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RESEARCH ARTICLE

ENHANCING STUDENTS' ACHIEVEMENT IN MATHEMATICS THROUGH THE USEFULNESS OF MATHEMATICS AND INTEREST: THE MEDIATING ROLE OF MOTIVATION

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ABSTRACT

The usefulness of mathematics in one's daily life and career cannot be overstated. Mathematics is a required subject in most African countries, including Ghana. Because of the importance of mathematics, it has been declared a requirement for entrance to tertiary institutions. In spite of the importance of mathematics and it being made a prerequisite for tertiary education, the performance of students has been extremely appalling. This study looked at the role of usefulness of mathematics, interest of students and motivation on the achievement of students in mathematics. The study was a survey, and structured questionnaire was used to collect data. The population was senior high school students in the Kumasi Metropolis. However, 360 students from three selected schools in the metropolis were selected using cluster and simple random sampling techniques. Approval was granted by the authorities of the schools where the data was collected. Data was gathered during classes hours, after permissions were sought from the tutors teaching at the time of data collection. The path analysis was by Structural Equation Modelling, by using Amos (v.23) software. It was concluded that mathematics motivation partially mediated the relationship between usefulness of mathematics and students' mathematics achievement. Also, mathematics motivation has a tendency of positively influencing students' interest in learning the subject.

KEYWORDS

Mathematics usefulness, interest, motivation and achievement

1. INTRODUCTION

According to Algani (2022), the usefulness of mathematics can best be appreciated by considering how Galileo defined mathematics: "Mathematics is the language in which God has written this world". Abdulaziz (2015) believes that a culture that considers itself civilized cannot push the study of mathematics to the side. According to him, one of the methods to determine how a civilization can progress is to study mathematics. Increased mathematics proficiency is intimately correlated with the growth of a society's many societal sectors. This demonstrates unequivocally that low mathematics enrolment and low mathematics performance among students lead to the downfall of every civilization.

According to Okereke (2006) mathematics is applied to science and technology in diverse and multiple ways, which make is impossible to have other spheres of science and technology well developed without mathematics.

The historical evidence that is currently available implies that practical experiences are where mathematics first evolved, according to (Roshan, 2021). It is believed that a great deal of mathematics was used in the creation of bricks, houses, bridges, gutters, temples, pyramids, numerous handicrafts, and planned towns. The rise of civilization in the ancient world was facilitated by the development of mathematics.

Ochieng (2022) believes that living in our world which is mathematically-oriented, requires that one should have a firm knowledge of mathematics, else one would be likened to a person who closes his eyes and walks through an art museum. He regards mathematics as life. Again, he is of the firm conviction that without mathematics, people will have a distorted view of this beautiful world we live in. Mathematics is seen and felt everywhere and contributes to making us fathom our world in a much meaningful way. Life will continue to be meaningless until humanity values mathematics and its impact in everything we do as a people. Arthur et al., (2017), intimated that the drive and interest students show in their quest to learn naturally intensify when they are able to discover the relevance of the link between what they learn and their day-to-day lives. A mathematician and renowned theologian, said mathematics is "an area whereby you have no idea what is it that you are doing and whether what you are claiming is correct" (Russell, 1901). This definition of Russell unequivocally illustrates the complexity of mathematics.

2. STATEMENT OF THE PROBLEM

The achievement of Ghanaian students in mathematics has been appalling. For instance, since the start of The International Mathematical Olympiad (IMO) in 1959, hosted in Romania, Ghana's participation in this worldwide mathematics program has been uninspiring, and our successes have been pitiful. Ghana first participated in this worldwide program in South Africa in 2014. The International Mathematical Olympiad (IMO) is a global event hosted every year in a different country for high school students. Ghana has competed in the program less than 10 times in the last sixty-four years, and it was only in 2020 that we won our first and only medal.

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Globally, students' achievements in mathematics have become topical issues for every country owing to the integral role mathematics plays in our dispensation which is regarded as an era of scientific and technological era. For example, available statistics indicate that Nigerian students' performance in mathematics is extremely poor, according to (Sa'ad et al., 2014). In his studies, he mentioned that the root cause of the abysmal performance of students are the negative behaviors of students towards mathematics and teachers' inability to use proactive instructional strategies and others. Furthermore, a study in Kenya also posited that students' mathematical performance is generally unimpressive (Mbugua et al., 2012). He further indicated that the factors responsible for their performance is not different from that of the Nigerian students enumerated above. Moreover, the students in Tanzania exhibited abysmal achievement in the subject, mathematics. This Population reported that the percentage pass of form four students in national examination in mathematics was 16% (Ndume et al., 2020). There is a pattern of low performance in mathematics. Various research indicates that in the year 2012 alone, 69% of form four students were unsuccessful in mathematics (Mazana et al., 2020). The same issue occurs once one moves beyond Africa's borders. To data reported on the achievements of Philippine students, indicating that the students performed poorly when they took the mathematics examination (Peteros et al., 2020). In 2020, for example, a greater numbers candidates, representing 53.01% scored below the national average.

