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Increasing Students' Interest in Mathematics: A Teaching Quality That Connects Mathematics to Real-Life Problems

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Abstract- Students' enthusiasm in mathematics is largely influenced by their math professors' capacity to relate the subject to real-world issues. In order to increase students' interest in mathematics, the current study aims to determine what aspects they would want to see their math teachers enhance. Using a random sample technique, the study chose ten (10) high schools and 1,263 students from different subject areas to answer a structured questionnaire about factors that influence students' interest in mathematics. The study examined the impact of teachers' capacity to relate mathematics to real-world issues on students' interest in the subject using principal component analysis and multiple linear regression analysis. According to the study, 57.4% of students' interest in mathematics is predicted by teachers' capacity to relate mathematics to real-world problems, which may be divided into two main components ($p<0.001$). The components utilized to connect mathematics to real-world problems were evaluated and their relative importance index was calculated. According to the study, when math teachers set aside quality time for pupils to do class exercises, they would be more engaged in the subject. The study also discovered that students' interest in mathematics is largely influenced by the teacher's capacity to connect mathematics to other topic areas. According to the study's findings, teachers' capacity to relate mathematics to real-world issues is crucial to the growth of students' interest in the subject.

Index Terms- Real life Problem, Eigen Values, Multiple Linear regression Analysis, Principal component Analysis.

I. INTRODUCTION

Students find mathematics more engaging when teachers can relate mathematical ideas to real-world issues and situations and make connections between the many types of mathematical knowledge. At all educational levels, this method of teaching mathematics is seen as essential to its instruction and learning. According to the guiding principles and criteria for mathematics education, students should be able to 1) recognize and apply the connections between mathematical concepts.2) Recognize how mathematical concepts build upon and link to form a cohesive whole; and 3) Acknowledge and use mathematics in non-mathematical contexts (Casey, Kersh, & Young, 2004; Fraivillig, Murphy, & Fuson, 1999).The connected mathematics project is a well-known mathematics curriculum in North America that emphasizes the importance of connecting mathematics and is founded on standards and concepts. This is done to help students understand the relevance of mathematics in relation to other topics and to difficulties in other fields (Ginsburg & Amit, 2008; Winheller, Hattie, & Brown, 2013).Effective mathematics teaching, for example, is required in Australia to assist students in making the connection between mathematics and other academic fields and the mathematical information they have acquired. They have concluded that a learner must be able to see the connections between mathematics and other types of knowledge as well as between mathematics and their personal experiences in order to become proficient.

There is disagreement among nations over the best way to connect mathematics to other topics and real-world issues, as well as the approach that should be used to accomplish this. While some countries have implemented reform-oriented curricula that advocate for the use of discussion-oriented and problem-solving pedagogies, others disagree with this approach (Ball, 1993; Intaros, Inprasitha, & Srisawadi, 2014).

When it comes to teaching mathematics, math professors have used a variety of approaches. This involves the teachers' capacity to relate mathematics to real-world issues; this approach has been used in mathematics education across a range of disciplines. Linking mathematics to other subjects can take many forms. One such example is the way a math teacher asks questions, which can increase students' engagement in math classes and aid in their acquisition of mathematical knowledge (Fredricks et al., 2016; Lubienski, 2002). Different student classes have been found to acquire

mathematical information in different ways. While working-class pupils struggle to finish mathematical assignments, their non-working counterparts find them simple.

II. MATHEMATICS AND REAL-LIFE PROBLEM CONNECTEDNESS

The literature that has helped to broaden the corpus of information regarding teachers' capacity to relate mathematics to real-world issues is reviewed in this section of the study.

There was a degree of disconnect between the students' understanding of mathematics and its application to real-world issues, according to the study by Palm (2008). This discrepancy could make it difficult for students to understand mathematics. Numerous authors' studies (Rakes, Valentine, McGatha, & Ronau, 2010) have made claims for bettering mathematics instruction and learning and further establishing a link between students' mathematical difficulties and their incapacity to answer problems. According to Rakes et al. (2010), students' poor performance and failure have been linked to the traditional teaching methods used for education, which have been blamed for the difficulties in relating mathematics to real-life problems.

