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Students Mathematics Interest in Senior High Schools: Empirical Evidence from Ashanti Region of Ghana

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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Abstract

The relevance of students' academic interest in mathematics is of great concern to stakeholders in education. The present study models students' interest in mathematics (SIM) using mathematics facility (MF), mathematics connection (MC), teacher motivation (TM) as well as instructor quality and availability (IQA). The study randomly selected 1500 students from 10 senior high schools from the Ashanti region of Ghana; however, 1,263 of the participants fully participated in the study. These participants were made to respond to validated self-administered questionnaires with alpha-reliability of 0.74, 0.69, 0.70, 0.699 and 0.68 for SIM, MC, MF, IQA and TM respectively. Findings from the study showed that MC, MF, IQA and TM explain 71.6% of the variance in students' interest in mathematics. The study further found that approximately 15% of variability in teachers' ability to connect mathematics to real life problems is attributable to availability of mathematics facility as well as instructor quality and availability. The study finally found that availability of mathematics facilities for teaching and learning explains 12.4% of instructor quality in teaching mathematics. The study concluded that students' interest in mathematics is influenced significantly by the teachers' ability to connect mathematics to real life and the immediate environment, availability of mathematics facility, teacher motivation as well as instructor quality and availability. The study recommended for mathematics educators to take into account the influence of these factors and integrate them in the delivery of mathematics in high schools.

Keywords: Instructor quality; mathematics connection; mathematics facility; students' interest; Teachers motivation.

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1 Introduction

Students' interest in mathematics is one of such constructs shadowed by the search for students' performance in mathematics in Ghana. Students who develop interest in mathematics may not struggle to perform in mathematics since interest is an important impute that produces performance. In the developed world, research into what produces performance in mathematics and other science related subjects has not been achieved insolation. However, the construct interest has been integrated in some extent in search for what constitutes performance. The developed world has placed a lot of importance to science, technology and mathematics education which is the driving force of every industrialized economy. The quest for Ghana and Africa to attain economic freedom through science, technology and innovation cannot be achieved without it being anchored strongly on mathematics education. Overcoming the problems associated with poor performance in mathematics will mean 'seeking first mathematics interest of the students and students' performance in mathematics will be added to them'. Seeking for students' interest in mathematics will further require that mathematics teachers adopt teaching strategies that improve students' conceptual understanding [1]. The students' lack of interest in mathematics and schooling as suggested by some academics and researchers posit that it can lead to school dropout in general. There are many psychological factors that literature acknowledges as having effect on students' academic performance which have received attention in mathematics educational research. Such studies further posit that learners who experience mathematics anxiety in schools consequently avoid mathematics in school which result in decline of academic achievement [2,3,4]. There are other studies that suggest that anxiety in mathematics affects students' upward progression. Truly, presence of anxiety in mathematics may result in declined interest and finally poor achievement [2,5,6,7]. This is, however, not to say anxiety is entirely bad in educational psychology but moderate amount of anxiety may in actuality facilitate performance although beyond certain degree its hinders performance [8,9]. The present study directed its attention to the least researched area of students' interest in mathematics by investigating into the determinants of students' mathematics interest and to what extent these factors predict students' interest in mathematics. Dealing with the problem of students' interest in mathematics will help deal with the problem of achievement and performance in mathematics. The problem of expanding the scarce literature in the area of mathematics education also makes it a problem justified for investigation and solution.

2 Review of Relevant Literature

The study reviewed literature related to the problem under investigation. The literature covers effect of facility availability, connectedness, and instructor quality and availability on mathematics interest.

2.1 Instructor quality and availability

The quality of instruction provided by mathematics teachers and availability of quality instructors shape the thinking and actions of students in mathematics and this further influence the belief system of students [10,11]. The students' belief about mathematics teacher in terms of quality of instruction is very important to students' needs of competence in solving mathematical problems [12,13]. In mathematics teaching and learning process, the teachers' beliefs about the subject affect the teachers mode of instruction and students learning outcomes [14,15]. Teachers with positive beliefs about their competences and their ability to teach mathematics confidently and effectively in disseminating mathematical knowledge improve students' psychological need of competence, autonomy and relatedness [12,16,17]. These motivational parameters are key to improving students' interest in mathematics. Instructor quality of good teaching has it that teachers who communicate and build relationship with students improves students learning [18,19,20]. The quality of instructor is also manifested when different teaching approaches are deployed in classroom setting by mathematics teachers to influence students' procedural knowledge and conceptual understanding.

2.2 Mathematics facility and quality of instruction

The quality of instructor has been shown to influence students' conceptual understanding and interest in mathematics [18,19,20]. The quality of instructor engaged to teach mathematics affects students' interest in mathematics. The instructor quality as a construct alone does not transform students' state of dislike for mathematics to interest but other factors such as facilities available for the teaching and learning of mathematics have important role to play. The availability of mathematics teaching facilities such as technological devices in both basic and high schools has strong impact on students' mathematics skills. Student practices such as working through textbook exercises, discussing ideas through problem based learning provides a flexible means of developing mathematics knowledge [21,22,23]. When students are provided with mathematical software and laboratory for practicing mathematics it influence students' interest in mathematics, however, if the mathematics facilities are unavailable to aid instruction and then student interest in mathematics will be decrease [24,25,26]. The more mathematics facilities are made available for teaching and learning, the more interested students will be in learning mathematics.