Mathematics is, admittedly, abstract in nature, and most schools lack enough concrete visual instructional resources to pique the learner's zeal required to comprehend mathematics. A lot of researchers have done studies to ascertain how students' motivation correlates with students' mathematical performance. For instance. in the words, students with inadequate motivation put forth fewer strokes, which lead to unsatisfactory achievement in school. They proposed that students' mathematical performance may be improved by providing motivation.

The study, evaluated the impact of student motivation for general academic accomplishment of students and reported that student motivation positively influences students' mathematical achievement (Steinmayr et al., 2019). This research also explored the effect of motivation, tactics, and other contributing factors on junior and senior high students' learning (Gbollie et al., 2017). He emphasized that the motivational approaches and learning method utilization are critical to increasing the performance of students.

Nonetheless, a meticulous look at the available research work shows that relatively little research has investigated the role motivation plays in improving students' mathematical performance. However, further search revealed that there has not been any research on how the motivation of students influences students' interest and their knowledge about the usefulness of mathematics in their daily lives and profession as a whole. It is against this backdrop that this topic is worthy of research. This is because it will seek to establish how motivating students can influence students' interest and the usefulness of mathematics leading to achievement in mathematics.

2.1 Objectives of the Study

The following are the objectives that the researcher anticipates to achieve:

i. To investigate the impact of the usefulness of mathematics on the achievement of students.

ii. To find out the effect of mathematics motivation on students' mathematics interest.

iii. To investigate the impact of students' mathematics interest on their mathematics achievement.

iv. To investigate the mediating effect of mathematics motivation between usefulness of mathematics and mathematics achievement.

Research Questions

i. What is the impact of the usefulness of mathematics on students' mathematics

achievement?

ii. What is the effect of mathematics motivation on students' mathematics interest?

iii. What impact does students' mathematics interest have on their mathematics achievement?

iv. What is the mediating effect of mathematics motivation between usefulness of mathematics and mathematics achievement?

3. Literature Review

3.1 Usefulness of Mathematics on Students' Achievement

According to Fatima (2013), all subjects that students' study in schools have great importance to both the learners and educators. She further stressed that, despite the seeming importance of all school subjects, the development that gradually occurs in people's minds, bodies, social, and economic systems provide an overarching goal for schooling that makes mathematics instruction unparalleled. with these is of a firm belief that mathematics education is what makes people creative and responsible thereby making them fit into the society they find themselves (Niss, 1996). Learning mathematics helps students satisfy the demands of society to create a versatile and highly skilled pool of workers.

Generally speaking, the usefulness and value of a thing is what make people exert all their energy in pursuing that thing. The study of mathematics is a prime illustration. Even though many students perceive mathematics to be tedious and difficult to master, they nonetheless see its value in everyday life. It is paradoxical. The quest to have a decent profession and, to some extent, to live a better life might be cited as a practical justification for the importance of mathematics. According to Niss (1994), the majority of young people are aware that, for mysterious reasons, mathematics competence is essential to securing desirable academic and job prospects (Niss (1994). This concept has been brilliantly stated by Jens Hjgaard Jensen in the phrase Mathematics is worthless to me, but at the same time I know that I am worthless without mathematics. The perceived usefulness is defined as the opinion students have regarding the applicability or significance of mathematics in both the present and the future by (Adelson et al., 2011). They also stated that learners' broad views about the topic, which will ultimately improve their academic success in the subject, are directly influenced by how they view the important nature of mathematics. Students who possess an understanding underlying the value of mathematics in their daily lives and future careers will, according to Syyeda (2016), have an inner desire and impulse to delve into, apply, and become familiar with the subject (Syyeda, 2016). According Guy et al.'s (2015) study, profitable performance is positively predicted by how useful mathematics is (Guy et al.'s, 2015). The work suggests that. For the future, discovering a meaning and significance in one's task may additionally promote participation on the part of students, their growth of competence, an improvement in performance.

