

Factors Affecting Students' Mathematics Academic Performance in the IB MYP Programme: Basis for the Formulation of an Action Plan

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Abstract

Mathematics is considered one of the most important subjects around the world and plays a crucial role in the advancement of Science and Technology. This study aims to determine the factors affecting students' Mathematics academic performance in the Tamagawa Academy - International Baccalaureate Middle Years Programme. The study employed the descriptive survey in gathering the quantitative data and correlational method of research to determine the factors affecting students' Mathematics academic performance. Fifty-two students participated in this study consisting of 25 boys and 27 girls. A purposive sampling technique was used in selecting the participants. A research-made questionnaire was used to collect data from the students; the questionnaire was made with the 5-point Likert scale of measurements. The instrument reliability was checked by using Cronbach's Alpha which shows a 0.90 coefficient value. The Pearson Correlation Coefficient was used to check the relationship between independent variables (attitudes toward mathematics, study habits, achievement motivation, and communication) on the dependent variable (academic performance). The results revealed that there is a positive correlation between the dependent variable and independent variables in the range of 0.395, 0.326, 0.446, and 0.459 respectively with the significant level at 0.05. The study suggests intervention activities that will gain interest among students such as academic support and the Math Day program to create an environment of camaraderie among students. Leadership teams and teachers should bear in mind that factors like attitudes toward mathematics, study habits, achievement motivation, and communication have significant importance on students' academic performance.

Keywords: Academic Performance, Achievement Motivation, Study Habits, Attitudes Toward Mathematics, Correlation, Cronbach's Alpha

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Introduction

Mathematics is considered as one of the most important subjects around the world and plays a crucial role in the advancement of Science and Technology. Many scholars share the same view that Mathematics is the foundation of scientific and technological development (Iddrisu et al., 2023). Likewise, a lot of scholarly educational research emphasizes the importance of mathematical knowledge and its utilitarian values. Almost everyone uses mathematical knowledge in their daily lives. This implies that learning Mathematics should not be taken for granted, as its purpose is to develop students' ability to solve a range of simple to complex mathematical problems through the application of Mathematics to familiar and unfamiliar situations.

Various empirical studies have been conducted on the factors affecting students' academic performance (Dagneu, 2017; Landicho, 2021; Ullah & Almani, 2022). These studies have found that there are three factors that consistently influence students' academic performance. These factors are school-related factors, student-related factors, and family-related factors. However, the most important factors that have a massive influence on students' academic performance were cognitive factors (attitudes toward Mathematics), behavioral factors (achievement motivation), and environmental factors (school support and facilities) (Dagneu, 2017; Ullah & Almani, 2022). Educators should understand these factors to enhance teaching and learning methodologies.

The academic performance of students in the IB MYP Division has been observed to be affected by several factors. Some of the factors observed are attitudes toward mathematics, study habits, achievement motivation, and communication skills. In Hwang and Son (2021) study, it was found that there is a positive relationship between students' attitudes toward mathematics and mathematics achievement. With these findings, educators need to evaluate students' attitudes toward mathematics and provide appropriate teaching strategies, teaching materials, and class activities to help stimulate the development of a positive attitude towards mathematics. In the study of Sakirundeen and Sanni (2017), it was found that there is a significant relationship between time allocation for study and academic performance which implies that the more time students allocated to study the better the academic performance. A recent study found that there is a significant and positive correlation between motivation and its dimensions with academic performance; it was found that both intrinsic motivation and extrinsic motivation have a moderate correlation with academic performance in mathematics (Yarin et al., 2022). In the study of Lomibao, et al (2016), it was found that challenging students to communicate both orally and in writing in mathematics class help deepen students' conceptual understanding and improve mathematics performance.

In view of the cited information gathered and observations made, the researcher found it necessary to conduct a study on factors affecting students' Mathematics academic performance in the IB Middle Years Programme (MYP). The results of the study will serve as a basis for formulating an action plan.

Theoretical Framework

The study is anchored on a Social Cognitive Theory of Bandura (Eggen & Kauchak, 2001), which explains that behavior, the environment, and personal factors; such as academic performance and motivation, all influence each other. For instance, a student's low academic performance in Mathematics (a personal factor) is influenced by the student's attitudes and

motivation (a behavioral factor) about the ability to do Mathematics. Student’s attitudes and motivation influence academic performance, and language ability influences academic performance. Social cognitive theorists call this mutual influence reciprocal causation. Behavioral factors can promote or hinder the development of the capabilities of students. In this study, the behavioral factor consists of attitudes toward Mathematics, study habits, and achievement motivation while a personal factor consists of communication skills and academic grade. These factors can cause positive expectations that can increase students’ academic performance in Mathematics if properly handled.