2.3 Mathematics connection

The students' interest will better be improved when quality mathematics teachers connect mathematics to real life problems. The mathematics teachers' ability to connect mathematical knowledge to its immediate environment as well as other subject areas will directly influence students' interest and conceptual understanding in mathematics [18,27]. To help teachers integrate mathematical knowledge into other subject areas and our immediate environment, educational leadership and stakeholders play important role in providing mathematics teaching facilities and quality instructors to champion the mathematics connectedness [19,28,29]. The instructor quality and availability together with the mathematics facility available positively influence the teachers' ability to connect mathematics to real life problem and other subject areas. Ascertaining the connection between students' interest in mathematics and factors such as availability of mathematics facility, instructor quality and availability, mathematics teachers' ability to connect mathematics to real life problems has not been determined empirically. The problem of this study is to conceptualise and empirically determine the relationship between mathematics facility, mathematics connection, instructor quality and students' interest in mathematics.

3 Research Objectives

The study seeks to model teachers' ability to connect mathematics to real life and our immediate environment. The study specifically investigated:

i. The impact of availability of mathematics facility, mathematics connection and instructor quality on students' interest in mathematics.
ii. The effect of mathematics facility and instructor quality on teachers' ability to connect mathematics to real life problems and our immediate environment.
iii. The influence of mathematics facility on instructor quality and availability.

4 Research Hypotheses

i. **H1:** Availability of mathematics facility does not contribute positively and significantly to teachers' ability to connect mathematics to real life problems and the immediate environment.
ii. **H2:** Availability of quality instructors does not contribute significantly and positively to mathematics teachers' ability to connect mathematics to real life problems and the immediate environment.
iii. **H3:** Availability of mathematics facility positively and significantly affects instructor quality and availability.
iv. **H4:** Availability of mathematics facility positively and significantly influences students' interest in mathematics.

v. **H5:** Availability of qualified mathematics instructors does not positively and significantly influence students' interest in mathematics.
vi. **H6:** Teachers' ability to connect mathematics to real life problems and our immediate environment does not positively and significantly affect students' interest in mathematics.

5 Research Methodology

The section presents the methodology adopted in the study. It presents the sample and research instrument used in the study.

5.1 Sample

The study randomly sampled 1500 students from randomly selected 10 Senior High Schools (SHS) in the Ashanti Region of Ghana. The valid participants for the study were 1,263 students comprising of 551 males and 700 female but 12 participants did not indicate their gender.

5.2 Research instrument

The study used researcher-designed questionnaire which was put into two major sections. The first part of the questionnaire contains 81 items which were subdivided into different constructs. The constructs were mathematics interest, students' perception, teacher motivation, instructor quality and availability, mathematics facility, mathematics connection and school leadership. Each of these constructs was rated on a 5-point Likert scale rating from strongly agree-5 to strongly disagree-1. Psychometric properties of these constructs were computed. The instrument was first piloted with 100 post senior high school students offering various courses in the University of Education, Winneba, and Kumasi campus with test-retest reliability of 0.97 and internal consistency of alpha coefficient of 0.939. The scales appeared to be consistent in their rating making the instrument very reliable for further replication in any related study. The school authorities as well as the participants gave their consent to be included in the study. The schools and the students were assured of their anonymity and data protection although the questionnaire did not require participants to provide any information that could give clue to schools or persons involved in the study.

5.3 Structural Equation Model (SEM)

The study used partial least squares (PLS) structural equation modelling techniques for the statistical data analysis. All statistical results were generated using smart –PLS version 3.0.

The focus of this study is explaining the endogenous construct using the variance based -partial least square (VB-PLS) analysis as a preferred method of analysis [30,32]. The study used the PLS-SEM since the PLS understands the latent variable as weighted sums of their respective indicators and further attempts to predict values for the latent constructs by using multiple linear regression [30,31,32]. The study applied no standardization to the data collected but rather, PLS model estimations were all performed using Smart PLS with the original dataset. The study used t-test method to test whether path coefficients differ significantly from zero. The bootstrap procedure was used to calculate all t-values for the test of significance for the constructs.

6 Data Analysis and Findings

The section presents data analysis, results and findings. It begins with demographic characteristics of the respondents.

6.1 Demographic characteristics of respondents

The study presented 44% of its valid respondents as males and 56% of the valid respondents as females as indicated in Table 1. The age categorization of the study appears in Table 1.The highest age category were students with ages between 14-16 representing 45% of the valid respondents which is consistent with age of most senior high school students. The category of basic schools attended indicated that 56.8% of the respondents attended public basic schools while 43.2% of the valid respondents attended private basic school. Table 1 further presents results on the level of respondents, the program of study and grade of the secondary school attended.