Since knowledge of earlier mathematical concepts helps students acquire and master new concepts, it is crucial that students study mathematics for comprehension and understanding. According to the study by Ketterlin-Geller and Chard (2011), students' motivation and performance will increase when they are provided with a solid conceptual basis through connectivity for efficient mathematical concept learning. According to Greer (2008) and Sciarra (2010), students who have trouble understanding mathematical concepts may be doing so because they do not relate mathematical topics to real-world issues. The study also reveals that since there is a correlation between past and future mathematical accomplishments, students' inability to understand can further hinder and cause them to become frustrated with higher education in mathematics and courses that require the application of mathematics (Greer, 2008; Sciarra, 2010).Before moving on to the next level of education, Ghana, like other nations worldwide, requires students to pass mathematics and mathematics-specific subjects (Fry, Ketteridge, & Marshall, 2009; Ketterlin-Geller & Chard, 2011).

According to research on mathematics interest, students' interest in the subject grows when they comprehend the skills and how they relate to the competencies required for performance in mathematics (Dweck, 1986; Mensah, Okyere, & Kuranchie, 2013; Rowland, Huckstep, & Thwaites, 2005).Students will be taught how to study and how to apply the necessary skills to their studies as part of the study of the skills required for understanding and performing well in mathematics. The capacity to relate pertinent mathematical ideas to prior mathematical knowledge is one of the learning strategies that students will require. According to the study by Tobias (1989), students who can use learning strategies that connect previously studied content to the topic they are studying have demonstrated positive outcomes for their interest in mathematics. Students must pass their high school mathematics course in order to fulfill this criterion. Students' interest in mathematics and how teachers can impact this interest construct by connecting mathematical concepts to real-life problems are the two conditions that cannot be disregarded when we look for solutions to poor performance in mathematics. Investigation and implementation are needed in Ghana on the issue of mathematics' relationship to real-world problems and other academic areas, as well as how it affects students' interest and comprehension to improve performance.

Objectives of the Study

In order to foster students' interest in mathematics, the current study aims to determine the methods that students would prefer their math professors to use.

From the perspective of the students, the study especially aims to establish the following.

- To ascertain how much students' interest in mathematics is influenced by teachers' capacity to relate the subject to real-world issues.
- To ascertain how the retrieved principal components affect the students' interest in mathematics, use a multiple linear regression model.
- The key elements of the mathematics connection constructions that support students' growing interest in the subject.
- To evaluate the inter-item correlations and PCA validity in order to conduct principal component analysis (PCA) on the mathematics link construct.

Research Questions

- How much does the assessment of mathematics connectedness influence students' growth in interest in the subject?
- How closely do the measurement and connection constructs in mathematics correlate with one another?
- How much do math teachers relate mathematics to real-world issues when instructing and learning the subject?
- How much does the extraction of the main components aid in the process of pupils developing their interests?

Research Hypothesis

The following hypothesis was put up by the study to be investigated.

- The extracted component of the mathematics connectivity constructs and students' interest are positively and significantly correlated.
- The items assessing the connectedness construct in mathematics have a strong link with one another.
- Students' interest in mathematics is significantly predicted by the extracted principal component.

III. RESEARCH METHODOLOGY

The methodology used by the researchers to arrive at the stated aims, research questions, and hypothesis is explained in this portion of the study.

Study Design and Approach
The study looks into the issue at hand using a strictly quantitative research approach. In order to uncover the impact of mathematics connectivity constructs on students' mathematical study, the study employed the survey method to gather data. The studies first examine the instrument's reliability before using it to describe how the construct affects students' interest in mathematics.

Instrument
The study created a novel tool that is tailored to the unique issues related to teaching and learning mathematics because of the geographical and cultural obstacles that exist in high school education around the world. Closed-ended questions from a standardized questionnaire were employed in the study. The six (6) items that make up the mathematics connectivity construct are designed to gauge how well teachers relate mathematical ideas to practical issues. The five-point Likert scale was used to measure each item in the concept.

