Comparative Analysis of Mathematics Proficiency and Attitudes Toward Mathematics of Senior High School Student

Adonis Fulgar Cerbito

Dr. Carlos S. Lanting College, Philippines

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Abstract- There have been a number of studies investigating how attitudes such as confidence and motivation affect students and their academic achievement. This study assessed the attitudes towards Mathematics and proficiency in Mathematics of Senior High School Students across different strands. The respondents of the study were 868 grade 11 senior high students of Science, Technology, Engineering and Mathematics (STEM), Pre-baccalaureate Maritime (Maritime), Accountancy, Business and Management (ABM), Humanities and Social Sciences (HUMSS), and Technical Vocation and Livelihood (TVL) strands. It aimed to ascertain the selected SHS students' level of Mathematics proficiency and their attitudes towards Mathematics. The Attitudes' Toward Mathematics Inventory (ATMI) was used to measure and determine the students' attitudes in terms of value, enjoyment, motivation, and self-confidence. Mathematics proficiency was based on the core subject, General Mathematics, the content was functions and graph. The two variables were correlated across different strands. To gather the data an Attitude Towards Mathematics Inventory (ATMI) and a teacher-made test were used. ATMI scores indicated that they valued mathematics, but their scores for Self-Confidence, Enjoyment, and Motivation were somewhat negative in attitudes. As a whole, students' across strands showed a negative attitudes towards mathematics. The results indicated that there is a significant relationship between attitudes towards mathematics and proficiency in mathematics. These findings indicate that teacher educators should be aware of Senior High School students across different strands' attitudes and seek to improve them in order to positively influence students' proficiency in mathematics.

Index Terms- ATMI, Attitudes, Values, Proficiency in Mathematics, Mathematics

I. Introduction

Attitude as a concept is concerned with an individuals' way of thinking, acting and behaving. It has a very serious implication for the learner, the teacher, the immediate social group and the entire school system (Mensah, et Al, 2013). Attitudes may affect behaviour that influences what the learner selects from the environment, how he/she will react towards teachers, towards the material being used and towards other students. As Vygotsky (1978) argues that, learners thinking and problem-solving ability are learners that can be performed independently, learners that can be performed with assistance and learners that cannot be performed even with assistance.

Research has established the importance of attitudes towards Mathematics in achievement (Tapia & Marsh, 2005). For instance, Langat (2015), conducted a study in Kenya and found that most of the students had positive attitudes towards mathematics. Similarly, Peteros, et al (2019) concluded that students' attitudes towards mathematics have a more significant impact on affecting the students' academic achievement. In another study conducted by Simegn and Asfaw (2017) in Ethiopia involving grade 10 and 12 students. They established that in both grade levels, there is no significant difference between genders where shown in their attitudes toward mathematics, however, female students showed a greater decline in attitudes in terms of grade level. They concluded that the enhancement of students' positive attitude can boost students' performance in mathematics, in particular female students. In a more recent study, Capuno, Necesario, et al (2019) conducted in a public national high school in Mandaue City Division, Cebu, Philippines. Their study revealed that students had positive attitudes toward mathematics in terms of value and neutral attitude in self-confidence, enjoyment, and motivation in mathematics. The study also established that there is an overall negligible positive correlation between attitudes and academic performance in mathematics.

It is generally believed that student's attitude towards Mathematics as a subject determines their success in the said subject. In other words, favourable attitudes results to a good achievement in the study of Mathematic. Attitudes influence success and persistence in the study of Mathematics. Self-confidence is a good predictor of success in Mathematics. A students' constant failure in the study of Mathematics can make him/her believe that he can never do well and thus accepting defeat. On the other hand, successful experienced can make a student develop a positive attitude towards Mathematics. While such preliminary evidence from attitudinal research is informative, a little or none is known about grades 11 and 12 students because most of the local researches have been concerned primarily with k to 10 and college.

Senior high school curriculum is intended to prepare students to enter into college/university or to work in the industry or be an entrepreneur. Last June 2016, the first batch of students entered SHS and each of them to choose on strand to master, These include Science, Technology, Engineering and Mathematics

(STEM); Accountancy, Business and Management (ABM); Humanities and Social Sciences (HUMSS); General Academic Strand (GAS); and Technical Vocational Livelihood (TVL). There are 15 core subjects that all SHS students will take; one of these core subjects is General Mathematics. (Department of Education, 2012).