Table 1. Demographic characteristics of the respondent

Variables	Response categories	Frequency	Percent
Gender	Male	551	43.6
	Female	700	55.4
	No Response	12	1
Age categories	14 – 16	238	18.8
	17 – 19	566	44.8
	20 – 22	294	23.3
	23 and above	156	12.4
	No Response	9	0.7
Basic school attended	Public School	692	54.8
	Private School	526	41.6
	No Response	45	3.6
Grade of school attended	Grade A School	554	43.9
	Grade B School	546	43.2
	Grade C School	156	12.4
	No Response	7	0.6
Course of study	General Art	230	18.2
	Visual Art	111	8.8
	Science	575	45.5
	Business	204	16.2
	Home Economics	137	10.8
	No Response	6	0.5
Level of student	SHS 1	200	15.8
	SHS 2	298	23.6
	SHS 3	712	56.4
	No Response	53	4.2

6.2 Structural Equation Model (SEM)

The section presents the conceptual framework and the established paths connecting the constructs under consideration as in Fig. 1.

The study analysed the reflective construct with most of the indicators loading very well with factor loadings above 0.70 as suggested by Vinzi et al. [33] and Sarstedt et al. [31]. The factor loadings indicated a strong fit as it measures the construct although some of the constructs indicators were below the acceptable threshold as indicated in Fig. 2.

In building the final model as in Fig. 4, all factor loadings below 0.5 were eliminated. The final model indicated that the composite reliability of each construct was uniformly higher than 0.7 while the Cronbach's alpha are also above 0.7 with the exception of mathematics connection construct. These results were consistent with the best practice suggested by Vinzi et al. [33] and Sarstedt et al. [31].

