performing Students (n = 50)			High Performing Students (n = 50)		
	Mean	*SD*	DE	Mean	*SD*	DE
My teacher has a good relationship with the students and co-teachers.	3.94	0.68	A	4.26	0.53	SA

My teacher shows smartness, confidence and firmness in making decisions regarding mathematics.	4.02	0.77	A	4.14	0.70	A
My teacher Imposes proper discipline and is not lenient in following the prescribed rules.	2.08	0.97	D	1.92	0.70	D
My teacher has an appealing personality and has a good sense of humor.	4.22	0.51	SA	4.26	0.44	SA
My teacher is open to suggestions and opinions and is worthy of praise.	3.84	0.77	A	4.00	0.57	A
My teacher explains the objectives of the lesson clearly at the start of the lesson.	3.74	0.80	A	3.88	0.66	A
My teacher has mastery of the subject matter.	4.22	0.51	SA	4.28	0.45	SA
My teacher is organized in presenting the lessons by systematically following the course outline.	4.26	0.44	SA	4.30	0.46	SA
My teacher is updated with the present trends, relevant to the subject matter.	4.12	0.63	A	4.18	0.63	A
My teacher uses various strategies, teaching aids/devices and techniques in presenting the lessons.	4.04	0.70	A	4.10	0.71	A
My teacher provides support for all students.	4.34	0.48	SA	4.42	0.50	SA
My teacher has a positive attitude daily.	4.20	0.40	A	4.34	0.48	SA
My teacher presents the information in a way that is easy to understand.	4.14	0.61	A	4.30	0.54	SA
My teacher cares about my academic and social well – being.	4.10	0.68	A	4.28	0.57	SA
My teacher is sensitive to all students.	4.10	0.58	A	4.10	0.71	A
Factor Mean	3.96	0.63	Positive	4.05	0.58	Positive

Note. DE is Descriptive Equivalent. 1.00 to 1.80 is Strongly Disagree or Very Negative; 1.81 to 2.60 is Disagree or Negative; 2.61 to 3.40 is Neutral and Moderately Positive; 3.41 to 4.20 is Agree or Positive; and 4.21 to 5.00 is Strongly Agree or Very Positive.

Results showed that the effects of the respondents' relationship with teachers in mathematics were mediated by mathematics achievement. Regarding the role of self-esteem, the non-significant indirect effects on mathematics achievement were consistent with other studies. When analyzing the presentation, both the low- and high-performing classes are positive. This effect could be interpreted in light of the relationship between self-esteem and the quality of the student-teacher relationship.

The data analysis showed a strong relationship between these measures. Therefore, the quality of the teacher-student relationship explains the large influence of teachers of mathematics' instruction. Students who are trusted can excel in mathematics, as recommended and demonstrated by several scholars.

Callaman and Itaas (2020) reported that the teacher-student relationship is academically connected with academic achievement in the mathematics examination. The beliefs students develop about their mathematical abilities help regulate what they do with the knowledge and skills they possess, which ultimately regulates their mathematics performance.

Parents' attitudes toward mathematics

This portion shows the results of the parents' attitudes toward mathematics among the respondents. The table shows the overall factor mean of 3.44 in the low-performing class, about 3.61 in the high-performing class, and an overall standard deviation of 0.86 in the low-performing class and about 0.77 in the high-performing class. This means that the respondents interpreted the parent attitude toward mathematics as positive in both low- and high-performing classes. The data suggests that parents' attitudes toward their children's mathematics vary, and respondents have improved in some way in the low and high-performing classes. The nature of the respondents' parental attitudes toward mathematics can be considered one of the reasons for better performance in mathematics.

Table 6. Parent Attitude toward Mathematics

Indicators	Low Performing Students (n = 50)			High Performing Students (n = 50)		
	Mean	*SD*	DE	Mean	*SD*	DE
My child is good at mathematics.	3.12	1.00	N	3.96	0.75	A
The challenge of mathematics problems appeals to my child.	3.14	1.13	N	4.02	0.68	A
Mathematics is hard for my child, even when he/she studies.	3.42	1.01	A	2.56	0.81	D
My child likes solving mathematics problems.	3.46	0.97	A	3.98	0.74	A
My child does not have much interest in mathematics.	3.40	0.99	N	2.02	0.68	D
My child looks forward to mathematics class.	3.20	0.97	N	4.02	0.74	A
My child would like to study mathematics in more detail than he/she does now.	3.22	0.86	N	3.94	0.68	A
My child enjoys discussing mathematics problems.	3.20	0.81	N	3.74	0.83	A
Answering questions in mathematics class makes my child nervous.	4.00	0.70	A	2.26	1.12	D
When my child can't immediately solve a mathematics problem, he/she sticks with it until a solution is reached.	3.48	0.74	A	3.54	0.95	A