After teaching for two years as a part-time senior high school teacher, the biggest frustration that the researcher encountered as an educator is that senior high school students across different strands tend to have little interest in Mathematics and could hardly see its relevance in their lives. Despite every effort every Mathematics teachers do to make their classrooms interactive, applicable and discovery-based, students still find Mathematics a very difficult subject with their very being. Even some bright students saw no purpose in it and had no desire to dig deeper. Although mathematical skills are an essential part of adult life, many students entered senior high school without such skills. The purpose of the study was to determine the relationship between attitudes towards Mathematics of Dr. Carlos S. Lanting College Senior High School students and their proficiency in Mathematics. Specifically, the study answered the following questions:

1. What is the proficiency level in Mathematics of Senior High School (SHS) students from different strands?
2. Is there a significant difference in the Mathematics proficiency of SHS students when grouped according to strands?
3. What are the attitudes of SHS students towards the learning of Mathematics from different strands?
4. Is there a significant difference that exists in the attitudes toward the learning of Mathematics of the senior high school students when grouped according to strands?
5. Is there a significant relationship that exists between the students' attitudes towards the learning of Mathematics and proficiency in Mathematics?

The following null hypotheses were tested in the study:

Ho: There is no significant difference in the Mathematics proficiency of the SHS students when grouped according to strands.

Ho: There is no significant difference in the attitudes toward Mathematics of the SHS student when grouped according to strands.

Ho: There is no significant relationship between the attitude toward Mathematics in terms of value, enjoyment, motivation, & self-confidence and Mathematics proficiency of SHS students?

II. METHODS

The main purpose of this research is to investigate whether there is correlation between attitudes towards Mathematics and proficiency in Mathematics across different strand of grade 11 senior high school student of Dr. Carlos S. Lanting College. This study is a descriptive correlational method.

Based on the research questions that will mainly investigate the correlation between attitudes and proficiency, this research is classified into descriptive research with correlation method. This study used explanatory design since this study will just investigate in the extent to which two variables (or more) co-vary, that is where changes in one variable are reflected in changes in the other. The group of students who took part of this study are all enrolled grade 11 senior high school student across different strand offered in Dr. Carlos S. Lanting College for the first quarter of the first semester of the academic year 2018-19.

In this study, the researcher used purposive sampling technique to obtain the sample. The average age of these students is typically between 15 to 17 years old and this corresponds to age bracket entering senior high school in the K-12 program of the Department of Education. The questionnaires was distributed to all Mathematics teachers and administered to all morning sections and present during the administration of the survey, only 868 out of 1,057 or 82.12 percent of the total population.

The instruments used were Attitudes toward Mathematics Inventory and a Teacher-Made Test. The Attitudes toward Mathematics Inventory (ATMI) (Tapia & Marsh, 2004) consists of 40 questions that measure four factors affecting student attitude. The subscales were: self-confidence (15 items), value of Mathematics (10 items), enjoyment of Mathematics (10 items), and motivation (5 items). As cited by Kalder and Lesik (2011), the responses to the survey were measured on a 5 point liker scale: Strongly Agree (5), Agree (4), Neutral (3), Disagree (2) and Strongly Disagree (1) and coded as interval data such that a "1" represents more negative attitudes, whereas "5" represents a more positive attitude. This allowed for descriptive measures such as mean score to be determined for multiple questions that were used in 4 categories (Kelley, 1999). "Neutral" response was taken a negative attitude. According to Chimi and Russell (2009), the respondents are knowledgeable about the subject matter (in this case, the attitude toward mathematics) and has a basis upon to which to form a response, the respondent is not neutral on the matter, simply does not care about the subject of the study. The researcher used the teacher made test to measure the proficiency in Mathematics of the senior high school student- participants.

The data gathered from the first quarter teacher-made test and the ATMI as instruments was treated statistically. Primarily, the researcher utilized the software SPSS version 23 using the following certain statistics.

III. RESULTS

In this study, the proficiency level aspect was established by determining the mean score of the senior high school strands: STEM, ABM, MARITIME, HUMSS and TVL. The mean score values were interpreted based on DepEd Order No. 73, s.2012 "Guidelines on the Assessment and Rating of Learning Outcomes Under the K to 12 Basic Education Curriculum".

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Table 1: Proficiency Level in Mathematics across Different Strands

Strands	N	Mean	SD	Proficiency Level
STEM	146	29.33	4.32	Advance
MARITIME	67	23.18	6.50	Proficient
ABM	268	26.54	5.71	Proficient
HUMSS	221	24.48	6.76	Proficient
TVL	166	22.05	6.31	Proficient
OVER-ALL	**868**	**25.37**	**6.43**	**Proficient**

Legend:	***Average Score***	***Descriptive Rating***
	30.50 – 35.00	*Advance*
	26.50 – 30.49	*Proficient*
	23.50 – 26.49	*Approaching proficiency*
	20.50 – 23.49	*Developing*
	0 – 20.49	*Beginning*

As indicated in Table 1, the overall mean of 25.37 with standard deviation of 6.43 indicated that the senior high school students of Dr. Carlos Lanting College were of proficient level in Mathematics and the students of STEM strand had the highest mean score (M=29.33, SD=4.32), indicated an advance proficiency level in Mathematics, while students from ABM (M=26.54, SD=5.71), HUMSS (M=24.48, SD=6.76), MARITIME (M=23.18, SD=6.50) and TVL (M=22.05, SD=6.32) strand indicated a proficient level in Mathematics.