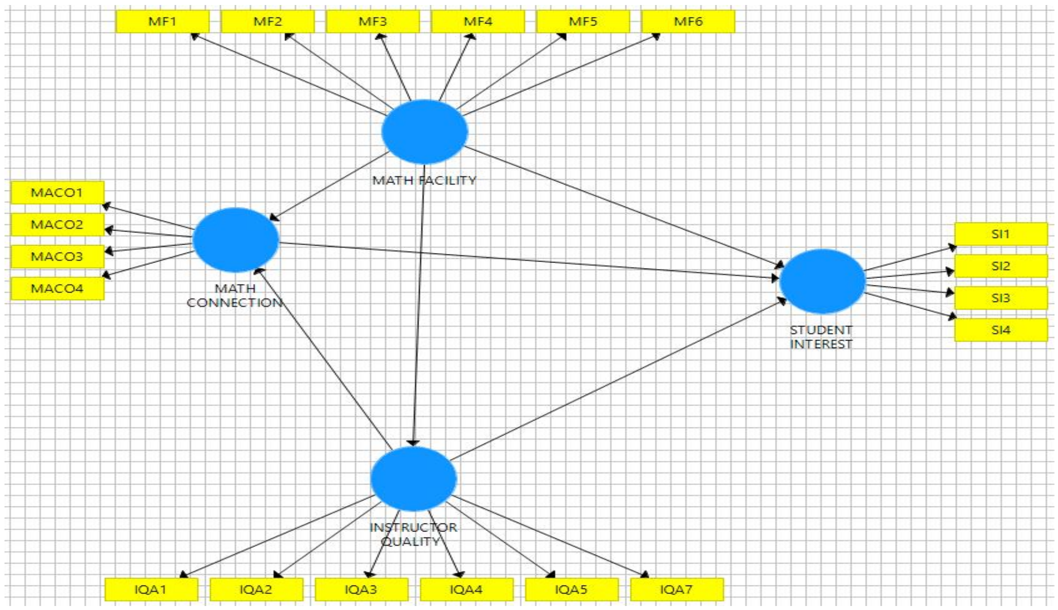

Fig. 1. Conceptual framework for students' interest in Mathematics

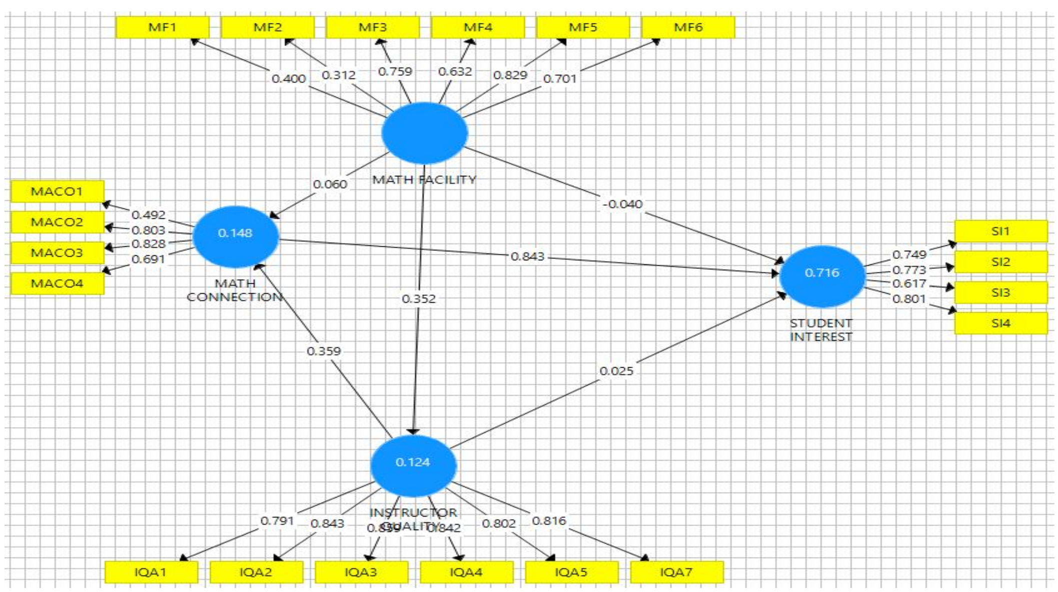

Fig. 2. Conceptual framework for students' interest in Mathematics

Table 2. Construct reliability and validity

Constructs	Cronbach's alpha	rho_A	Composite reliability	Average Variance Extracted (AVE)
Instructor quality	0.907	0.911	0.928	0.682
Math connection	0.677	0.738	0.802	0.513
Math facility	0.709	0.774	0.786	0.402
Students' interest	0.724	0.752	0.826	0.545