3.2 Motivation in Mathematics on Students' Achievement

Different theories explain motivation, which highlights how challenging it is to put it into plain and straightforward terms. Most people think of motivation as an underlying desire or need that propels someone to take action to fulfill it. The word "motivation" comes from the word "motive," which is used to describe a person's needs, goals, or inclinations. According to Schiefele (2009), motivation is generally regarded as a sense of wishing to carry out a particular task in a particular circumstance. Motivation is usually associated with efforts. Some people define effort as the "total work done to achieve a particular end." This theories explained that if a student is more motivated to learn or to complete an assignment, they will more likely put in more effort to complete the task at hand (Schiefele, 2009). Personal interest and effort are frequently linked. A student will likely be more motivated to learn about a subject if they think it to be highly relevant, which will boost the amount of effort put out. Smith et al., 2012 discovered that motivation ignites students' interests in a variety of academic fields and consequently results in improvement performance, particularly in mathematics.

When students are highly motivated, they will be enthused and fascinated to work assiduously and persistently to achieve the goals that educational authorities have set for them. Motivation of learning therefore refers to the concerted efforts made by students owing to the learning goals they envisage to achieve. They view achieving the goals of education as a necessity, including a desire to put learning into action, the need to see results from learning, and the need to get beyond barriers to education. Student motivation has always been a top concern for researchers and educators because it is intimately tied to student achievement and the desired outcome (Esra and Sevilen, 2021). Numerous studies have demonstrated that increasing student motivation to learn results in higher academic achievement as well as outcomes.

According to Ogunmoyero and Omasheye (2012), people have an inherent desire to learn and are hence teachable and inquisitive by nature. However, in order for people to succeed in learning, motivation is frequently required. The arousal, direction, and maintenance of students'

behaviors are all aspects of motivation, according to (Glynn and Koballa, 2006). This explains why students put in a lot of effort to succeed well in science classes, especially mathematics. It also clarifies the depth, duration, and feelings that go into such undertakings as well as the motivation behind achievement in such fields.

Different theories can be used to analyze motivation. The convictions of a person in their ability to do something, their reasons and aims for accomplishing the assignment in question, and their subjective reaction to finishing the duties all fall under the umbrella term of motivation in the discipline of education. According to a study, motivating students to learn could be the solution to their mediocre performance in mathematics. Despite the fact that multiple studies have shown a direct correlation between motivation and overall academic achievement, they claimed that there is a gap in the study for students in the high levels of education.

Different theories can be used to analyze motivation. The convictions of a person in their ability to do something, their reasons and aims for accomplishing the assignment in question, and their subjective reaction to finishing the duties all fall under the umbrella term of motivation in the discipline of education. As a result stated that a student's commitment to giving an academic endeavor significance and value in order to gain its rewards is referred to as "motivation to learn" (Glynn and Koballa, 2006). Students need to be motivated and inspired in order to arouse and sustain their interest in mathematics learning. This is required because mathematical operations are abstract and complicated. However, motivation results from the desire to achieve a goal.

Using a successful method for motivating students is essential to raising their performance (Bataineh, 2014). When students are motivated, doing mathematics comes naturally to them and brings them tremendous happiness. According to Hafizul et al. (2017), if educators want their students to succeed in all they study in school, they must pay urgent attention to motivation as a few of the crucial components. As a result, learning will become more motivating once it is assumed to be necessary. Success and learning both depend on motivation. In the context of higher education, motivation is considered as having a structure that is multidimensional and tied to learning and motivation for study. According to Theobald (2006), motivation improves learning and helps students develop and maintain an interest in mathematics. Due to the link between student motivation and performance, particularly boosting motivation for learners in the mathematics classroom is an essential issue for instructors and researchers. motivation (Alagic et al., 2007). The forces that account for enthusiasm, choice, direction, and continuity of activity are often referred to as motivational factors. Brown (2011) believed that when students are highly motivated, they will be interested in learning mathematics.

3.3 Interest in Mathematics on Students' Achievement

It is a common belief among mathematics researchers that with regards to learning, one of the most crucial components is interest in the learning of mathematics. According to Oyeniran (2003), learning is the process of gaining knowledge, developing a skill, improving oneself, or moving forward. Interest is a prerequisite for knowledge of any kind to have an impact on character. The data that must be processed by the mind must become ingrained in and uniquely its own. This implies that learning requires interest, which is a necessary prerequisite. Interest is a highly important aspect in mathematics instructions, according to Obodo (1997). He added that the type of interest learners build for the subject greatly influences the degree and direction of attitude toward mathematics. That is to say, a lot of students have such high levels of nervousness from traumatic events in the lower grades that by the time they are in high school, they are fundamentally petrified in the subject of mathematics. Hidi and Renninger (2006) defined interest as a psychological state characterized by involvement in or a propensity to continue involvement with a given piece of content across time. Their research divided interests into two categories: situational interests and individual interests. when students are motivated by a variety of circumstances or specific environmental elements. Such an interest is categorized as situational interest. Personal interest, on the other hand, is an interest that develops through time because of a sustained interest in a subject or activity. According to Arthur et al. (2014), students naturally gravitate toward deeper study about a subject when they are interested in it. Their theory is that students are motivated to learn even when their teacher is not present because of their interests.