Conceptual Paradigm

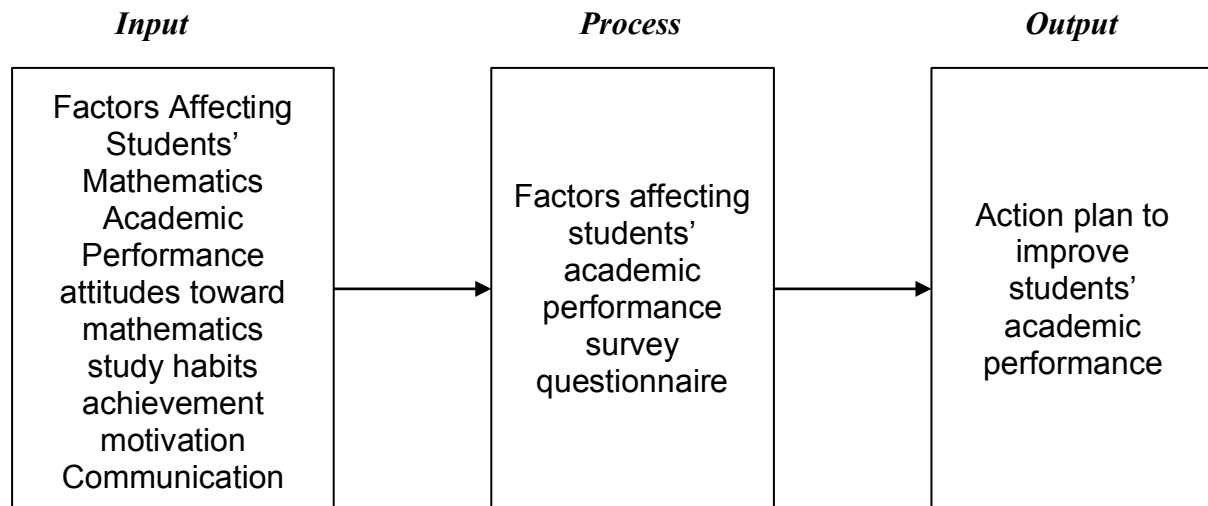


Figure 1: Research Paradigm on Factors Affecting Students’ Mathematics Academic Performance

Figure 1 shows the paradigm of the study. The researcher follows the input-process-output to attain the objectives of the research. The input consists of the factors affecting students’ performance which are student-related. The process includes the survey questionnaire as a tool to know the factors affecting student performance in Mathematics. The output entails the proposed action plan to improve students’ academic performance.

Statement of the Problem

This study aims to determine the Factors Affecting Students’ Mathematics Academic Performance in the IB MYP Programme: Basis for the Formulation of an Action Plan.

Specifically, this study sought to answer the following questions;

1. What are the factors that could affect the Mathematics academic performance of the IB MYP students;
 - 1.1 attitudes toward Mathematics,
 - 1.2 study habits,
 - 1.3 achievement motivation, and
 - 1.4 communication.

2. Is there a significant relationship between students' attitudes toward Mathematics, study habits, achievement motivation, and communication to students' academic performance?
3. Based on the findings of the study, what action plan can be formulated to improve students' academic performance?

Hypothesis

Ho: There is no significant relationship between students' attitudes toward Mathematics, study habits, achievement motivation, and communication to students' academic performance.

Scope, Delimitation, and Limitation of the Study

This research covered the analysis of data gathered from a questionnaire on factors affecting students' Mathematics academic performance in the IB MYP Programme Division. The respondents were Grade 6 students at Tamagawa Academy with a total of 52 students: 25 boys and 27 girls.

In this study, stakeholders such as parents, subject teachers, subject leaders, coordinators, and a head of the division were not included. Also, the study did not address environmental factors outlined in the social cognitive theory as a potential factor affecting students' academic performance.

The data collected were limited to responses from Grade 6 students in the IB MYP Programme Division of Tamagawa Academy.

Significance of the Study

The findings of this study on the factors affecting students' academic performance in Mathematics will help the researcher in developing an effective action plan to improve students' academic performance. Also, the result of this study will greatly benefit the school leaders, coordinators, teachers, and students. Moreover, the results will help stakeholders to better understand the factors affecting students' academic performance in the IB MYP Division. In addition, the findings will be useful in formulating intervention programs to improve student performance in Mathematics.