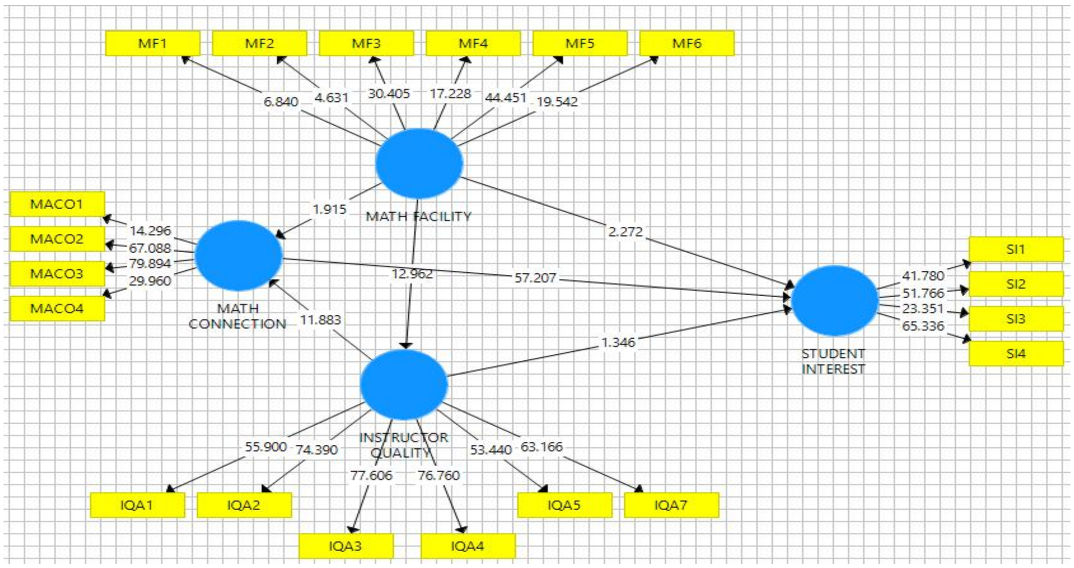

Fig. 3. Empirical model for students' interest in Mathematics

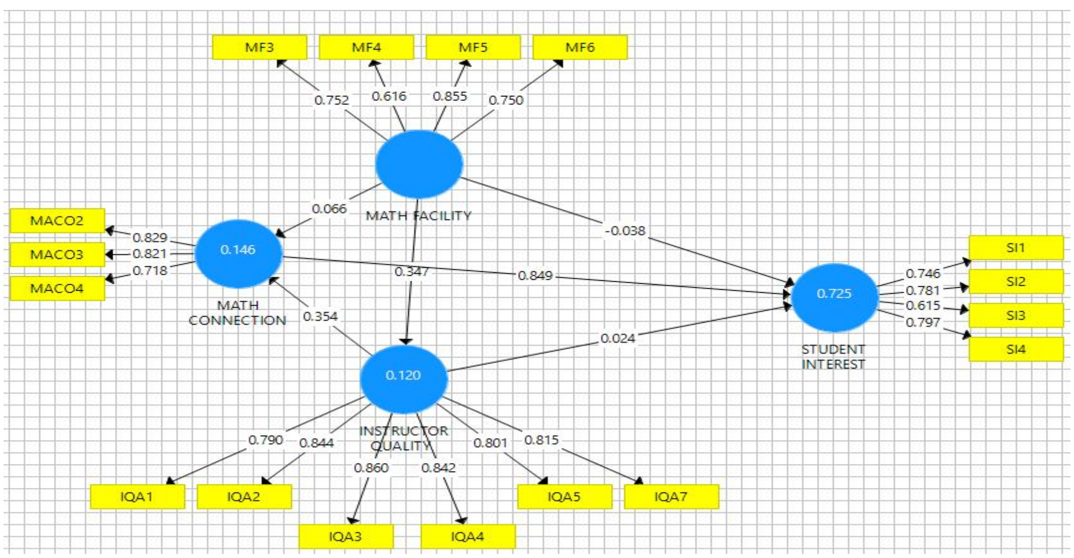

Fig. 4. Modified empirical model for students' interest in Mathematics

The results in Table 2 further present the construct reliability and validity value and the corresponding T-values and p-values to ascertain its significance. The results further indicate that convergent validity for all the constructs except for mathematics connection which failed the test of convergent validity. The study evaluated the construct for passing the test for discriminant validity using Fornell /Larcker (1981) criterion. For this criterion, square root of each construct average variance extracted (AVE) is compared with its bi-variate correlations with all opposing constructs. The results in Table 4 clearly indicate that the square root of AVE is greater than the variance shared between each bi-variate correlation of two opposing constructs. The results further indicate that the discriminant validity between the constructs is confirmed as suggested by Hair et al.[30] and Wong [32].

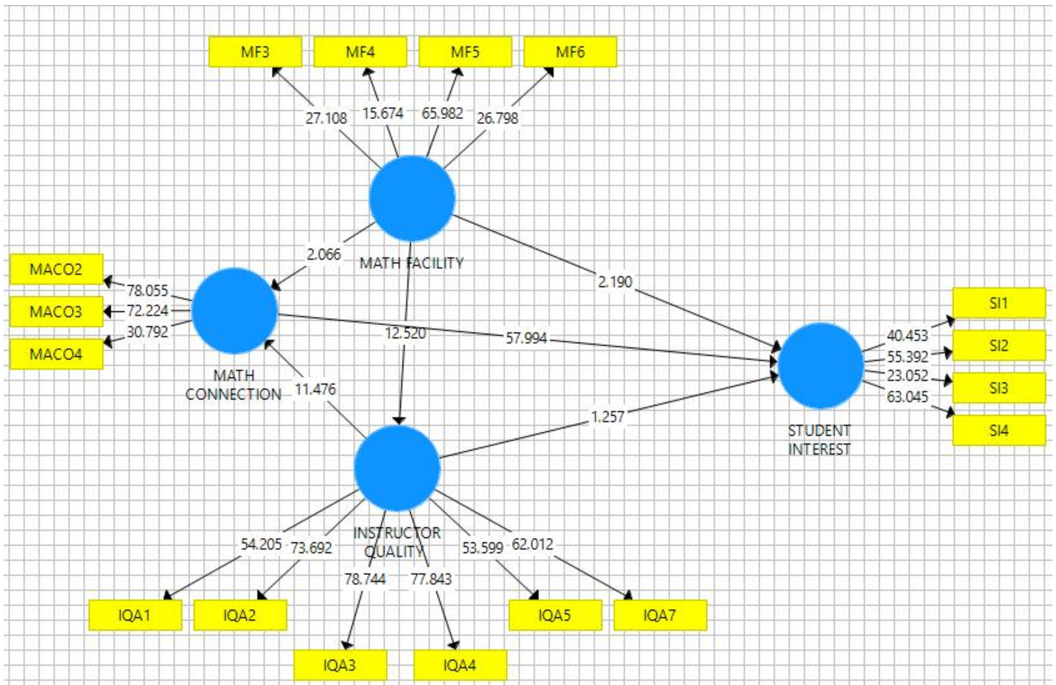

Fig. 5. Modified empirical model for students' interest in Mathematics

Table 3. Discriminant validity using Fornell-Larcker criterion

Constructs	Instructor quality	Math connection	Math facility	Student interest
Instructor quality	0.826			
Math connection	0.380	0.716		
Math facility	0.352	0.187	0.634	
Students' interest	0.331	0.845	0.126	0.738

Table 4 further assessed the extent to which the average variance extracted for constructs under study is significant. The results indicate that the AVE for all the constructs were significant ($p<0.01$).

Table 4. Average Variance Extracted (AVE) mean, STDEV, T-values, P-values

Constructs	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
Instructor quality	0.682	0.682	0.011	61.176	0.000
Math connection	0.513	0.513	0.013	39.049	0.000
Math facility	0.402	0.401	0.014	28.065	0.000
Students' interest	0.545	0.546	0.013	41.140	0.000

Table 5 presents composite reliability values and the associated p-values. The results indicated that t the constructs were reliable and significant for further analysis.