Population, Sample and Sampling Techniques
All senior high school students in …… Region make up the population. The participating schools in the study were first chosen at random using multistage sampling. Participants are chosen from the chosen schools to answer the study's questionnaires in the second sampling stage. 1500 participants were chosen at random from 10 randomly chosen schools for the study; however, 1,263 participants successfully completed the questionnaire items in order to be considered for inclusion in the final analysis, which represents an 84.2% response rate.

IV. DATA ANALYSIS, RESULTS, FINDINGS AND DISCUSSION

Both descriptive and inferential multivariate statistical analysis methods, including multiple linear regression analysis and exploratory factor analysis, were employed in the study. These methods assisted in reaching a result that appropriately addresses the goals, research questions, and hypotheses put forth for examination. Both the descriptive and multivariate inferential statistics results were produced by the study using SPSS version 16. As seen below, the descriptive statistics for every item in the construct were examined.

Through the use of questionnaires, the study examined how creatively math teachers applied mathematical concepts to real-world issues. Among the components in the construct were: Teachers relate mathematical concepts to real-world issues, Teachers make connections between mathematics and other subjects. During mathematics instruction, teachers offer case studies and examples. Instructors set aside valuable time to practice class exercises. The teacher's assignments and class work are coordinated, and ultimately, mathematics is taught abstractly.

To determine the participants' perceived influence on the construct and how this construct influences the prediction of students' interest in mathematics, the study was descriptively evaluated item by item. Although 48.8% of research participants had varying opinions about whether or not math teachers relate mathematical principles to real-world issues, 30% of respondents overall disagreed with this statement. Additionally, the survey discovered that 21.2% of all participants were undecided about the claim that math teachers relate math to other subjects. The mean score for students' teachers' ability to relate mathematical ideas to real-world problems was 3.25, with a standard deviation of 1.35. However, Table 1 shows that the overall score for the relative importance index was 0.65.

The ability of teachers to connect mathematics to other topic areas was also examined in the study. Though the study found that 60.8% of the valid participants agreed with the fact that mathematics teachers' links to other subject areas may influence their interest in mathematics, 18.8% of the total participants cumulatively disagreed with those teachers connecting mathematical concepts to other subject areas. The study also shows that 20.4% of all participants had no opinion about the idea that teachers' connections between mathematics and other subjects help students become more interested in the topic. Participants gave teachers' cumulative evaluations of their ability to connect mathematics to other subject areas a very high grade, with a mean score of 3.69 and a standard deviation of 1.31. Additionally, as shown in Table 1, the survey determined that teachers' capacity to connect mathematics to other subject areas was rated as having a relative value of 0.74.This outcome is in line with research by Ginsburg & Amit (2008) and Winheller et al. (2013) that highlights how teachers can relate curriculum material to real-world issues and how this influences students' enthusiasm in mathematics.

The study also looked into how students' interest in mathematics is affected when teachers provide examples and

case studies during math lessons. According to the survey's results, 23.2% of participants disagreed that teachers' provision of exercises and case studies during mathematics lessons would affect students' interest in the subject. In contrast, 50.1% of participants thought that teachers' provision of sufficient exercises and case studies during mathematics lessons would help students become more interested in the subject. The study also shows that, oddly, 25.6% of the legitimate participants believe that offering enough case studies and examples will have little effect on students' interest in mathematics. The findings also show that, as shown in Table 1, the rating's mean and standard deviation were 3.44 and 1.22, respectively, with a relative importance score of 0.69.The findings are somewhat related to research in (Dweck, 1986; Mensah et al., 2013; Rowland et al., 2005), which shows that when students' interest in mathematics grows, math teachers systematically create instructional materials to help students perform better.