Literature is replete with examples of how academic accomplishment and interest of students are positively correlated. Increased attention, efforts, effects, and experience were mentioned as some of the fundamental qualities of interest in the study done by Toli et al., (2021). To increase students' interest in learning science, their study used a situational interest growth approach. In the end, it became clear that there is a positive correlation between students' interest and their educational outcomes or performance. In other words, it was found that how students do is influenced by their level of interest. Azmidar et al. (2017), one of the most significant aspects influencing students' performance is their interest in studying. They came to the conclusion that students who show a high level of interest in learning mathematics perform well in the subject, and the opposite is also true. Reeve et al. (2015) claim that students' passion in mathematics propels them to want knowledge in the subject, which ultimately boosts their achievement in the subject. According to a recent study by Luzano (2023), student's decreased interest in mathematics instruction may also be a contributing factor to their poor mathematics performance. Singh et al. (2002) stated that one of the attitudes and influential variables that predict academic achievement of students in studying mathematics or avoidance of it is interest.

3.4 Students' Mathematics Achievement

A student's achievement is determined by how much of a course material or topic they have learned. What a student has accomplished in the past serves as the foundation for his potential in the future, Aiken (1985). Most researchers are of the opinion that the achievement of students in mathematics has continuously been appalling. One of such researchers is for example, many times, students struggle to understand the mathematical concepts that their teachers are trying to teach them, which results in a general lack of success in examinations that are internal as well as external (Ale, 1989). To achieve the ambitions of both the individual student and Nigeria as a whole, secondary school mathematics education in Nigeria requires constant improvement. According to research, poor performance in mathematics external tests is becoming more prevalent (Akinsola, 2013). This might be because some individuals are unaware of how important the subject is to everyday life, especially for people who aspire to become business people and for the country as a whole.

The analysis posited that in order to receive appropriate therapy in the classroom, students' fear of mathematics has been recognized as learning ailment, but people are yet to discover the virus that is responsible for it (Abdullahi, 2018). However, when mathematics is taught and learned in class, the signs of this ailment are constantly visible on the faces of the students. Students who abhor mathematics refuse to increase their interest in the subject in secondary school, and this attitude is carried over to higher educational institutions. Students are known to leave the classroom early or during mathematics classes under the illusion of taking a break.

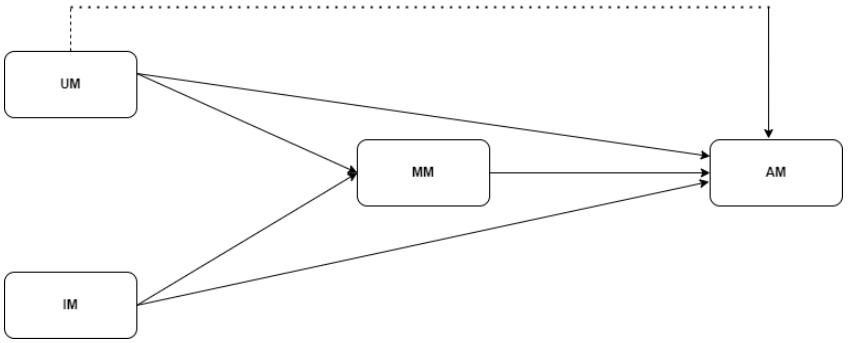

Figure 1: Conceptual Framework

It is clear from the existing research that student performance in mathematics is quite low. The academic performance of students in mathematics has always been subpar, despite how crucial mathematics is to one's career or the country as its entirety. Academic performance is

undoubtedly a major problem for educational scholars because students' lives become unpredictable and depressing when they perform poorly on national exams. It should be emphasized that a student's success or failure in senior high school plays a significant impact in whether or not they will continue their education at the postsecondary level, and mathematics plays a significant role in this regard. Numerous research has examined how gender affected math proficiency. The scholastic achievement of girls in mathematics was comparable to that of boys in the primary grades, but it decreased in middle school, according to research (Morgade and Bonder's, 1995). Furthermore, investigation conducted found that girls' arithmetic abilities tend to be on par with boys in the early primary school years but tend to deteriorate in high school by (Fennema and Sherman, 1977). The TIMSS findings revealed that there is no disparity in the standard level of mathematical knowledge among male and female students across all of the examined countries (Ismail, 2009).