To examine whether there exist any differences in the proficiency level in Mathematics across senior high school strands, one way ANOVA was conducted.

Table 2: Test of Difference in the Respondents' Proficiency in Mathematics Across different Strands

Source of Variation	SS	df	MS	F-value	p-value
Between Groups	4988.24	4	1247.06		
Within Groups	30801.26	863	35.69	34.941	0.000*
Total	35789.50	867			

*Significant at p-value of <0.05-0.01; very significant at p-value of < 0.01.

Table 3: Post Hoc Test Results

(Senior High School Strand)		Mean Difference	Std. Error	Sig.
STEM vs.	MARITIME	6.150*	.882	.000
	ABM	2.784*	.615	.000
	HUMSS	4.854*	.637	.000
	TVL	7.281*	.678	.000
Prebacc MARITIME	ABM	-3.366*	.816	.002
vs.	HUMSS	-1.296	.833	.659
	TVL	1.131	.865	.789
ABM vs.	HUMSS	2.070*	.543	.005
	TVL	4.497*	.543	.000
HUMSS vs.	TVL	2.427*	.614	.004

*Significant at p-value of <0.05-0.01; very significant at p-value of < 0.01.

The results in Table 2 show a very significant differences on the proficiency level of the students across SHS strands F(4, 683)=34.941, p-value=0.000. Post hoc analysis using the Scheffe post hoc criterion for significance showed in Table 3 that STEM vs. MARITIME, STEM vs. ABM, STEM vs. HUMSS and STEM vs. TVL are very significant proficiency level at p-value<0.01 indicating that the respondents' of STEM (M=29.33, SD=4.32) strand where proficiently advance in Mathematics than ABM (M=26.54, SD=5.71), HUMSS (M=24.48, SD=6.76), MARITIME (M=23.18, SD=6.50) and TVL (M=22.05, SD=6.32) strands.

It can also be noted in Table 3, the post hoc test that ABM vs. Maritime, ABM vs. HUMSS, and ABM vs. TVL are very significant at p-value<0.01. This means that ABM (M=26.54,

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SD=5.71) is more proficient in Mathematics than HUMSS (M=24.48, SD=6.76), MARITIME (M=23.18, SD=6.50) and TVL (M=22.05, SD=6.32) strands.

On the other hand, MARITIME vs. HUMSS and MARITIME vs. TVL had no significant difference in their proficiency level at p-value>0.05

The Table 4 show the respondents' descriptive statistics for attitudes towards Mathematics in terms of self-confidence or "a belief that one's self is good or bad in Mathematics", value or "a belief that Mathematics is useful or useless", enjoyment or "liking or disliking of Mathematics" and motivation or "a tendency to engage or avoid Mathematics." It shows that the mean score of STEM (M=3.08) is greater than the mean score of MARITIME (M=3.06), ABM (M=3.16), HUMSS (M=2.89), and TVL (M=2.95) but across strands the means scores are less than 3.50.

Table 4: **Descriptive of Attitudes of the Respondents toward Mathematics across Different Strands**

	STEM	MARITIME	ABM	HUMSS	TVL	OVER-ALL
Self Confidence	3.08	3.06	3.16	2.89	2.95	3.03
Value	4.11	3.43	3.93	3.62	3.73	3.80
Enjoyment	3.37	3.10	3.33	2.99	3.19	3.20
Motivation	3.34	3.20	3.32	3.02	3.21	3.22
OVER-ALL ATTITUDE	3.44	3.18	3.41	3.11	3.24	3.29

Legend: Mean Scale Description
1.0-3.49 Negative attitude
3.5-5.00 Positive attitude

Table 4 also shows the weighted mean of the respondents' attitudes towards Mathematics as to value. It can be note from table 6 that across strands, STEM (M=4.12) got the highest rank, ABM (M=3.93) ranked second, next are TVL (M=3.73) and HUMSS (M=3.62). Which implies that students' from STEM, ABM, TVL, and HUMSS strands had a positive attitude towards Mathematics and highly believes in the usefulness of Mathematics. Prebacc-MARITIME (M=3.43) strand got the lowest rank, implying that although technically a part of the STEM strand, it is unlikely that the students' from these strand believe that Mathematics is useless.

