Predicting Academic Performance in Mathematics Achievement of Architecture and Engineering Students in Baliwag City, Philippines

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Received: 13.07.2024 Revised: 16.08.2024 Accepted: 22.09.2024

ABSTRACT

This study aims to create a solution for the current problem by providing consistent, excellent service and guidance to the student's achievement and academic performance in Mathematics. In addition, it offers personalized tutorials both face-to-face and virtually — administered by well-experienced and competent teachers. In this way, the learners can enhance the abilities and skills they need to acquire to deal with schoolwork challenges and can avoid drop-outs and frustration in the Mathematical fields. This study aims to distinguish the Mathematics achievement and performance of the learners. This study sought to find out how the level is described. Furthermore, the significant influence of Academic Performance in Mathematics Achievement of Architecture and Engineering Freshmen Students in Baliwag City, Philippines, and the management implications that may be drawn in accordance with the result.

The results of this study will contribute to the area of mathematics, particularly in predicting students' academic performance, which results from the mathematics achievement score. This study also provides a framework for the educational system that creates a solution for the current problem in mathematics achievement.

Keywords: Academic Performance, Mathematics Achievement

INTRODUCTION

Mathematics is a science of all sciences and art of all arts; there will be no science without mathematics because it is the foundation of understanding science. Physics, Engineering, Chemistry, and Medicine exist due to the application of Mathematics. Therefore, it is an essential tool for further studies and discoveries.

As per the Department of Education, it is the subject that pervades one's life at any stage, and its significance transcends further than the classroom and school. Having knowledge about mathematics will bring a person to places, and people use it in their everyday lives. While mathematical challenges in basic education may not be complicated, unresolved difficulties can be carried out in tertiary education, and these foundational gaps can contribute to struggles with more advanced mathematical concepts and potentially impact their academic performance negatively (Dayao, 2018).

Over the past decades, researchers have succeeded in identifying the various factors as predictors of mathematics achievements and the academic performance of students. They determined that a positive attitude toward the subject boosts the brain's memory and is a predictor of performance in mathematics (Chen & Menon, 2018). Despite significant efforts to improve achievement in the field of STEM, students continue to lag behind their international counterparts, particularly in mathematics (Organization for Economic Cooperation. Numerous studies have investigated the root causes of mathematics learning difficulties, identifying potential contributing factors such as output, organization, language, attention, visual-spatial, and multitasking challenges. Additionally, specific mathematical difficulties may be traced from mastering basic number facts, arithmetic weaknesses, recognizing written symbols and concrete materials, and the language and visual-spatial aspects of texts.Richards (2020) experts argued that classes often prioritize the formulas and procedures instead of teaching the students to think creatively and critically in solving complex issues, which includes the area of Mathematics. In line with this, the students encounter difficulty in competing globally or participating in international examinations. Therefore, to make education more reflective for students in high-performing countries, experts recommend providing a math curriculum in the 21st century.

This study aims to create a solution for the current problem by providing consistent, excellent service and guidance to the learners for their mathematics achievement and academic performance. In addition, it offers personalized tutorials both face-to-face and virtually — administered by well-experienced and

competent teachers. In this way, the learners can enhance the abilities and skills they need to acquire to deal with schoolwork challenges and can avoid drop-outs and frustration in the Mathematics and Science fields. This study aims to distinguish the level of Mathematics achievement and performance of the learners. This study sought to find out how the level is described. Furthermore, the significant influence of Mathematics Achievement Tests and performance on learners and the management implications that may be drawn in accordance with the result.

The outcomes of this research will offer support in Mathematics with concern to the likelihood of the results of Achievement Tests in Mathematics and the students' academic performance. This work also recommends a framework regarding the educational system that creates a solution for the current problem in mathematics achievement.

Theoretical Framework

The study draws theoretical support from Piaget's theory of Cognitive Psychology. This theory is highly relevant to the study since one variable studied in this research is student Mathematics achievement, a dependent variable that is a measure of learning. Academic performance is usually boosted by mathematical skills most especially when the act is for acquisition of knowledge in line with the discipline that the student is engaged in.