4. Materials and Methods

4.1 Population, Sample and Data Collection

This study adopted descriptive design with quantitative research method. The population for the research was all the form three students in Senior High School in the Kumasi Metropolis in the Ashanti region. The form three students were used since they are more exposed to mathematics and have more experience in mathematical concepts compared to those in form one and form two. The target population comprised three selected schools in the Kumasi Metropolis. The total population of the form three students in the three schools under was 3650. Using confidence interval of 95% with 5% (0.05) margin of error, the Yamene's formular was used to calculate the sample size as illustrated below:

$$n = \frac{N}{1+Ne^2}$$

$$n = \frac{3650}{1+3650x0.05^2} = 360$$

To determine how many students to be sampled from each of the three schools, the population of each school was expressed as a fraction of the population of the three schools (3650) multiplied by the total sample (360). Prempeh College=1020/3650 x 360=100, Kumasi Girls' SHS=1109/3650 x 360=110 and Armed Forces SHS=1521/3650 x 360=150. Since there were five departments, namely: General Science, General Arts, Home Economics, Business and Virtual Art, the sample to be selected from each department in each school was found by dividing the total sample of each school by five.

Cluster random sampling was first used to select clusters from each department. In each school, the classes under each department were put into clusters. For each of these departments, the class representatives were invited to participate in a simple ballot to select their class as a cluster or otherwise for the study. This was done by using cards, some bearing "Yes" and others bearing "No." If a class representative picked "Yes," it means his or her class would be included in the research. Nonetheless, if a class representative picked "No," it means his or her class would be excluded from the data collection exercise. The researcher arrived at the classes from each of the departments for the study. To ensure that each students had the same likelihood of being chosen, a simple random sampling method was adopted. In all, the required 360 students were selected for the study.

4.2 Measures and Questionnaire

This research used one dependent variable, that is performance in mathematics, one mediator, that is motivation in mathematics, and two independent variables, which are usefulness of mathematics and interest in mathematics. The performance of students in mathematics measurement items were adapted from Zhou et al. (2020); students' interest in mathematics measurement item were developed from Zhang and Wang (2020); those of the usefulness of mathematics were drafted from Fennema (1976) and those of motivation in mathematics were developed from Prast et al., (2018). There was a total of 40 items on the questionnaire, 10 items for each of the four variables. Although the measurement items were chosen from earlier research, they were amended in order to suit the current study's primary focus on Usefulness of Mathematics, Interest in Mathematics, Motivation in Mathematics and Achievement in Mathematics.

5. Validity and Reliability Analysis

Amos (ver. 23) was used to calculate CFA. The CFA analysis is defined in Table 1. The observed variables from the rotated components were used to examine the CFA following the EFA. The CFA was examined using factor loading larger than 0.4, and observable variables from the EFA with weak factor loading below 0.5 were eliminated. Table 1 shows that there were three variables for Mathematics Usefulness, three for Mathematics Motivation, three for Mathematics Interest, and five for Mathematics Achievement. Variables eliminated under each construct had inadequate factor loading, which was evident from the EFA results.

Table 1: Confirmatory Factor Analysis (Cfa)

Model Fit Indices: CMIN = 210.258; DF = 97; CMIN/DF = 2.168; TLI = .983; CFI =.988 ; RAMSEA = .057; SRMR = ; PClose = .132	**Factor Loadings**
Usefulness of Mathematics (MATH_USE): CA = .953; CR = .964; AVE = .871;	
UM5: I will pursue mathematics related course in future	.988
UM6: Learning Mathematics helps me learn other subjects	.906
UM7: Mathematics is the best among all the subjects I study	.924
UM8: I will get good job in future if I learn mathematics	.912
Mathematics Motivation (MATH_MOT) : CA = .927; CR = .931; AVE = .819;	
MM1: My teacher motivates me to do mathematics	.951
MM4: I study on my own the lesson I missed in class	.788
MM5: I find extra time to practice mathematics	.965
Mathematics Interest (MATH_INT) : CA = .974; CR = .975; AVE = .928;	
IM1: I feel happy in solving mathematics	.923
IM2: I enjoy learning mathematics	.976
IM3: Mathematics is not a boring subject to me	.990
Mathematics Achievement (MATH_ACH) : CA = .984; CR = .983; AVE = .895;	
AM1: I perform well in mathematics	.966
AM2: I think I am good in mathematics	.951
AM3: My friends think I am successful at mathematics	.934
AM4: I see myself as successful student in mathematics	.934
AM8: I am able to solve questions without my teacher's assistance	.933
AM9: I am able to answer questions during mathematics lessons	.957
AM10: I get good grades in mathematics exams	.946