My child would rather have someone give him/her the solution to a difficult mathematics problem than have to work it out for himself/herself.	3.60	0.90	A	3.76	0.96	A
My child will need mathematics for his/her future career.	3.72	0.73	A	4.10	0.58	A
My child believes that mathematics is useful in everyday life.	3.90	0.58	A	4.22	0.58	SA
Knowing mathematics will help my child be successful in life.	3.82	0.60	A	4.10	0.81	A
My child frequently uses a calculator for calculations in everyday life.	2.86	0.93	N	3.86	0.61	A
Factor Mean	3.44	0.86	Positive	3.61	0.77	Positive

Note. DE is Descriptive Equivalent. 1.00 to 1.80 is Strongly Disagree; 1.81 to 2.60 is Disagree; 2.61 to 3.40 is Neutral; 3.41 to 4.20 is Agree; and 4.21 to 5.00 is Strongly Agree.

This section shows the results of the collected data on parent attitudes towards mathematics. Generally, the overall factor mean and its standard deviation are positive, which means that the parents had better attitudes toward their children's confidence in learning mathematics. Although the subject is so complex, students still find a way to learn mathematics. Therefore, it is important to increase students' confidence in learning the subject so that they also improve their attitude towards it. Teachers need to find strategies to increase students' confidence in learning the subject.

In the study of Mohamed and Waheed (2018), they said that "assessing the perceptions of the respondents on the value of math in their lives exhibits their attitudes towards the subject." This indicates that the respondents had positive attitudes towards the value of mathematics. Students expressed that mathematics is important in their lives because they can integrate these concepts into some of their daily activities. However, these positive attitudes still need to be boosted to make them comprehend that mathematics is beneficial regardless of a person's status in life. Therefore, learning mathematics is important, as it is one of the necessary skills that everyone needs in their lives now and in the future.

Learning Environments in Mathematics

This part shows the results of the respondents' learning environment in mathematics. The table shows the overall factor mean of 3.89 in the low-performing class and about 4.08 in the high-performing class, with an overall standard deviation of 0.76 in the low-performing class and about 0.75 in the high-performing class. This means that the respondents interpreted the learning environment in both low- and high-performing classes as positive.

The data suggests that the respondents' learning environment has improved in some way for all respondents. Given the type of learning environment the respondents have, this can be considered as one of the reasons for the respondents' better performance in mathematics.

Table 7. Learning Environment in Mathematics

Indicators	Low Performing Students (n = 50)			High Performing Students (n = 50)		
	Mean	*SD*	DE	Mean	*SD*	DE
Create safe learning environments to enhance learning through consistent implementation of policies, guidelines, and procedures.	4.08	0.78	A	4.22	0.65	SA
Maintain learning environments that promote fairness, respect and care to encourage learning.	3.92	0.7	A	4.12	0.72	A
Manage classroom structure to engage students individually or in groups in exploration, discovery, and meaningful hands-on activities in a variety of physical learning settings.	3.98	0.77	A	4.26	0.78	SA
Maintain supportive learning environments that encourage and inspire students to participate, cooperate and collaborate in lifelong learning.	3.84	0.79	A	3.72	0.86	A
Lead and empower colleagues in promoting learning environments that effectively motivate learners to achieve quality outcomes by assuming responsibility for their own learning.	3.64	0.78	A	4.06	0.74	A
Factor Mean	3.89	0.76	Positive	4.08	0.75	Positive

Note. DE is Descriptive Equivalent. 1.00 to 1.80 is Strongly Disagree; 1.81 to 2.60 is Disagree; 2.61 to 3.40 is Neutral; 3.41 to 4.20 is Agree; 4.21 to 5.00 is Strongly Agree.

It is revealed that the learning environment has a positive influence on learning achievement. Motivation is a state inherent in a person that inspires him to perform certain actions to accomplish goals. Students who do not know about the purpose of learning in school will certainly disturb their motivation to study.

Therefore, the learning environment factor influences the success of the learning process. According to F. Rohman (2018), the learning environment is everything that surrounds students when doing learning activities. A conducive learning environment certainly creates a comfortable atmosphere for learning (Arianti, 2019). Supportive learning environment conditions such as the availability of physical learning facilities, a comfortable place to study, a calm environment, and harmonious relationships with the social environment can inspire students to learn mathematics, so that students' achievement in mathematics learning increases.

Summarized Data on the Status of the Respondents in Mathematics

This part shows the outcomes of the summarized data on the status of the respondents in mathematics. The table shows the overall factor mean and its standard deviation of study

habits, learning problems, mathematics anxiety, relationships with teachers, parental attitudes, and learning environments for low- and high-performing classes.