Literature Review

Mathematics has always been a very interesting subject to teach because it involves conceptual understanding and has a real-life application. The ability to use mathematical knowledge in familiar and unfamiliar situations is something that students need to practice and apply. Such applications can give students insights that school mathematics is practical and useful - insights that can motivate students to achieve good academic performance. According to Social Cognitive Theory of Bandura (Eggen & Kauchak, 2001) there are factors that affect students' academic performance. In various scholarly studies, the attitudes toward mathematics, study habits, achievement motivation, and communication skills are some factors that could affect students' academic performance.

Students' Attitudes Toward Mathematics

In the study of Hwang and Son (2021) and Capuno, et al. (2019), it was found that there is a positive relationship between students' attitudes towards mathematics and mathematics achievement. While, in the study of Ghimire (2021), it was found that there is a positive correlation between the attitudes of students towards success in mathematics with their performance in mathematics. Likewise, in the study of Landicho (2021), it was mentioned that students always want to get good grades in tests, quizzes, written works and performance tasks.

Students' Study Habits

In the study of Sakirundeen and Sanni (2017) and Capuno, et al. (2019), it was found that there is a significant relationship between time allocation for study and students' academic performance in mathematics. Similarly, Bibi (2020) states that there is a significant relationship between students' study habits and academic performance which means that students who are performing better in mathematics have better study habits than students who allocate small amounts of time. This result was supported by the study of Saranya (2024), which states that students who have regular study schedules tend to perform better academically than those who lack this habit. The study of Sasi and Anju (2020) reveals that there is a positive correlation between students' study habits and academic performance. It means that the increase in hours of study directly affects the increase of academic performance of students.

Students' Achievement Motivation

The study of Tremblay (2016) states that intrinsic/achievement motivation naturally leads to higher achievement in mathematics. Similarly, in the study of Manhas (2017) and Mastur (2020) state that there is a significant and positive correlation between achievement motivation and academic achievement. Therefore, it can be concluded that the higher achievement motivation students have in studying, the better academic performance will be.

Students' Communication Skills

The study of Thangadurai and Selvam (2017) states that the communication skills of higher secondary students is positively correlated with academic performance. This implies that good communication skills both oral and written will yield better academic performance. Similarly, the study conducted by Hidayati (2020) states that communication skills of the students can be improved by using the Project Based Learning Model. The model has a positive impact on students' interest to learn mathematics and it can contribute in achieving high academic performance.

Methodology

The study employed the descriptive survey in gathering the quantitative data and correlational method of research to determine the factors affecting students' Mathematics academic performance. The researcher considered the methods appropriate to use because "it determines the relationships among two or more variables and explores the implications for cause and effect" (Fraenkel et al., 2020, p.12). Best, et al. (1998) define descriptive research

as a “method of research which seeks to find answers to questions through the analysis of variables and their relations.”

Fifty-two students participated in this study consisting of 25 boys and 27 girls. A purposive sampling technique was used in selecting the participants in this study. A research-made questionnaire was used to collect data from the students; the questionnaire was made with the 5-point Likert scale of measurements. The instrument reliability was checked by using Cronbach’s Alpha which shows a 0.90 coefficient value.

Table 1: Reliability Statistics of the Questionnaire

Scales	Cronbach’s Alpha	Number of Items	Mean	SD	Interpretation
Attitudes toward Mathematics	0.68	5	4.04	0.52	Reliable
Study habits	0.67	5	3.77	0.32	Reliable
Achievement motivation	0.73	5	3.93	0.28	Reliable
Communication	0.81	5	3.62	0.10	Very Reliable
Overall	0.90	20	3.84	0.35	Very Reliable

The validity and reliability are the requirements of the instrument for an accurate result. The questionnaire reliability was checked by using Cronbach's Alpha (Internal Consistency Reliability Analysis) which the results were shown on Table 1.

Legend: Cronbach’s Alpha Value (Adhika, A., 2017)

<i>Cronbach’s Alpha Value</i>	<i>Level of Reliability</i>
0.0 - 0.20	Less Reliable
> 0.20 - 0.40	Rather Reliable
> 0.40 - 0.60	Quite Reliable
> 0.60 - 0.80	Reliable
> 0.80 - 1.00	Very Reliable

The researcher utilized a statistical tool to quantify the responses of the students by using weighted mean. A 5-point Likert scale is used in the responses of the students on factors affecting students’ Mathematics academic performance with verbal interpretation.