Cronbach's alpha (CA) was also used to evaluate the observed variables' internal consistency. The CA of the retained items of the various variables under study was calculated using SPSS (v.23). It should be noted that when the CA score is at least 0.7, there is an achievement of the reliability of the observed variables. The CA of all the latent variables captured in the table were above 0.7, which is an indicative of the achievement of internal consistency. The CA score of Usefulness of Mathematics was 0.953, the CA score of Mathematics Motivation was 0.927, the CA of Mathematics Interest was 0.974 and that of Mathematics Achievement was 0.984.

To assess the convergent validity and reliability of the resulting observed variables that estimated the CFA, the average variance extracted (AVE) and composite reliability (CR) were determined. It is recommended that the AVE and CR have expected values of at least 0.5 and 0.7, respectively. The technique of other researchers, such as, who explained that discriminant validity is acquired when AVE has a value above the correlation coefficient, which the coefficient values were derived from the CFA output using the covariance, was used to evaluate the discriminant validity (Arthur, 2022). Table 2 compares the $\sqrt{AVE}$ and associated latent variable association.

Table 2: Discriminant Validity

Variable	MATH_USE	MATH_INT	MATH_MOT	MATH_ACH
MATH_USE	.933			
MATH_INT	.376***	.963		
MATH_MOT	.232***	.298***	.905	
MATH_ACH	.329***	.407***	.326***	.946

According to Table 2, where the lowest AVE value is .905 and the greatest correlation coefficient is .407, the least AVE value is bigger than the highest value for correlation of the latent variables. It is clear from this why discriminant validity is attained.

Table 3: Direct Path

Direct Path	Std. Estimate	S.E	C.R	P-Value
Gender→ MATH_ACH	-.100	.102	-.978	.328
Age → MATH_ACH	.039	.118	.328	.743
Programme → MATH_ACH	.040	.036	1.101	.271
Track → MATH_ACH	.282	.117	2.414	.016
MATH_MOT → MATH_ACH	.215	.053	4.021	.000
MATH_INT → MATH_ACH	.302	.059	5.082	.000
MATH_USE → MATH_ACH	.174	.044	3.938	.000
MATH_USE → MATH_MOT	.193	.043	4.445	.000
MATH_USE → MATH_INT	.251	.038	6.524	.000
MATH_MOT → MATH_INT	.208	.047	4.388	.000