The data suggest that the first two factors have their level of difficulty in learning mathematics. In study habits, both performing classes are satisfactory and very satisfactory, respectively, which means that the learning process is better in high-performing classes compared with low-performing classes. In learning problems, the low-performing students encountered more learning gaps in mathematics than the high-performing students. In mathematics anxiety, both types of respondents have a low level of mathematics performance, which means that the respondents are pressured with the subject but the level of anxiety in mathematics is not high. Moreover, the rest of the factors, such as teacher relationship, parent attitude, and learning environment, are positive, which means that these types of factors exist in learning mathematics for both low and high performers.

Table 8. Summarized Data on the Status of the Respondents in Mathematics

Variables	Low Performing Students (n = 50)			High Performing Students (n = 50)		
	Factor Mean	*SD*	DE	Factor Mean	*SD*	DE
Study Habits	3.05	1.08	Satisfactory	4.17	0.85	Very Satisfactory
Learning Problem	3.20	1.04	High	3.42	0.71	Moderate
Mathematics Anxiety	3.60	0.86	Low	4.09	0.84	Low
Teacher relationship	3.96	0.63	Positive	4.05	0.63	Positive
Parent Attitude	3.44	0.86	Positive	3.61	0.77	Positive
Learning Environment	3.89	0.76	Positive	4.08	0.75	Positive

The value of the data collected had the highest factor mean of 3.96 in low-performing classes, that is, the teacher relationship, with a standard deviation of 0.63, which means that students had a positive attitude towards the value of mathematics in their lives with the help and feedback of their teachers. On the other hand, the highest factor mean of 4.17 in high-performing classes could be explained by their attitude and motivation towards the subject, which showed that the respondents were oriented towards learning the subject. is in study habits, with a standard deviation of 0.85, which means that students had very satisfactory scores about the value of mathematics in their lives in an academic sense. Thus, this performance could be explained by their attitude and motivation towards the subject, which showed that the respondents were oriented towards learning the subject. It implies the guidance of teachers to improve their academic attitude towards the subject.

Reyes (2015) stated that the students moderately felt test anxiety in mathematics. Test anxiety is considered a factor that might affect the students' mathematics performance. Moreover, teachers may develop different learning strategies in all mathematics subjects. One of the learning outcomes that should be essential for students to achieve their academic goals is the ability to integrate mathematics and science knowledge to solve problems.

Table 9. Significant Analysis on the Six Variables

Variables (Equal Variance Assumed)	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Interpretation
Study habits	-3.90	98.00	0.000	-5.220	1.338	Significant
Learning Problem	-2.63	98.00	0.010	-3.200	1.215	Significant
Mathematics Anxiety	-6.09	98.00	0.000	-4.900	0.805	Significant
Teacher Relations	-1.80	98.00	0.076	-1.400	0.779	Not Significant
Parental Attitudes	-1.81	98.00	0.073	-2.540	1.401	Not Significant
Learning Environment	-1.95	98.00	0.054	-0.920	0.471	Not Significant

Table 9 shows the significant analysis of the six variables of the respondents in the survey concerning the standardized questionnaire with 100 respondents from the low- and high-performing classes. It found that there is no significant difference in teacher relations, parental attitudes, or learning environment with t-values of -1.80, -1.81, and -1.95, respectively. Moreover, there is a significant difference in study habits, learning problems, and mathematics anxiety, with t-values of -3.90, -2.63, and -6.09, respectively.

Guinocor, et al (2020) stated that the college students should develop an effective system of study strategies that will enable them to understand mathematics better and, at the same time achieving more towards their academic performance.

Table 10. Overall Discriminant Analysis of the Six Factors

Wilks' Lambda

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.	Interpretation
1	0.643	41.922	6	0.000	Significant

Table 10 is the discriminant analysis table, which provides information about the Wilks' Lambda test of function(s), which is a statistical test used to determine the significance of discriminant functions in distinguishing between groups. Wilks' Lambda Value: Wilks' Lambda is the measure of the proportion of variance in the dependent variable that is not explained by the independent variables (or discriminant functions). In this case, the Wilks' Lambda value is 0.643. The chi-square value is a test statistic that measures the discrepancy between the observed frequencies and the frequencies expected under the null hypothesis. In this case, the chi-square value is 41.922. Degrees of Freedom (df): represents the number of independent parameters in the model. In this case, there are six degrees of freedom. The significance value (Sig.) signifies the probability of observing the obtained result (or a more extreme result) if the null hypothesis is true. In this case, the significance value is 0.000, which indicates that the result is highly significant. Based on the significance value, the result of the Wilks' Lambda test is significant (Sig. = 0.000). This suggests that at least one of the discriminant functions is statistically significant in distinguishing between groups. In other words, the independent variables included in the analysis have a significant effect on the dependent variable(s), and there is evidence to reject the null hypothesis of no difference between groups. Overall, the significant result of the Wilks' Lambda test indicates that the discriminant analysis model is effective in distinguishing between groups based on the independent variables included in the analysis.