<i>Scale</i>	<i>Range Interval</i>	<i>Interpretation</i>
1	1.00 - 1.79	Strongly disagree
2	1.80 - 2.59	Disagree
3	2.60 - 3.39	Undecided
4	3.40 - 4.19	Agree
5	4.20 - 5.00	Strongly Agree

The following statistical instruments were used: weighted mean, ranking, standard deviation, and a Pearson correlation coefficient.

Weighted Mean, Standard Deviation, and Ranking were utilized to determine the factors affecting students' Mathematics Academic Performance along the following variables: attitudes toward Mathematics, study habits, achievement motivation, and communication.

Pearson Correlation Coefficient was used to investigate the interrelationships between independent variables (attitudes toward mathematics, study habits, achievement motivation, and communication) and a dependent variable (academic performance).

Results and Discussion

The purpose of this study was to find out the factors affecting students' Mathematics academic performance at Tamagawa Academy - IB MYP Division. There were 52 students participating in this study. A questionnaire was administered to the respondents for data collection and students' academic performance was checked through the students' academic Math results. Detailed findings were shown in the tables below.

Table 2: Responses of Students Regarding Attitudes Toward Mathematics

Statement	N	Mean	SD
I enjoy the challenges presented by Mathematics problems.	52	4.17	0.76
I listen actively to the lecture of my Math teacher	52	4.17	0.71
I participate actively in class discussions and clarify information that I do not understand.	52	3.81	0.74
I want to get good marks in the summative assessments.	52	4.73	0.60
I get frustrated when the discussion is interrupted by inattentive classmates.	52	3.33	1.00

Table 2 shows responses of students regarding their attitudes toward Mathematics. It can be noticed that the attitude of students towards Mathematics is to always get good marks in the summative assessments with a weighted mean of 4.73 and standard deviation of 0.60. Ranked 2.5, students enjoy the challenge of Mathematics problems and listen actively to the lecture of their Mathematics teacher with a weighted mean of 4.17 and standard deviations of 0.76 and 0.71 respectively. Next to it is students actively participating in class discussions and clarifying information that they do not understand with a weighted mean of 3.81 and standard deviation of 0.74. Lastly, students get frustrated when the discussion is interrupted by inattentive classmates with a weighted mean of 3.33 and standard deviation 1. These results were supported by the study of Landicho (2021), which mentioned that students always want to get good grades in tests, quizzes, written works and performance tasks.

Table 3: Responses of Students Regarding Study Habits

Statement	N	Mean	SD
I do my homework regularly.	52	4.27	0.77
I spend more time doing difficult Math problems.	52	3.58	0.96
I see to it that school clubs do not hamper my studies.	52	3.46	1.07
I study and prepare for formative and summative assessments.	52	3.90	1.07
I study the presentations uploaded on Math Google Classroom.	52	3.65	0.86

Table 3 shows the indicating factors on study habits among students. Among the determining factors on study habits, the first rank is to do my homework regularly with a weighted mean of 4.27 and standard deviation of 0.77. Second in the rank is to study and prepare for formative and summative assessments with a weighted mean of 3.90 and standard deviation of 1.07. Third in the rank is to study the presentations uploaded on Math Google Classroom with a weighted mean of 3.65 and standard deviation of 0.86. Fourth in the rank is to spend more time doing difficult Math problems with a weighted mean of 3.58 and standard deviation of 0.96. Fifth in rank is to see to it that school clubs do not hamper students' studies with a weighted mean of 3.46 and standard deviation of 1.07. These findings were supported by the study of Sakirudeen and Sanni (2017), which states that there is a significant relationship between time allocation for study and students' academic performance in mathematics. Likewise, the results were supported by the study of Saranya (2024), which states that good learning habits, such as regular study schedules, active participation in class, keeping up-to-date with course materials, and seeking help when needed, tend to perform better academically than those who lack these habits.