Table 4 reveals that the average weighted mean across strands are below the required average of 3.50. STEM (M=3.37), ABM (M=3.33), next is TVL (M=3.19), Prebacc-MARITIME (M=3.10) and HUMSS (M=2.99). Implies that students across strands, including STEM, disliking or not enjoyed doing Mathematics.

As seen in table 4, the average weighted mean of STEM (M=3.34), ABM (M=3.32), TVL (M=3.21), Prebacc-MARITIME (M=3.20), and HUMSS (M=3.02) are all below the required average of 3.50. Implies a negative attitude towards Mathematics, indicating that students' across strands were not motivated and willing to engage themselves in doing Mathematics.

Generally, the students have a negative attitudes towards Mathematics as evidenced by the over-all average weighted mean of 3.29. Among the attitudes, the students were found to have a positive attitude in the value of Mathematics (M=3.80) but were negative in all other dimensions of attitudes, self-confidence (M=3.03), enjoyment (M=3.20) and motivation (M=3.22).

The following table's shows the data related to test of significant difference on the attitudes towards Mathematics across different strands in terms of the following variables: self-confidence, value, enjoyment, motivation, and overall attitudes towards mathematics. As presented in table 5, there was a significant difference in the attitudes of respondents in Mathematics as to self-confidence across different strands, F(4,863)=7.452, p-value=0.00.

Table 5: Test of Difference in the Attitudes of Respondents in Mathematics As to Self-confidence across different strands

Source of Variation	SS	df	MS	F	p-value
Between Groups	9.921	4	2.480		
Within Groups	287.225	863	.333	7.452	0.000
Total	297.146	867			

*Significant at p-value of <0.05-0.01; very significant at p-value of < 0.01

Table 6: **Post Hoc Test Results**

(Senior High School Strand)		Mean Difference	Std. Error	p-value
STEM vs.	MARITIME	.02220	.08513	.999
	ABM	-.07631	.05934	.799
	HUMSS	.18760	.06153	.055

	TVL	.12931	.06546	.420
MARITIME vs.	ABM	-.09851	.07880	.815
	HUMSS	.16540	.08046	.377
	TVL	.10711	.08350	.801
ABM vs.	HUMSS	.26391*	.05242	.000
	TVL	.20562*	.05698	.012
HUMSS vs.	TVL	-.05829	.05925	.915

*Significant at p-value of <0.05-0.01; very significant at p-value of < 0.01

It can be noted in the post hoc analyses using Scheffe post hoc criterion for significance, presented in table 6, that ABM vs. HUMSS and ABM vs. TVL has a significant difference across the five strands, with a computed p-values of 0.000 and 0.012, respectively. This means that the respondents from ABM strand has self-confidence in Mathematics between the respondents from HUMSS and TVL Strand.

As presented in table 7, there was a significant difference in the attitudes of respondents in Mathematics on to value across different strands, F(4,863)=18.592,p-value=0.00, the null hypothesis is rejected.

Table 7: Test of Difference in the Attitudes of Respondents in Mathematics As to Value across different strands

Source of Variation	SS	df	MS	F-value	p-value
Between Groups	35.262	4	8.816		
Within Groups	409.197	863	.474	18.592	0.00
Total	444.459	867			

*Significant at p-value of <0.05-0.01; very significant at p-value of < 0.01

Table 8: Post Hoc Test Results

(Senior High School Strand)		Mean Difference	Std. Error	p-value
STEM vs.	MARITIME	.67607*	.10161	.000
	ABM	.18167	.07083	.161
	HUMSS	.48854*	.07344	.000
	TVL	.37999*	.07813	.000
MARITIME vs.	ABM	-.49440*	.09405	.000
	HUMSS	-.18753	.09603	.432
	TVL	-.29608	.09967	.067
ABM vs.	HUMSS	.30688*	.06257	.000
	TVL	0.19832	.06801	.076
HUMSS vs.	TVL	-.10855	.07072	.671

*Significant at p-value of <0.05-0.01; very significant at p-value of < 0.01

STEM. It can be noted, in table 8, in the post hoc analysis using the Scheffe post hoc criterion for significance that STEM vs. MARITIME, STEM vs. HUMSS and STEM vs. TVL has a significant difference across the five strands. STEM vs. Maritime, HUMSS, and TVL had a mean difference of 0.67607, 0.48854, and 0.37999, respectively, thus the null hypothesis is rejected. This means that the respondents from the STEM strand value Mathematics than the respondents of the MARITIME, HUMSS and TVL strands.