However, Table 10 shows the Wilks lambda of each independent variable, which shows that of the six predictors, only three were significant discriminating factors in mathematics performance.

Li (2024) found that discriminant analysis is a popular technique for supervised classification problems and works quite well when the number of classes is small, but the accuracy decreases as the number of classes increases. In the process, we generate a sample a sample using certain classification criteria to determine which class or classes it belongs to. With appropriate choices, we show that the proposed method is much more precise than the conventional one.

Table 11. Discriminating Factors of Mathematics Performance

	Wilks' Lambda	F	df1	df2	Sig.	Interpretation
Study habits	0.866	15.211	1	98	0.000	Significant
Learning Problem	0.934	6.933	1	98	0.010	Significant
Mathematics Anxiety	0.726	37.028	1	98	0.000	Significant
Teacher Relations	0.968	3.226	1	98	0.076	Not Significant
Parental Attitudes	0.968	3.289	1	98	0.073	Not Significant
Learning Environment	0.963	3.811	1	98	0.054	Not Significant

Table 11 presents the results of a discriminant analysis examining the discriminating factors in mathematics performance. Each row represents a different independent variable, and the table provides the Wilks' Lambda value, F-value, degrees of freedom (df1 and df2), and the significance level (Sig.) for each variable. Wilks' Lambda is a multivariate statistical test used to assess the significance of each independent variable in distinguishing between groups (in this case, different levels of mathematics performance). It ranges from 0 to 1, where a value closer to 0 indicates a stronger discriminatory effect. The F-value is the test statistic for each independent variable, measuring the strength of the relationship between the independent variable and the grouping variable (mathematics performance). Higher F-values indicate a greater discriminatory effect.

Degrees of Freedom (df1 and df2): These represent the degrees of freedom associated with the F-test. df1 refers to the degrees of freedom for the independent variable, while df2 refers to the degrees of freedom for the error term. The significance level (Sig.) indicates the probability with which the obtained result (or a more extreme result) is observed if the null hypothesis is true. A significance level less than 0.05 (typically denoted as $p < 0.05$) is considered statistically significant.

Study Habits: The Wilks' Lambda value is 0.866, with a significant F-value of 15.211 and a significance level of 0.000. This suggests that study habits have a significant discriminatory effect on mathematics performance.

Learning Problem: The Wilks' Lambda value is 0.934, with a significant F-value of 6.933 and a significance level of 0.010. This indicates that learning problems also have a significant impact on mathematics performance.

Mathematics Anxiety: The Wilks' Lambda value is 0.726, with a highly significant F-value (37.028) and a significance level of 0.000. This suggests that mathematics anxiety is a strong predictor of mathematics performance.

Teacher Relations, Parental Attitudes, and Learning Environment: These three variables have Wilks' Lambda values of 0.968, 0.968, and 0.963, respectively. While their F-values are relatively low and their significance levels are above the typical threshold of 0.05, they may still have some influence on mathematics performance, albeit not statistically significant in this analysis.

Skagerlund (2024) noted that learning mathematics depends not only on purely intellectual processes but also on social and emotional factors. One such important emotional factor that is receiving cumulative attention in the literature is mathematics anxiety (MA), which can be defined as "feelings of tension and anxiety that interfere with the manipulation of numbers and the solving of mathematical problems in a wide range of academic and everyday situations." Therefore, it is of utmost importance that we understand how these factors develop, what their causes are, and through what mechanisms they interfere with mathematics learning.

In summary, study habits, learning problems, and mathematics anxiety are identified as significant discriminating factors of mathematics performance, while teacher relations, parental attitudes, and learning environment may have some influence but are not statistically significant in this analysis. These findings highlight the importance of addressing study habits, learning problems, and mathematics anxiety to improve mathematics performance.

4. Conclusion

The positive learning insights brought about by the discriminant analysis of the low- and high-performing classes somehow enable this study to provide another window of opportunity for addressing learning gaps within the context of curricular implementation and reinforcement.

With appropriate learning materials, primarily the mathematics enhancement activities, mathematics instruction is always fun and challenging, as learning becomes more valuable not only to teachers but to the learners as well.

The mathematics enhancement activities and strategies, being the key output of this study, somehow make mathematics instruction more innovative, engaging, and meaningful, as everyone is given the leverage to benchmark and pilot appropriate and effective pedagogical approaches and strategies as far as the real intent of the implemented curriculum, which is to reinforce weak areas to attain mastery of skills and competencies.

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