Table 4: Responses of Students Regarding Achievement Motivation

Statement	N	Mean	SD
I am confident I can understand the complex concepts taught in Mathematics class.	52	3.58	0.80
I believe that I will use the concepts learned in IB MYP Mathematics in my daily life.	52	3.71	0.80
I think that learning IB MYP Mathematics is important because it stimulates my thinking skills.	52	4.17	0.83
I am confident that I can get good marks in IB MYP Mathematics assessments if I study hard.	52	4.21	0.85
I think learning IB MYP Mathematics prepares me into a challenging IB Diploma Programme.	52	4.00	0.84

Table 4 shows the responses of students regarding achievement motivation. The results revealed that students are confident that students can get good marks in IB MYP Mathematics assessments if students study hard with a weighted mean of 4.21 and standard

deviation of 0.85; think that learning IB MYP Mathematics is important because it stimulates students thinking skills with a weighted mean of 4.17 and standard deviation of 0.83; think learning IB MYP Mathematics prepares students into a challenging IB Diploma programme with a weighted mean of 4.00 and standard deviation of 0.84; believe that students will use the concepts learned in IB MYP Mathematics in students daily life with a weighted mean of 3.71 and standard deviation of 0.80; and students are confident that they can understand the complex concepts taught in Mathematics class with a weighted mean of 3.58 and standard deviation of 0.80. These results were supported by the study of Tremblay (2016), which states that intrinsic/achievement motivation naturally leads to higher achievement in mathematics.

Table 5: Responses of Students Regarding Communication

Statement	N	Mean	SD
I can understand most of the terminologies in Mathematics.	52	3.63	1.01
I can read and interpret complex graphs and charts.	52	3.77	0.81
I can write and concise reports in Criteria C and D assessments.	52	3.56	0.78
I can communicate coherent mathematical lines of reasoning.	52	3.52	0.80
I can use appropriate mathematical language in both oral and written statements.	52	3.62	0.80

Table 5 shows responses of students regarding communication. The results revealed that students can read and interpret complex graphs and charts with a weighted mean of 3.77 and standard deviation of 0.81; can understand most of the terminologies in Mathematics with a weighted mean of 3.63 and standard deviation of 1.01; can use appropriate mathematical language in both oral and written statements with a weighted mean of 3.62 and standard deviation of 0.80; can write clear and concise reports in Criteria C and D assessments with a weighted mean of 3.56 and standard deviation of 0.78; and can communicate coherent mathematical lines of reasoning with a weighted mean of 3.52 and a standard deviation of 0.80. These results of the study were similar to the study conducted by Hidayati (2020), which states that communication skills of the students can be improved by using the Project Based Learning Model. The model has a positive impact on students' interest to learn mathematics and it can contribute in achieving high academic performance.

Table 6: Descriptive Statistics of The Variables Considered in the Study

Statistics	Variables				
	Attitudes Towards Mathematics	Study Habits	Achievement Motivation	Communication	Academic Performance
Mean	4.04	3.77	3.93	3.62	30.71
SD	0.52	0.32	0.28	0.10	6.11
Variance	6.44	9.69	8.07	10.01	36.56

Table 6 shows the descriptive statistics of the variables considered in the study. The means, variances, and standard deviations of the scores of students' attitudes towards Mathematics, study habits, achievement motivation, communication, and academic performance of the students were displayed.

Table 7: Correlation Between Attitudes Toward Mathematics and Academic Performance

		<i>Attitudes Towards Mathematics</i>	<i>Academic Performance</i>
<i>Attitudes Towards Mathematics</i>	Pearson Correlation	1	0.395
	Sig. (2-tailed)		.00
	N	52	52
<i>Academic Performance</i>	Pearson Correlation	0.395	1
	Sig. (2-tailed)	.00	
	N	52	52

Correlation is significant at the 0.05 level (2-tailed)

Table 7 shows the correlation between the attitudes toward mathematics and academic performance. The correlation coefficient between the attitudes of students toward mathematics with their academic performance is 0.395, which is significant at 0.05 level of significance. This refers to the fact that the variable attitudes toward mathematics and academic performance is positively correlated which suggests us to conclude that the students who have positive attitudes toward mathematics have comparatively better academic performance. This result was supported by the study of Hwang and Son (2021), which stated that there is a positive relationship between students' attitudes toward mathematics and mathematics achievement. The result implies that students with high academic achievement are more likely to believe that learning mathematics is empirical in daily life and enjoy challenges presented by mathematics. Likewise, the result from the study of Ghimire (2021) stated that there is a positive correlation between the attitudes of students towards success in mathematics with their performance in mathematics.