ABM. In can also be noted in the post hoc test, as presented in table 8, that ABM vs. MARITIME and ABM vs. HUMSS has a significant differences among other strand. With a computed p-value less than 0.05 for ABM (p-value=0.000) and vs. MARITME (p-value=0.000) and for ABM vs. HUMSS (p-value=0.00). This means that the respondents from ABM strand value Mathematics than the respondents from MARITIME and HUMSS.

In addition, STEM vs. ABM has no significant in the five strands p-value=0.161, the null hypothesis is not rejected.

It can be gleaned in table 9 that there is a significant difference in the attitudes of respondents in Mathematics on to enjoyment across different strands. At significant level of 0.05 and F(4,863)=12.174, p-value=0.000, the null hypothesis is rejected.

Table 9: Test of Difference in the Attitudes of Respondents in Mathematics As to Enjoyment across different Strands

Source of Variation	SS	df	MS	F-value	p-value
Between Groups	18.921	4	4.730		
Within Groups	335.327	863	0.389	12.174	0.000
Total	354.248	867			

*Significant at p-value of <0.05-0.01; very significant at p-value of < 0.01

Table 10: Post Hoc Test Results

(Senior High School Strand)		Mean Difference	Std. Error	Sig.
STEM vs.	MARITIME	.2678	.09198	.077
	ABM	.0406	.06412	.982
	HUMSS	.3782*	.06648	.000
	TVL	.1811	.07073	.162
MARITIME vs.	ABM	-.2272	.08514	.131
	HUMSS	.1104	.08693	.806
	TVL	-.0867	.09022	.921
ABM vs.	HUMSS	.3377*	.05664	.000
	TVL	.1405	.06157	.268
HUMSS vs.	TVL	-.1972	.06402	.051

*Significant at p-value of <0.05-0.01; very significant at p-value of < 0.01

Table 10 shows the post hoc analyses using the Scheffe post hoc criterion for significance.

STEM. It can be noted in the post hoc test that STEM vs. HUMSS has a significant difference across the five strands, with a mean difference of 0.3782 and a p-value=0.00, the null hypothesis is rejected. This means that the respondents from STEM strand has enjoyed Mathematics between the respondents from HUMSS Strand.

ABM. Also, it can be noted that ABM vs. HUMSS has a significant difference across five strands with a mean difference of 0.3377 and a p-value=0.000. This means that the respondents from STEM and ABM strand has enjoyed Mathematics between the respondents from HUMSS Strand.

As presented in table 11, there was a significant difference in the attitudes of respondents in Mathematics on to motivation across different strands. At significant level of 0.05 and F(4,863)=10.190, p-value=0.000, the null hypothesis is rejected.

Table 11: Test of Difference in the Attitudes of Respondents in Mathematics as to Motivation Across different Strands

Source of Variation	SS	df	MS	F-value	p-value
Between Groups	13.838	4	3.460		
Within Groups	292.983	863	.339	10.190	0.000
Total	306.821	867			

*Significant at p-value of <0.05-0.01; very significant at p-value of < 0.01

Table 12: Post Hoc Test Results

(Senior High School Strand)		Mean Difference	Std. Error	P-value
STEM vs.	MARITIME	.1427	.0860	.600
	ABM	.0166	.0599	.999
	HUMSS	.3198*	.0621	.000
	TVL	.1301	.0661	.424
MARITIME vs.	ABM	-.1261	.0796	.643
	HUMSS	.1771	.0813	.315
	TVL	-.0126	.0843	1.000

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ABM vs.	HUMSS	.3032*	.0529	.000
	TVL	.1135	.0575	.422
HUMSS vs.	TVL	-.1897*	.0598	.040

*Significant at p-value of <0.05-0.01; very significant at p-value of < 0.01

STEM. It can be noted in the post hoc test, as indicated in table12, that STEM vs. HUMSS has a significant difference with a mean difference of 0.3198 and a p-value=0.00, the null hypothesis is rejected. This means that the respondents from STEM strand has more enjoyment in Mathematics between the respondents from HUMSS Strand.

ABM. It can be noted that ABM vs. HUMSS has a significant difference across five strands with a mean difference of 0.3032 and a p-value=0.000. This means that the respondents from ABM strand has more enjoyment in Mathematics between the respondents from HUMSS Strand.

HUMSS. HUMSS vs. TVL has a negative significant difference across five strands since the mean difference is -0.1897 with a p-value=0.040. This means that the respondents from TVL strands are motivated in Mathematics than the respondents of the HUMSS strand.

As presented in table 13, there is a significant difference in the over-all attitudes of respondents in Mathematics across different strands. At significant level of 0.05 and F(4,863)=16.246, p-value-0.000, the null hypothesis is rejected.