Table 5. Composite reliability mean, STDEV, T-values, P-values

Construct	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
Instructor quality	0.928	0.928	0.003	268.704	0.000
Math connection	0.802	0.802	0.009	88.058	0.000
Math facility	0.786	0.784	0.015	53.051	0.000
Students' interest	0.826	0.826	0.008	104.492	0.000

Table 6. Heterotrait-Monotrait Ratio (HTMT) Mean, STDEV, T-values, P-values

Constructs path	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T Statistics (|O/STDEV|)	p-values
Math connection -> instructor quality	0.472	0.472	0.037	12.890	0.000
Math facility -> instructor quality	0.385	0.385	0.033	11.548	0.000
Math facility -> math connection	0.234	0.249	0.031	7.622	0.000
Students' interest -> instructor quality	0.383	0.384	0.037	10.249	0.000
Students' interest -> math connection	1.120	1.121	0.023	48.708	0.000
Students' interest -> math facility	0.179	0.198	0.022	8.193	0.000

7 Discussion

The section discusses the results from the study. The study investigated the influence of instructor quality and availability, mathematics connection and availability of mathematic facility on students' interest in mathematics.

7.1 Influence of instructor quality and availability, Mathematics connection and availability of Mathematic facility on students' interest in Mathematics

The results have indicated a direct relationship between instructor quality and availability and students' interest in mathematics. The path coefficient from instructor quality and availability to students' interest in mathematics and the p-value are 0.024 and $p<0.001$ respectively. Thus, quality and available mathematics instructors will positively influence students' interest in mathematics. The more qualified instructors are hired at the basic and senior high level of education, the better the chances of students developing interest in mathematics. This possibly may be due to the fact that quality instructors in the mathematics discipline understand the pedagogical strategies needed to deliver the content. The findings support other studies [34,35,12,16,17] that suggest that the competences exhibited by the instructors in disseminating mathematical knowledge improve students' interest as well as their psychological need of competence, autonomy and relatedness.

The findings further showed that direct relationship exists between the mathematics teachers' ability to connect mathematics to real life problems and students' interest in mathematics. The path coefficient from mathematics connection to students' interest in mathematics and the p-value are 0.849 and $p<0.001$ respectively. This result suggests that the more mathematics teachers are able to connect mathematical concepts to real life problems, the better the students conceptual understanding of content taught. However, the study showed an inverse relationship between availability of mathematics facilities and students' interest in mathematics. The findings are consistent with studies such as [18,27] which reported teachers' ability to connect mathematics to real life problems positively impact on students' conceptual understanding and interest in mathematics. The path coefficient from instructor quality and availability to students' interest in mathematics and the p-value are -0.038 and p<0.001 respectively. This result may seem strange as it indicates that availability of mathematics facilities negatively influence students' interest in mathematics. This finding may be due to the fact that in Ghana, mathematics is taught without any facilities other than chalk or marker, textbooks and chalk or marker board. There exists no laboratory works that will help demonstrate mathematics practically. Mathematics has been taught abstractly for very long time and requires a new paradigm. Furthermore, the findings suggest that further training for the instructors may be required to enable them integrate practical sessions in mathematics lessons. The negative impact of mathematics facility on students' interest may change as students see the other side of mathematics instruction where laboratory works are integrated into the teaching and learning of mathematics.

The results predict 71.24% of variability in students' interest in mathematics emanating from mathematics facility availability, instructor quality and availability as well as mathematics teachers' ability to connect mathematics to real life problems. The mathematics teachers' ability to connect mathematics to real life problems is the most effective construct for predicting students' interest in mathematics.

7.2 Influence of Mathematics facility availability as well as instructor quality and availability on Mathematics connection

The results from the study revealed that direct relationship exists between the mathematics facility and mathematics teachers' ability to connect mathematics to real life problems. The path coefficient from instructor quality and availability to students' interest in mathematics and the associated p-value are 0.066 and p<0.001 respectively. This result suggests that availability of mathematics facility for instruction positively affects the mathematics teachers' ability to connect mathematics to real life problems and their immediate environment. The findings further suggest that instructor's ability to connect mathematical concepts to real life problems depends on the availability of facilities; the absence of these facilities for instruction may negatively affect teacher's ability to connect mathematics concepts to real life problems. Furthermore, the results have demonstrated that instructor quality and availability has direct influence on the teachers' ability to connect mathematics to real life problems. The path coefficient from instructor quality and availability to mathematics teachers ability to connect mathematics to real life as indicated in Fig. 2, Figs. 4 and 5 are 0.354 and p<0.001 respectively. The study argues that for a mathematics teacher to connect mathematics to real life problems, the teacher's pedagogical content knowledge is key. The higher the instructor quality and availability, the better the teacher is able to connect mathematics to real life problem. The instructor quality and availability as well as the availability of mathematics facility predicted 14.6% of variability in teachers' ability to connect mathematics to real life problems. The instructor quality and availability is the most important construct for predicting mathematics teachers' ability to connect mathematics to real life problems.