The study also looked into the impact of teachers' dedication to setting aside quality time for students to practice class exercises. The study found that, overall, 17.1% of participants disagreed that teachers set aside quality time for students to practice class exercises, while 66.5% of participants agreed, with 16.5% of participants expressing no opinion. With a mean and standard deviation of 3.8 and 1.25, respectively, and a high relative relevance index of 0.76, as shown in Table 1, the study shows that teachers' commitment of quality time for practicing class exercises was the most significant component. The study also investigated whether or not the assignments that math teachers assign their students and the lessons they teach in class are coordinated.

According to the survey's findings, 57.8% of the valid participants agreed with the assertion that there is coordination between class work and assignments assigned by math teachers, while 22.8% of the total participants disagreed. With a mean of 3.49 and a standard deviation of 1.27, as well as a relative importance index of 0.70, as shown in Table 1, the study found that instructors' capacity to effectively manage the class work and assignments assigned by math teachers was crucial to the development of students' interest. The findings are somewhat in line with a research by Palm (2008) that showed how disconnected students' understanding of mathematics was from its application to real-world issues. Students may find it difficult to comprehend mathematics as a result of this separation.

Lastly, the study looked into how students' interest in mathematics is influenced by their opinion that mathematics is presented abstractly. The findings show that while 55.6% of participants agreed that mathematics is taught abstractly, 20% of participants disagreed. It is noteworthy that 25.4% of all participants expressed no opinion regarding the abstract nature of mathematics instruction. With a relative relevance index of 0.71 and a mean and standard deviation of 3.58 and 1.91, respectively, as indicated in Table 1, the fact was ranked highly overall.

The study took into account some of the data from the EFA in order to calculate the number of components (factors) that needed to be removed. Principal component analysis was conducted using the data after the KMO and Bartlett's test of sample adequacy revealed significant results.

Kaiser's criterion uses components with Eigen values of 1 or more to determine the number of components in the six (6) items testing math teachers' ability to relate arithmetic to the immediate environment from the perspective of the students.

Two factors were retrieved from the final rotated component matrix, and these two components show that the six elements of the mathematical connection can be further reduced to two. After the factors were switched, the first one explained 42.1% of the variation, while the second one explained 14.7%. The items and factor loadings for the rotated factors are shown in Table 1, with loadings smaller than 0.4 excluded for clarity.

Table 1 Descriptive Statistics of Mathematics connectivity constructs

Factors	SD	D	N	A	SA	RII	M	SD
Teachers connect Mathematical concept to real life problems	14.9 %	15.1 %	21.2 %	27.5 %	21.3 %	0.65	3.25	1.35
Teachers link Mathematics to other subject areas	9.5%	9.3%	20.4 %	23.8 %	37%	0.74	3.69	1.31
Teachers provide example and case studies	7.4%	15.8 %	25.6 %	27.3 %	23.9 %	0.69	3.44	1.22
Teachers dedicate quality time for practicing class exercise	7.2%	9.9%	16.5 %	28.2 %	38.3 %	0.76	3.8	1.25
There is coordination between class work and assignment given by Mathematics teacher	10.4 %	12.4 %	19.4 %	33.5 %	24.3 %	0.70	3.49	1.27
Mathematics is abstractly taught	8.9%	10.1 %	25.4 %	29%	26.6 %	0.71	3.58	1.91

Table 2 KMO and Bartlett's Test of Sampling Adequacy

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.785
Bartlett's Test of Sphericity	Approx. Chi-Square	1184
	Df	15
	Sig.	0.00

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Table 3 Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.527	42.123	42.123	2.527	42.123	42.123
2	0.884	14.738	56.862	0.884	14.738	56.862
3	0.825	13.746	70.607			
4	0.718	11.975	82.582			
5	0.61	10.164	92.746			
6	0.435	7.254	100			

Table 4 The Two-Component Rotated Structure Matrix

Rotated Component Matrix		
	Component	
	1	2
Teachers connect Mathematical concept to real life problems.	0.812	
Teachers link Mathematics to other subject area during mathematics lesions.		0.602
Teachers provides example and case studies during mathematics lesions.	0.501	
Teachers dedicate quality time for practicing class exercise.	0.695	
There is coordination between class work and assignment given by mathematics teacher.	0.515	
Mathematics is abstractly taught.		0.835