Table 13: Test of Difference in the Over-all Attitudes of Respondents in Mathematics across different Strands

Source of Variation	SS	df	MS	F-value	p-value
Between Groups	15.475	4	3.869		
Within Groups	205.510	863	.238	16.246	0.000
Total	220.985	867			

*Significant at p-value of <0.05-0.01; very significant at p-value of < 0.01

Table 14: Post Hoc Test Results

(Senior High School Strand)		Mean Difference	Std. Error	Sig.
STEM vs.	MARITIME	.2621*	.0720	.010
	ABM	.0290	.0502	.987
	HUMSS	.3270*	.0520	.000
	TVL	.2050*	.0554	.009
MARITIME vs.	ABM	-.2331*	.0667	.016
	HUMSS	.0649	.0681	.923
	TVL	-.0571	.0706	.957
ABM vs.	HUMSS	.2980*	.0443	.000
	TVL	.1760*	.0482	.010
HUMSS vs.	TVL	-.1220	.0501	.206

*Significant at p-value of <0.05-0.01; very significant at p-value of < 0.01

STEM. It can be noted in the post hoc test that STEM vs. MARITIME, STEM vs. HUMSS and STEM vs. TVL has a significant difference across the five strands. With a mean difference of 0.2621 (p-value=0.010) for STEM vs. Maritime, 0.3270 (p-value=0.000) for STEM vs. HUMSS and 0.2050 (p-value=0.009) for STEM vs. TVL, the null hypothesis is rejected. This means that the respondents from the STEM strand has more positive attitude in Mathematics than the respondents of the MARITIME, HUMSS and TVL strands.

ABM. In can also be noted in the post hoc test that ABM vs. MARITIME, ABM vs. HUMSS, and ABM vs. TVL has a significant differences among other strand. With a new tabular value of 9.52 that is less than the computed values of 12.23 for ABM vs. MARITME, 45.17 for ABM vs. HUMSS, and 13.33 for ABM vs. TVL. This means that the respondents from ABM strand value more Mathematics than the respondents from MARITIME and HUMSS.

In addition, STEM vs. ABM has no significant difference at p-value>0.05. This means that respondents from STEM and ABM strands possess positive attitude in Mathematics.

Pearson Product Moment correlation was used to examine the inter-correlations between self-confidence, value, enjoyment, motivation, and proficiency in Mathematics. These relations implied that those independent variables had significant correlation with other dependent variables as well.

Table 15: **Test of Significant Relationship between the Respondents' Attitudes toward Mathematics and Mathematics Proficiency**

	1	2	3	4	5	6
Score (1)	1					
Self-confidence (2)	.169**	1				
Value (3)	.173**	.276**	1			
Enjoyment (4)	.151**	.680**	.495**	1		
Motivation (5)	.082*	.521**	.493**	.659**	1	
Overall Attitude (6)	.195**	.825**	.704**	.885**	.757**	1

***. Correlation is significant at the 0.01 level (2-tailed).*

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

Table 15 reveals that the proficiency level in Mathematics and the attitude toward Mathematics of students are significantly related in the case of all strands and in over-all computations. The null hypothesis therefore is rejected. Over-all attitude towards Mathematics has shown statistically significant relation with Mathematics proficiency (r=0.195).

Table 15 also describe the inter correlation between the subscales of ATMs and proficiency in Mathematics. As shows there were inter-correlation between the independent and the dependent variable. Self-confidence, value, enjoyment and motivation has shown statistically significant relation with mathematics proficiency (r=0.169, r=0173, r=0.151, and r=0.082, respectively). In indicates that the student's self-confidence, value, enjoyment, and motivation increases, their proficiency in Mathematics increases and vice versa. In addition, there were a significant positive inter-correlation between self-confidence, value, enjoyment, and motivation. This indicates that as self-confidence increases, value of mathematics, enjoyment of Mathematics and motivation increases (r=0.276, r=0.680, r=0.521) and vice versa. This also indicates that students who enjoy solving Mathematics problems had more self-confident. Also, there is an increase in the value of mathematics onto enjoyment (r=0.495) and motivation (r=0.493) in Mathematics and vice versa.

The contribution of the independent variables to the prediction of proficiency in Mathematics can be seen in the following tables using Regression analysis.

As revealed in Table16, the predictor variables Motivation, Senior High School Strand, Value of Mathematics, Self-confidence, and Enjoyment for Mathematics all together contributed for the variation of students' Mathematics score by 13.2%. it implies that 132 percent proportion of proficiency in Mathematics variance accounted for the independent variables. The remaining proportion could not be known in this study. The adjusted R-squared which represents the unbiased estimate of R-squared was 0.127. It indicated that there were overall relationships between predictors (Motivation, Senior High School Strand, Value of Mathematics, Self-confidence, and Enjoyment for Mathematics) and the outcome variable (proficiency in Mathematics. This proportion was statistically significant, F(5,862)=26.267, p-value<0.01.