This study further draws theoretical support from Geary (2004) who discovered that developmental delays and deficits associated with mathematics learning difficulties appear to be related to some difficulties with information representation in the language system. Further theoretical support is drawn from Chard (2006) who diagrammed the four common difficulty areas that affect mathematical fluency of struggling learner and focused on the area of linguistic and vocabulary difficulties.

This paper posits that academic performance can be determined by some factors, one of which is mathematical skills.

This study used the Independent Variable-Dependent Variable model.

The first frame contains the independent variables in the study — Mathematics Achievement while the second frame presents the dependent variable of the study which is the academic performance of the students. The arrow from the independent variables going to the dependent variable shows that the IVs have an effect on the DV.

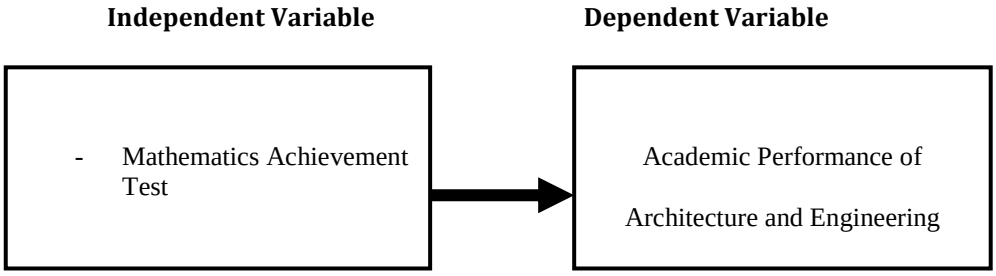

Figure 1. Conceptual Framework of the Study

Statement of the Problem

The general problem of the study is, "How does the results of Mathematics achievement predict the academic performance of Grade 9 students?"

Specifically, it sought to answers the following questions:

1. What is the level of mathematics achievement test of the students?
2. What is the level performance of engineering and architecture students in Mathematics as reflected in their GWA?
3. Does the results of mathematics achievement by Grade 9 students has significant relationship to their academic performance?
4. What management implications may be drawn based on the result of the study?

METHODS AND PROCEDURE

Respondents and Setting of the Study

The study was conducted in a private university in the City of Baliwag. The respondents were the engineering and architecture freshmen students of who were enrolled in the School Year 2023 -2024.

Data Gathering Procedure

The Mathematics Achievement Test data was collected using the School-based Assessment Test, administered by the mathematics teacher under timed conditions. The performance data for mathematics was obtained from the architecture and engineering mathematics teacher.

With permission from the Registrar's Office, the researcher gathered data on the respondents' academic performance. This data was then reclassified and organized for analysis

Data were tallied and organized for analysis and interpretation.

Data Processing and Statistical Treatment

The collected data was tabulated and analyzed using the Statistical Package for Social Sciences (SPSS). The findings were presented in tables and figures.

To analyze and interpret the data, the following statistical measures were employed:

The students' mathematical achievement was measured and described using the range of scoring. The instrument is a School-based achievement test, which was approved by the school and facilitated by a Mathematics teacher.

The students' Mathematics and academic performance were quantified using the university grading system.

RESULTS AND DISCUSSION

The Level of Engineering and Architecture Freshmen Students in Mathematics Achievement Test

The level of Engineering and Architecture Freshmen Students achievement test was described based on the score of the test. This score is shown in Table 2.

The Mathematics achievement test was administered to a sample of students enrolled in a private university in Baliwag City. All the topics covered on the test were taught in their mathematics class. The test consisted of 50 items; results were organized, and the summary of the findings is presented in Table 1.

It can be gleaned from the data that only 44.13 percent of the respondents whose scores went beyond the cut-off score passed the test, while the majority, comprising about 55.87 percent, did not reach the standards of Mathematics Achievement.