Table 8: Correlation Between Study Habits and Academic Performance

		<i>Study Habits</i>	<i>Academic Performance</i>
<i>Study Habits</i>	Pearson Correlation	1	0.326
	Sig. (2-tailed)		.00
	N	52	52
<i>Academic Performance</i>	Pearson Correlation	0.326	1
	Sig. (2-tailed)	.00	
	N	52	52

Correlation is significant at the 0.05 level (2-tailed)

Table 8 shows the correlation between the study habits and academic performance. The correlation coefficient between the study habits with their academic performance is 0.326, which is significant at 0.05 level of significance. This refers to the fact that the variable study habits and academic performance is positively correlated which suggest that the students who have good study habits have comparatively better academic performance. This result was supported by the study of Bibi (2020), which states that there is a significant relationship between students' study habits and academic performance. It means that students who are high achievers have better study habits than those who are low achievers. Likewise, the study of Sasi and Anju (2020) reveals that there is a positive correlation between students' study habits and academic performance. It means that the increase in hours of study directly affects the increase of academic performance of students.

Table 9: Correlation Between Achievement Motivation and Academic Performance

		<i>Achievement Motivation</i>	<i>Academic Performance</i>
<i>Achievement Motivation</i>	Pearson Correlation	1	0.446
	Sig. (2-tailed)		.00
	N	52	52
<i>Academic Performance</i>	Pearson Correlation	0.446	1
	Sig. (2-tailed)	.00	
	N	52	52

Correlation is significant at the 0.05 level (2-tailed)

Table 9 shows the correlation between the achievement motivation and academic performance. The correlation coefficient between the achievement motivation with their academic performance is 0.446, which is significant at 0.05 level of significance. This indicates that the variable achievement motivation and academic performance is positively correlated which suggest us to conclude that the students who have positive achievement motivation have comparatively higher academic performance. This result was supported by the study of Manhas (2017) and Mastur (2020), which states that there is a significant and positive correlation between achievement motivation and academic achievement. Therefore, it can be concluded that the higher achievement motivation students have in studying, the better academic performance will be.

Table 10: Correlation Between Communication and Academic Performance

		<i>Communication</i>	<i>Academic Performance</i>
<i>Communication</i>	Pearson Correlation	1	0.459
	Sig. (2-tailed)		.00
	N	52	52
<i>Academic Performance</i>	Pearson Correlation	0.459	1
	Sig. (2-tailed)	.00	
	N	52	52

Correlation is significant at the 0.05 level (2-tailed)

Table 10 shows the correlation between communication and academic performance. The correlation coefficient between communication with their academic performance is 0.459, which is significant at 0.05 level of significance. This indicates that the variable communication and academic performance is positively correlated which suggests us to conclude that the students who have better communication have comparatively higher academic performance. This result was supported by the study of Thangadurai and Selvam (2017), which states that the communication skills of higher secondary students is positively correlated with academic performance. This implies that good communication skills both oral and written will yield better academic performance in IB MYP.

Conclusions

With reference to the findings and discussions mentioned above, the following conclusions were derived: Students' attitudes towards mathematics, study habits, achievement motivation, and communication were positively correlated and significant in relation to academic performance. It can be concluded that students' attitudes towards mathematics is positively correlated to the academic performance of students which means that the attitudes the students hold towards mathematics clearly reflects their academic performance. Therefore, as a mathematics teacher it is important to develop a program that would improve students' attitudes towards mathematics that will result in better academic performance in mathematics among students. Students' study habits and academic performance is positively correlated which means that the increase in hours of study directly affects the increase of students' academic performance. Students' achievement motivation and academic performance is positively correlated; therefore, it can be concluded that the higher achievement motivation students have in studying, the better academic performance will be. Students' communication skills and academic performance is positively correlated which implies that good communication skills both oral and written will yield better academic performance in IB MYP.

Recommendations

There are various factors in-school that could influence the quality of academic performance of students. This study only focused on four factors that influence the students' academic performance - attitudes towards mathematics, study habits, achievement motivation, and communication. As educators our responsibility is to educate our students effectively so that they may be able to show quality academic performance. To be able to achieve this objective it is essential to understand some of the factors that influence students' academic performance.

In light of the findings and conclusions, the following recommendations are offered:

1. Intervention activities that will gain interest among students such as academic support programs for those students who struggle academically and the Math Day program to create an environment of camaraderie among students.
2. Leadership team and teachers should bear in mind that factors like attitudes toward mathematics, study habits, achievement motivation, and communication have significant importance on students' academic performance. By preparing some kind of experience like boot camp, conferences, and workshops it might help students.
3. Similar studies can be conducted to determine if there is an improvement on the student academic performance applying intervention activities.

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