Table 16: Results of Regression Analysis

	Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**	**R^2**	**Adj R^2**
Regression	4731.97	5	946.39	26.267	.000[b]	0.132	0.127
Residual	31057.53	862	36.03				
Total	35789.50	867					

a. Dependent Variable: Score in General Mathematics 1st Quarter Examination

b. Predictors: (Constant), Motivation, Senior High School Strand, Value of Mathematics, Self-confidence, Enjoyment for Mathematics

Table 17: Summary of Multiple Regression

	Regression Coefficient B	**Std. Error**	**Beta Coefficient**	**t**	**p-value**
(Constant)	23.775	1.580		15.045	.000
SHS Strand	-1.418	.158	-.290	-8.986	.000
Self-confidence	1.527	.484	.139	3.154	.002
Value	1.149	.344	.128	3.340	.001
Enjoyment	.242	.521	.024	.464	.643
Motivation	-1.121	.478	-.104	-2.347	.019

a. Dependent Variable: Score in General Mathematics 1st Quarter Examination

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As can be seen in Table 17, in the summary of multiple regression analysis we can observe statistically significant relation between the predictor (Motivation, Senior High School Strand, Value of Mathematics, Self-confidence, Enjoyment for Mathematics) and the outcome variable (proficiency in Mathematics). For instance, t-test showed in the multiple regression analysis as there was statistically significant relation between SHS strand and proficiency in Mathematics, t=-8.986, p-value<0.05; self-confidence and proficiency in Mathematics, t=1.527, p-value<0.05; value of Mathematics and proficiency in Mathematics, t=1.149, p-value<0.05; and motivation and proficiency in Mathematics, t=-1.121, p-value<0.05. On the other hand, there was no statistically significant relation between enjoyment and proficiency in Mathematics, t=0.242, p-value>0.05. In general, self-confidence in Mathematics had highly dominant and very influential for the variation of the students' proficiency in Mathematics among other variables.

IV. ANALYSIS

1. *What is the proficiency level in Mathematics proficiency of SHS across different strands?*

The overall mean indicated that the senior high school students of Dr. Carlos Lanting College were of proficient level in Mathematics.

Considering the mean score, students of STEM strand had the highest mean score, indicated an advance proficiency level in Mathematics, while students from ABM, HUMSS, MARITIME and TVL strand indicated a proficient level in Mathematics. In terms of standard deviation, STEM students are more homogenous than the other groups while HUMSS appeared to be the most heterogeneous group as their scores were varied indicating varied Mathematics abilities.

2. *Is there a significant difference among proficiencies in Mathematics of SHS across different strands?*

The results exhibit a differences in the proficiency level in Mathematics across senior high school strand, namely: STEM, ABM, MARITIME, HUMSS, and TVL. As shown in the results, it was expected that students from STEM strand are proficiently advance in mathematics compared to the other groups. This was promising results since STEM students will be taking engineering courses in college where there are many Mathematics subject. Similarly, ABM strand was more proficient in Mathematics than HUMSS, MARITIME, and TVL. On the other hand MARITIME vs. HUMSS and MARITME vs. TVL exhibit almost the same proficiency in Mathematics.

3. *What are the attitudes of senior high school students towards the learning of Mathematics from different strands?*

Generally, the students have a negative attitudes towards Mathematics as evidenced by the over-all average weighted mean of 3.29 with the STEM getting the highest average weighted mean and HUMSS obtaining the lowest. This implies need to develop positives attitudes towards the subject if the teachers will help them by exposing them to the learning of mathematics in an enjoyable manner.

Among the attitudes, the students were found to have a positive attitude in the value of Mathematics but were negative in all other dimensions of attitudes. They got the lowest mean in self-confidence in Mathematics indicating that some students still feel anxiety in understanding when in Mathematics class.

This supports the study of Capuno, Necesario, et al (2019) conducted in a public national high school in Mandaue City Division, Cebu, Philippines. Their study revealed that students had positive attitudes toward mathematics in terms of value and neutral attitude in self-confidence, enjoyment, and motivation in mathematics.