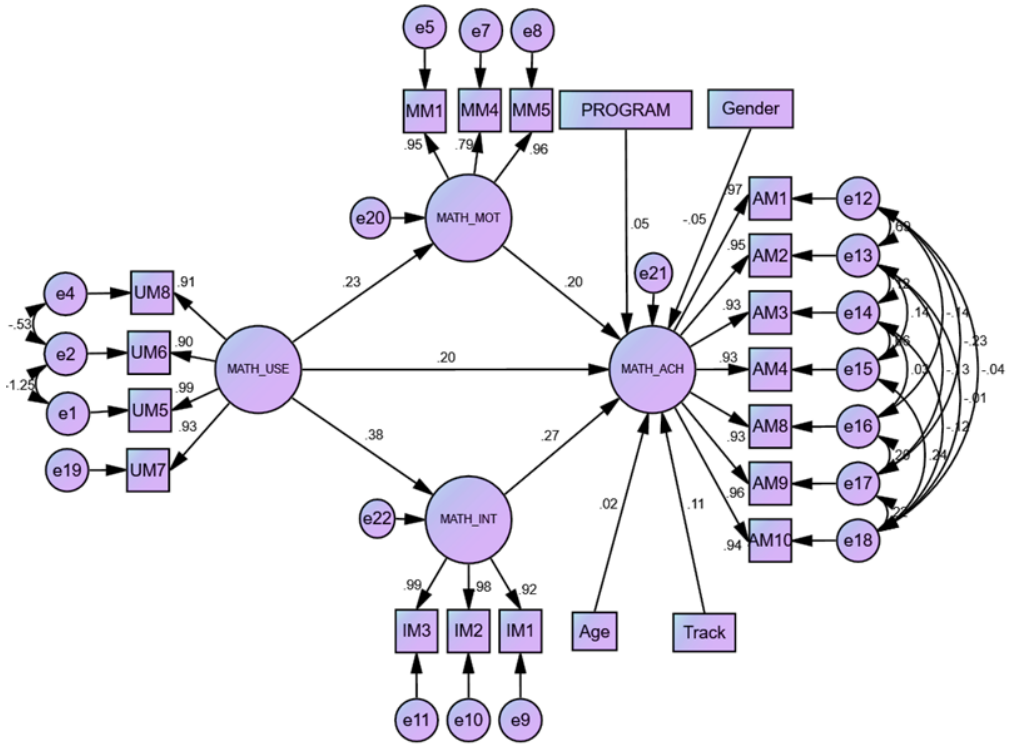

Figure 2: Structural Paths

Research Question One: What is the impact of usefulness of mathematics on students' mathematics achievement?

The first research question sought to find the impact of usefulness of mathematics on students' mathematics achievement. This was answered by the direct effect analysis (MATH_USE→MATH_ACH) from table 3. Usefulness of mathematics has a direct positive effect on mathematics achievement as a predictor with a p-value < 0.01. The results of the analysis showed that relationship between usefulness of mathematics and mathematics achievement had a p-value of 0.000 which was statistically significant at 1%. Results on the hypothesized paths indicate that usefulness of mathematics had a direct positive impact on mathematics achievement among senior high school students (β = 0.174; C.R. = 3.938). This means that about 17.4% of the improvement in the mathematics achievement of high school students is experienced, when students know the usefulness of mathematics.

Research Question Two: What is the effect of mathematics motivation on students' mathematics interest?

The second research question sought to find the effect of mathematics motivation on students' mathematics interest. This was answered by the direct effect analysis (MATH_MOTI→MATH_INT) from table 3. Mathematics motivation has a direct positive effect on students' mathematics interest as a predictor with a p-value < 0.01. The results of the analysis showed that relationship between mathematics motivation

and mathematics interest had a p-value of .000 which was statistically significant at 1%. Results on the hypothesized paths indicate that mathematics motivation had a direct positive impact on students' mathematics interest (β = .208; C.R. = 4.388).

Research Question three: What is the impact of interest of mathematics on students' mathematics achievement.

The third research question sought to find the impact of mathematics interest on students' mathematics achievement. This was answered by the direct effect analysis (MATH_INT→MATH_ACH) from table 3. Mathematics interest has a direct positive effect on mathematics achievement as a predictor with a p-value < 0.01. The results of the analysis showed that relationship between mathematics interest and mathematics achievement had a p-value of 0.000 which was statistically significant at 1%. Results on the hypothesized paths indicate that mathematics interest had a direct positive impact on mathematics achievement among senior high school students (β = 0.302; C.R. = 5.082).

Research Question Four: What is the mediating effect of mathematics motivation between usefulness of mathematics and mathematics achievement?

Table 4: Indirect Path

Path effect	Std. Estimate	S.E	C.R	P-Value
MATH_USE→ MATH_ACH	.235	.044	5.366	.000
MATH_USE → MATH_MOT	.192	.043	4.435	.000
MATH_MOT→ MATH_ACH	.280	.054	5.143	.000
Indirect effect	**Std. Estimate**	**Lower BC**	**Upper BC**	**P-Value**
MATH_USE→MATH_MOT→MATH_ACH	.118	.037	.288	.001

From table 4, usefulness of mathematics has a direct positive impact and statistically significant on mathematics achievement with p-value less than 1% (β = .450; C.R = 3.595). This means that, 45% improvement of students' mathematics achievement is by usefulness of mathematics. Moreover, Usefulness of mathematics has a positive effect and statistically significant on students' mathematics motivation with p-value < 1% (β = .319; C.R = 4.029). Also, Mathematics motivation has a positive effect and statistically significant on students' mathematics achievement with p-value < 1% (β = .796; C.R = 4.125). The indirect effect size of .118 was statistically significant with p-value less than 1%, as shown in Table 8 (zero does not lie within the range of the lower bound =.037 and the upper bound =.288). This means that, mathematics motivation partially mediates the relationship between usefulness of mathematics and students' mathematics achievement. The study further explains that, without the mediating variable (mathematics motivation), usefulness of mathematics has a positive effect and statistically significant on students' achievement in mathematics.