7.3 Influence of Mathematics facility availability on instructor quality and availability

The influence of mathematics facility on instructor quality and availability as revealed by the study suggests that a direct relationship exists. The path coefficient from mathematics facility to the instructor quality and availability and the p-value are 0.347 and p<0.001 respectively. This result suggests that availability of mathematics facility for instruction positively affects the instructor quality and availability. The findings further suggest that quality of mathematics instruction and instructor availability will improve as mathematics facilities are made available for instruction.

8 Conclusions and Recommendations

The section presented the conclusions and recommendation made from the finings. It begins with the conclusions followed by recommendations.

8.1 Conclusions

The study made the following conclusions from the findings of the study.

The study concluded that availability of mathematics facility; mathematics connection and instructor quality and availability are related to students' interest in mathematics since these factors explain 71.2% of variance in the students' interest in learning mathematics. The study, however, found inverse relationship between mathematics facility availability for teaching and learning of mathematics and the students' interest in learning mathematics. The study also concluded that availability of mathematics facility as well as instructor quality and availability are also related to mathematics teachers' ability to connect mathematics to real life problems since these two factors explain 14.6% of the variance in mathematics teachers' ability to connect mathematics to real life problems and our immediate environment. The study further concluded that there is direct relationship between availability of mathematics facility and instructor quality and availability; availability of mathematics facility explains 12.0% of instructor quality and availability.

8.2 Recommendations

The study recommends that since interest is very paramount in students' mathematics learning process and key determinant of performance, mathematics teachers should adopt strategies to arouse students' interest in mathematics. One of such key areas where mathematics teachers should improve on their strategies is to connect mathematics to real life problems as well as other subject areas to help improve students' interest and performance in mathematics. The study also recommends to educational leadership and stakeholders in mathematics education to provide the needed materials for the teaching and learning of mathematics since they directly predict the quality of instructions and motivate mathematics teachers in delivering quality mathematics lessons.

Consent

As per international standard Students' written consent has been collected and preserved by the author(s).

Competing Interests

Author has declared that no competing interests exist.

References

[1] Angrist JDD, Lavy V. Does teacher training affect pupil learning ? Evidence from matched comparisons in Jerusalem public schools. Journal of Labor Economics. 2001;19(2):343–369.
Available:https://doi.org/10.1086/319564

[2] Ashcraft MH, Krause JA. Working memory, math performance and math anxiety. Psychonomic Bulletin & Review. 2007;14(2):243–248.
Available:https://doi.org/10.3758/BF03194059

[3] Selvakumar S, Rajaram K. Achieving excellence in engineering education through improved teaching-learning process. Teaching, Assessment; 2015.
Available:http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=7386052

[4] Sherman BF, Wither DP. Mathematics anxiety and mathematics achievement. Mathematics Education Research Journal. 2003;15(2):138–150.
Available:https://doi.org/10.1007/BF03217375

[5] Ball DL. Unlearning to teach Mathematics. For the Learning of Mathematics. 1988;8(1):40–48.

[6] Núñez-Peña MI, Suárez-Pellicioni M, Bono R. Effects of math anxiety on student success in higher education. International Journal of Educational Research. 2013;58.
Available:https://doi.org/10.1016/j.ijer.2012.12.004

[7] Zakaria E, Zain NM, Ahmad NA, Erlina A. Mathematics anxiety and achievement among secondary school students. American Journal of Applied Sciences. 2012;9(11):1828–1832.
Available:https://doi.org/10.3844/ajassp.2012.1828.1832

[8] Buelow MT, Frakey LL. Math anxiety differentially affects WAIS-IV arithmetic performance in undergraduates. Archives of Clinical Neuropsychology. 2013;28(4).
Available:https://doi.org/10.1093/arclin/act006

[9] Lavasani MG, Hejazi E, Varzaneh JY. The predicting model of math anxiety: The role of classroom goal structure, self-regulation and math self-efficacy. In Procedia - Social and Behavioral Sciences. 2011;15.
Available:https://doi.org/10.1016/j.sbspro.2011.03.141

[10] Blomhøj M. Different perspectives in research on the teaching and learning mathematical modelling – Categorising the TSG21 papers. In Mathematical applications and modelling in the teaching and learning of mathematics. Proceedings from Topic Study Group 21 at the 11th International Congress on Mathematical ducation in Monterrey, Mexico. 2008;1–18.

[11] Fraivillig JL, Murphy LA, Fuson KC. Advancing children's Mathematical thinking in everyday Mathematics classrooms. Journal of Research in Mathematics Education. 1999;30(2):148–170.
Available:https://doi.org/10.2307/749608

[12] Carter G, Norwood KS. The relationship between teacher and student beliefs about Mathematics. School Science and Mathematics. 1997;97(2):62–67.
Available:https://doi.org/10.1111/j.1949-8594.1997.tb17344.x

[13] Wentzel KR. Student motivation in middle school: The role of perceived pedagogical caring. Journal of Educational Psychology. 1997;89(3):411–419.
Available:https://doi.org/10.1037/0022-0663.89.3.411

[14] Klassen RM. Effects on teachers' self-efficacy and job satisfaction: Teacher gender, years of experience and job stress. 2010;102(3):741–756.
Available:https://doi.org/10.1037/a0019237