A close inspection of the data in the table shows that Sections C and D reached an average achievement of 26.58 and 30.7, respectively, a value that is above the grand mean, 23.06. With a grand standard deviation of 5.59, it can be generalized that the rest of the respondents in the two other classes performed far below this grand mean, with class means of 17.26 and 18.6 for Sections A and B, respectively.

It can be further stated that average students in Section D performed within scores of 24.92 and 36.48, as indicated by the class standard deviation. This finding further articulate how far the other two classes were in terms of achievement in the subject: their mean achievement did not even meet the lowest score among average students in Section C and D classes. Further, it is highly notable that the average students in Section A and Section B classes did not reach the cut-off score, which is 25, to pass the test, as indicated by their class means and standard deviations, 17.26 and 4.41 and 18.6 and 4.75, respectively.

These findings verify their performance in the Mathematics Achievement test, where only two classes passed the test and did above the grand mean of the sample. These findings point out that almost fifty percent of the respondents also perform better in the Mathematics Achievement Test. Students dislike mathematics. Students' negative attitudes towards mathematics often stem from difficulties understanding the subject matter and certain teacher-related factors. This can lead to disengagement, as students who dislike the subject may allocate less attention to it. To improve performance, it is crucial to develop effective study habits, especially when students struggle with the lesson. A negative mindset can hinder academic progress, so cultivating a positive approach is essential for achieving success in mathematics Consequently, students' achievement in mathematics may deter due to a lack of time and attention devoted to the subject.(Capuno et al., 2019).

These findings provide a clear background of the respondents' mathematical ability within the domains of the Achievement Test. The sample consisted of students whose achievement in the subject can be said to be average.

These data further verify those that pertain to the respondents' Mathematics Achievement Test, wherein Section C and Section D classes performed above the grand mean and the other two classes generally performed below the grand mean.

In light of these findings, it can, therefore, be safely said that a great majority of the respondents showed average Achievement in Math.

Table 1. Mathematics Achievement Test of Engineering and Architecture Freshmen Students

Class	Performance in Standard Geometry Test										Class SD
	8-11	12-15	16-19	20-23	24-27	28-31	32-35	36-39	40-42	Class X	
	F %	F %	F %	F %	F %	F %	F %	f %	F %		
Section A	2	9	17	8	1	2	0	0	0		
	3.33	60	29.82	38.1	8.33	6.25	0	0	0	17.26	4.41
Section B	4	4	21	5	5	3	0	0	0		
	6.67	26.67	36.84	23.81	41.67	9.38	0	0	0	18.6	4.75
Section C	0	2	7	5	5	10	5	3	1		
	0	1.33	12.29	23.81	41.67	31.25	33.33	37.5	33.33	26.58	7.41
Section D	0	0	2	3	1	17	10	5	2		
	0	0	3.51	14.29	8.33	53.13	66.67	62.5	66.67	30.7	5.78
Total	6 3.77	15 9.43	57 35.85	21 13.21	12 7.55	32 20.13	15 9.43	8 5.03	3 1.89	23.06	5.59

The Mathematics Performance of Students

Mathematical achievement reflects a student's competency in mathematics. It is the outcome of acquired knowledge, understanding, skills, and techniques developed in the subject of mathematics at a specific stage (Mangal, 2008).

Data on the students' performance in Mathematics were collected and summarized in Table 3. Here, this variable was interpreted based on five levels given by the school: whether the student's grade is Outstanding, Very Satisfactory, Satisfactory, Fairly Satisfactory, and did not meet expectations.