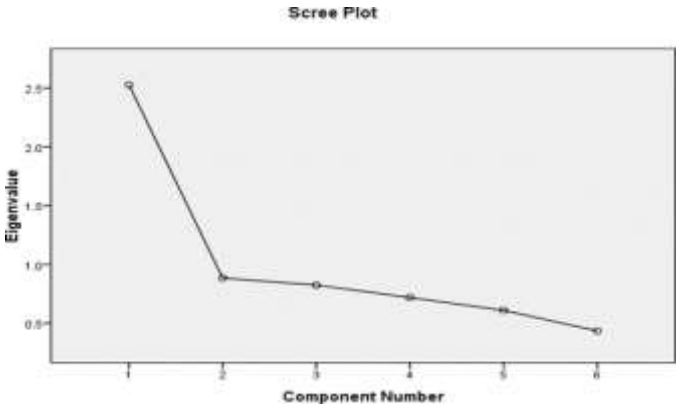

Fig 1 Scree plot Rotated structure component

Table 4 Correlation Analysis of Students' Interest with Extracted Components

Correlations				Descriptive statistics	
	Students Interest	Component 1	Component 2	Mean	Std. Deviation
Students Interest		0.731**	0.606**	3.6342	0.94471
Connectedness			0.448**	3.5032	0.88138
Abstraction				3.6382	1.31947

Table 6 Summary of Multiple Regression Analysis Results

Model Summary					
R	R Square	Adjusted R Square	Std. Error Estimate	Change Statistics	
				R Square Change	F Change
.795	0.632	0.631	0.57381	0.632	1080.364

ANOVA					
	Sum of Squares	Df	Mean Square	F	P-value
Regression	711.432	2	355.716	1080	0.000
Residual	414.862	1260	0.329		
Total	1126.294	1262			

Coefficients					
	Unstandardized Coefficients		Standardized Coefficients	t-Statistics	P-value
		Std. Error	Beta		
(Constant)	0.567	0.069		8.281	0.00
Connectedness	0.617	0.021	0.575	30.075	0.00
Abstraction	0.249	0.014	0.348	18.202	0.00

The study identified the main elements of the mathematics connectedness construct using exploratory factor analysis. To find out how well the retrieved principal components predicted students' interest in mathematics, the study also performed regression analysis. In the parts that follow, the study's findings and suggestions are listed.

V. CONCLUSIONS AND RECOMMENDATIONS

The study after analysis concluded that

- The two main components of the mathematics connection construct—connectedness and abstraction—significantly predict 63.1% of the variation in students' interest in mathematics.
- The most crucial element in the mathematics connectedness construct is the teachers' commitment of valuable class time for performing exercises.According to

the pupils, it has had the biggest impact on their growing interest in mathematics.

- Since it predicts 63.1% of the variance in students' interest in mathematics, math teachers' ability to relate mathematics to real-world situations in a variety of topic areas is essential to fostering students' interest in the discipline.
- Students' interest in mathematics will grow if the lessons being taught and the assigned homework are coordinated.

Recommendations

Following a thorough data analysis of the gathered data, the study issued the following suggestions for mathematics educators and stakeholders.

According to the study, math teachers should make a link between the material they teach in the classroom and the tasks they assign their pupils. Students' interest in mathematics will increase when teachers can make a connection between what they have taught and the assignments they assign. In addition to other subject areas, teachers are expected to relate mathematics to real-world issues and their immediate surroundings. This will make it easier for pupils to relate what they are learning to society or their chosen field of study. The study also suggests that math professors create strategies for handling abstraction in the classroom so that less motivated pupils will understand the benefits of mastering the subject without difficulty. In order to push the boundaries of the literature on mathematics connectedness, the study recommends that more research be done on the variables that predict and have a major impact on math teachers' capacity to relate mathematics to real-world issues.

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