[15] Tiedemann J. Parents' gender stereotypes and teachers' beliefs as predictors of children's concept of their Mathematical ability in elementary school. Journal of Educational Psychology. 2000;92(1):144–151.
Available:https://doi.org/10.1037/0022-0663.92.1.144

[16] Krapp A. Basic needs and the development of interest and intrinsic motivational orientations. Learning and Instruction. 2005;15(5):381–395.
Available:https://doi.org/10.1016/j.learninstruc.2005.07.007

[17] Ruzek EA, Hafen CA, Allen JP, Gregory A, Mikami AY, Pianta RC. How teacher emotional support motivates students: The mediating roles of perceived peer relatedness, autonomy support, and competence. Learning and Instruction. 2016;42.
Available:https://doi.org/10.1016/j.learninstruc.2016.01.004

[18] Arthur YD, Asiedu-addo S, Assuah,C. Connecting Mathematics to real life problem using instructor quality and availability, Mathematics facility and teacher motivation for prediction. International Journal of Scientific Research in Education. 2017a;10(3):311–324.

[19] Arthur YD, Asiedu-Addo S, Assuah C. Teacher-student variables as predictor of students' interest in Mathematics: The use of stepwise multiple linear regression analysis. Asian Research Journal of Mathematics. 2017b;4(3):1–11.
Available:https://doi.org/10.9734/ARJOM/2017/33544

[20] Lazarides R, Ittel A. Instructional quality and attitudes towards mathematics: Do self-concept and interest differ across students' patterns of perceived instructional quality in mathematics classrooms. Child Development; 2012.

[21] Keong CC, Horani S, Daniel J. A study on the use of ICT in Mathematics teaching. Malaysian Online Journal of Instructional Technology. 2005;2(3):43–51.

[22] Kim C, Park SW, Cozart J. Affective and motivational factors of learning in online mathematics courses. British Journal of Educational Technology. 2014;45(1):171–185.
Available:https://doi.org/10.1111/j.1467-8535.2012.01382.x

[23] Lin CY. Preservice teachers' beliefs about using technology in the mathematics classroom. Journal of Computers in Mathematics and Science Teaching. 2008;27(3):341–360.
Available:http://www.editlib.org/p/24223

[24] Arthur YD, Asiedu-Addo S, Harris E. Statistical Software Packages (SSPs) integration in teaching and learning of statistics in Ghanaian Tertiary Institution. Journal of Scientific Research and Reports. 2015;7(4):257–265.
Available: https://doi.org/10.9734/JSRR/2015/17470

[25] Strässer R. Everyday instruments: On the use of mathematics. In Modelling and Applications in Mathematics Education The 14th ICMI Study. 2007;10:171–178.

[26] Tay LY, Lim SK, Lim CP, Koh JHL. Pedagogical approaches for ICT integration into primary school English and mathematics: A Singapore case study. Australasian Journal of Educational Technology. 2012;28(4).

[27] Intaros P, Inprasitha M, Srisawadi N. Students' problem solving strategies in problem solving-mathematics classroom. Procedia - Social and Behavioral Sciences. 2014;116:4119–4123.
Available:https://doi.org/http://dx.doi.org/10.1016/j.sbspro.2014.01.901

[28] Heck RH, Hallinger P. Collaborative leadership effects on school improvement. Elementary School Journal. 2010;111(2):226–252.
Available:https://doi.org/Article

[29] Jacobson S. Leadership effects on student achievement and sustained school success. International Journal of Educational Management. 2011;25(1):33–44.
Available:https://doi.org/10.1108/09513541111100107

[30] Hair J, Ringle C, Sarstedt M. PLS-SEM: Indeed a silver bullet. Journal of Marketing Theory and Practice. 2011;19(2):139–151.

[31] Sarstedt M, Ringle CM, Smith D, Reams R, Hair JF. Partial least squares structural equation modelling (PLS-SEM): A useful tool for family business researchers. Journal of Family Business Strategy. 2014;5:105–115.

[32] Wong KK. Partial Least Squares Structural Equation Modelling (PLS-SEM) techniques using SmartPLS. Marketing Bulletin, 24, Technical Note. 2013;1:1–33.

[33] Vinzi VE, Chin WW, Henseler J. Handbook of partial least squares: Concepts, methods and applications. Handbook of Partial Least Squares; 2010.
Available:https://doi.org/10.1007/978-3-540-32827-8

[34] Abrantes JL, Seabra C, Lages LF. Pedagogical affect, student interest and learning performance. Journal of Business Research. 2007;60(9):960–964.
Available:https://doi.org/10.1016/j.jbusres.2006.10.026

[35] Arthur Y, Asiedu-Addo S, Assuah C. Effect of instructor quality and availability on Ghanaian students' interest in Mathematics using regression and principal component analysis. Advances in Research. 2017;11(5):1–11.
Available: https://doi.org/10.9734/air/2017/34570

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