4. *Is there a significant difference that exists in the attitudes toward the learning of Mathematics of the senior high school across different strands?*

The results revealed that the attitudes towards Mathematics in terms of value of STEM strand is significantly more positive in attitude across all strand. The respondents from STEM strand had more positive attitude toward mathematics across different strand. This finding supports the major principle of expectancy-value theory, which states that learners with high expectancy for success and valuing of academic task towards learning will more likely show positive achievement (Wigfield et. al, 2016). This result is supported by Fisher et. al (2013) who found out that there was a significant effect for major across each of the four subscale of the ATMI, with STEM majors having a significantly more positive attitude toward Mathematics than non-STEM majors. STEM strands believe that they are capable of achieving proficiency in Mathematics and motivated, enjoyment and value Mathematics. Similarly, ABM strand is significantly more positive in attitude compared to MARITME, HUMSS, and TVL strand.

In addition, STEM and ABM strand has no significant difference of their attitudes toward Mathematics in terms of self-confidence, value, enjoyment and motivation. This means that the respondents from STEM and ABM strands possesses the same attitudes toward the subject Mathematics. This results is supported that STEM strand help develop ability to evaluate and formulate solution through the application and integration of mathematical concepts as it prepares to pursue college degrees leading them to become future mathematicians, scientists, technological analysts and experts, and programmers and the like. Also, the result is supported that Accountancy, Business and Management (ABM) strand trains students to think logically and scientifically accounted with accounting principles in order to prepare them to pursue college degrees as future accountants.

5. *Is there a significant relationship that exists between the students' attitudes towards the learning of Mathematics and proficiency in Mathematics?*

Pearson Product Moment correlation was used to examine the inter-correlations between self-confidence, value, enjoyment, motivation, and proficiency in Mathematics. These relations implied that those independent variables had significant correlation with other dependent variables as well.

To determine the overall relationship of the independent variables and proficiency in Mathematics, a multiple regression was used. The results of the multiple regression analysis indicated when proficiency in Mathematics was regressed on all the independent variable (strand, self-confidence, value, enjoyment, and motivation), the multiple coefficient of determination was 13.2%.

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The results suggest that the independent variables (strand, self-confidence, value, enjoyment, and motivation), when combined, have a significant relationship with the students' proficiency in Mathematics.

It appears that when students have good attitudes towards Mathematics they likely to become proficient in Mathematics. Similarly, poor attitudes towards Mathematics may result to poor proficiency in the said subject.

This result is supported by Tudyet. al (2014) who found out the attitude towards Mathematics manifested significant influence to academic performance. Students who shows positive attitude towards the Mathematics tend to perform well. Hence, performance in Mathematics can be improved by developing a positive attitude towards the subject.

V. DISCUSSIONS

Conclusions:

1. The respondents have the ability to understand Mathematics with the STEM strand excelling in the said subject.
2. Students from different strands possess different mathematical abilities.
3. Generally, students have negative attitudes toward Mathematics; however, they have a positive attitude in terms of value.
4. Students from different stands possess varied attitudes toward Mathematics.
5. Students' attitude toward Mathematics influences their proficiency in the said subject.

Recommendations:

1. There is a substantially heterogeneity in the proficiency level in Mathematics. It is not only important for a teacher to have content knowledge, but also develop awareness of how individual students learn. Teachers must make appropriate choices with regard to pedagogy to provide learning opportunities such that students are able to construct their Mathematical Knowledge.
2. Students found to be not so good in Mathematics may be advised to attend remedial classes in Mathematics that will be offered by the school and the different student organizations. They should also be given more attention by the teachers when discussing the lesson in their respective classes to help them improve their performance in Mathematics.
3. Positive attitudes toward learning and achievement in Mathematics are necessary ingredients in secondary school. It is important and imperative for all students across different strands (STEM, ABM, HUMSS, MARITIME and TVL) to develop their positive attitude towards the subject and make Mathematics more enjoyable, motivated for, and self – confident in learning.
4. Researches shows that there is a successive relationship among attitudes, learning, and achievement in Mathematics. The negative relationship between the respondents attitudes towards Mathematics and proficiency level in math demonstrate that attitudes plays a significant role in students learning across strands. A positive relationship should be established early enough in a students' Mathematics education. Mathematics teachers should wisely utilize available learning resources to reinforce and neutralize negative attitudes toward learning and performing in Mathematics. Unfavorable attitudes should be curtailed professionally and early enough before students completely give up in learning and/or being proficient in Mathematics.
5. A replication of this study in another research environment may be conducted.
   a. The study was carried out in one school only. Similar studies could be carried out in other parts of the country to gather adequate information on the subject to be able to generalize.
   b. This study focused on the students' attitudes toward learning of Mathematics and achievement in Mathematics.

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AUTHORS

First Author – Adonis Fulgar Cerbito, Dr. Carlos S. Lanting College, Philippines, adonisfcerbito@yahoo.com