It may be gleaned in Table 2 that the performance of freshmen engineering and architecture students is generally satisfactory, as shown by the mean of 80.94. This means that, in general, the students yielded a performance of about 77.15%-84.73%

Table 2. Performance of Students in Mathematics

Indicators	Frequency	Percentage
90 – 100 (Outstanding)	2	1.26
85 – 89 (Very Satisfactory)	32	20.13
80 – 84 (Satisfactory)	66	41.51
75 – 79 (Fairly Satisfactory)	59	37.11
74 and below (Did not meet Expectations)	0	0.0
Total	159	100.0
Mean – 80.94		
Std. Deviation – 3.79		

Mathematics Achievement and Academic Performance Freshmen Engineering and Architecture Students

Table 4 presents the relationship between mathematics achievement and the academic performance of the students. Data were subjected to correlation analysis. The correlation coefficient was interpreted as follows: 0.00 – 0.10 (Negligible Correlation), 0.10 – 0.39 (Weak Correlation), 0.40 – 0.69 (Moderate Correlation), 0.70 – 0.89 (Strong Correlation), 0.90 – 1.00 (Very Strong Correlation).In these results, the Correlation Coefficient between Mathematics achievement and academic performance is about .494, which denotes that there is a moderate positive relationship between the variables. The relationship between this variable is positive, which indicates that, as the Mathematics achievement of student's increases, the academic performance of student's decreases.

In these results, the p-value for the correlation between mathematics achievement and academic performance is less than the significance level of 0.05, which indicates that the correlation coefficient is highly significant and the null hypothesis is rejected.

Learning mathematics can enhance learner's logical, analytical, critical, and abstract thinking skills (Cresswell and Speelman, 2020). Similar findings were reported in studies conducted by Hemmings et al. (2011), which revealed that mathematics achievement and performance are significant predictors of overall academic success.

Table 3. Correlation Coefficients on Mathematics Achievement and Academic Performance of Freshmen Students

	MAT	**Performance**	
MAT	Pearson Correlation	1	.494**
	Sig. (2-tailed)		.000

The Implications on Academic Performance that may be Drawn Based on the Study

The study found out that the Mathematics achievement and performance as significant indicators of students' academic performance in a university in Baliwag City. Based on the findings of the study, the following implications were drawn:

- Students' prior knowledge, experiences, and their surrounding circumstances can influence how they engage with teaching-learning activities and learn mathematics.
- Effective collaboration between teachers and students is to achieve learning goals set by the teacher.
- Implementing an outcomes-based approach to teaching and learning can help identify and address students' current learning challenges, before such difficulties mount in the students' future endeavors in the disciplines of mathematics.
- Assessment of students' prior knowledge and entry-level skills, across all subjects, can inform teachers' lesson planning and instructional activities.
- A standardized diagnostic test given at the start of the school year can help teachers identify students' strengths and weaknesses and provide targeted support to those struggling with learning difficulties.
- Collaborative professional development can enhance students' learning experiences and help prevent academic failure by informing each other with effective strategies and best practices.

CONCLUSIONS

The researcher determined the mathematical achievement and performance of students as predictors of academic performance, which the following conclusions were drawn:

1. Almost half of the students whose scores went beyond the cut-off score passed the test and reached the standards of Mathematics Achievement;
2. The majority of the students demonstrated a "satisfactory' rating in Mathematics performance;
3. That more than half of the total students' yielded a "very satisfactory to outstanding" academic performance;
4. The majority of the students demonstrated a "satisfactory' rating in Mathematics performance;
5. Implications are drawn based on the findings of the study.

Recommendations

Based on the conclusions, the recommendations were as follows:

1. Students' achievement in Mathematics can be enhanced by identifying their needs and levels through a diagnostic test at the beginning of the school year so that the repercussions of their difficulties in other subjects may be prevented. In addition to this, students should be made aware of their reading difficulties so that they can address the problem appropriately.
2. That more mathematics ability enhancement programs be provided to students who have difficulties in the discipline and
3. Teachers should continue to monitor the students' mathematics achievement and remind the parents to continue guiding their children.
4. Students improve their Mathematical skills so as to boost their problem-solving ability, which is a predictor of academic performance.
5. The implications drawn from this study are recommended for consideration in order to improve students' achievement in Mathematics and academic performance.

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