6. Findings and Discussions

According to the study's analysis, usefulness of mathematics has a direct positive effect on mathematics achievement. The results of the analysis showed that the relationship between usefulness of mathematics and mathematics achievement was statistically significant, which support a number of writings and literature works of many researchers. For instance, conducted a study to ascertain the correlation between mathematics usefulness and mathematics success (Guy et al., 2015). They came to the conclusion that mathematics usefulness is a positive predictor of success. According (Adelson et al., 2011) to the perceived usefulness is the opinion students have regarding the applicability or significance of mathematics in both the present and the future. They also stated that learners' broad views about the subject, mathematics which will ultimately improve their academic success in the subject, are directly influenced by how they view the important nature of mathematics. The work of Eccles & Harold (1991) clearly supports the findings of this research. In their work, they intimated that, discovering a meaning and significance in one's task may additionally promote participation on the part of students, their growth of competence, an improvement in performance.

The study found out that there exists a direct positive effect on mathematics motivation and students' mathematics interest. In other words, mathematics motivation has a direct positive effect on students' mathematics interest. The findings of this study also revealed a statistically significant correlation between mathematics motivation and students' mathematics interest. There are a lot of writings that support this finding of the study. Various researchers have uncovered this positive correlation between these two variables. These researchers believe that in order to enhance the interest of students in learning mathematics, motivation should be regarded as a crucial factor. For example (Yeh et al., 2019), asserted that a low level of motivation results in low interest in learning mathematics and hence low achievement. Admittedly, from the work of these researchers, a high level of motivation will arouse and sustain the interest of students in learning mathematics which will result in a better performance of students. This assertion then confirms that the students' interest and their academic achievements are correlated.

Again, the findings discovered that motivation ignites students' interests in a variety of academic fields and consequently results in improvement performance, particularly in mathematics (Smith et al., 2012). This means that, the higher the motivation, the more interested students become in learning mathematics.

The study's findings showed that there was a statistically significant correlation between students' mathematics interest and mathematics achievement, something that can be supported by a lot of assertions by various researchers and educators. It can be reported from the findings of the study that mathematics interest has a direct positive effect on mathematics achievement.

Studied interest as one of the attitudinal and influential variables that are predictors of students' achievement in learning or avoidance of learning mathematics (Singh et al., 2002). They stated categorically that lack of interest in learning mathematics results in low achievement and vice versa. This then presupposes that any teacher who is able to arouse and sustain the interest of his students in their mathematics education will see his students do well asserted that the abstract nature of mathematics makes it difficult for students to have interest in the subject (Yeh et al., 2019). Consequently, this loss of interest in the subject leads to low achievement. Conversely, high interest in mathematics leads to high achievement. The study conducted by (Toli et al., 2021) studied the basic characteristics of interest, which they identified as increased attention, efforts, effects and experience. In the end, it came to light that students' interest and their learning outcomes or performance are positively correlated. In order words, they discovered that interest influences students' performance. The study of (Azmidar et al., 2017) highlighted student interest as one important factor that affect their performance. Their conclusion, which was students who exhibit a high level of interest in learning mathematics do well in the subject and vice versa really supports this research finding. Again, the findings of this present study are also in accordance with the study of (Reeve et al., 2015), which posited that interest students have in learning mathematics catapults them to crave for having mathematical knowledge eventually promotes their achievement in mathematics. Similarly, according, students' reduced interest in learning mathematics may be another factor that contributes to low success in mathematics to (Luzano, 2023). This presupposes that reduced interest may lead low academic achievement, whereas increased interest fosters high academic achievement. Furthermore by Tsoto et al., (2016), the research is in support of the findings of this current research. In their research, they concluded that the interests of students foster their accomplishments in mathematics and that these interests have been proven to increase the drive of learners to study mathematics and have a bearing on their academic performance.

The mediating analysis (indirect path) was the main focus of this present study. Motivation in mathematics was used as a mediator between usefulness of mathematics and mathematics achievement. This means that, mathematics motivation partially mediates the relationship between usefulness of mathematics and students' mathematics achievement. The study further explains that, without the mediating variable (mathematics motivation), usefulness of mathematics has a positive effect and statistically significant on students' achievement in mathematics.

7. Conclusion

First, it can be concluded that students' knowledge of the usefulness of mathematics enhances their achievement. Second, the findings of the study revealed to the researcher that mathematics motivation has the potency of positively influencing students' interest in learning the subject.

Third, it can be concluded based on the findings of the study that, students' mathematics interest is an extremely important factor in enhancing the achievement of students in mathematics. Fourth, the results obtained from the data analysis revealed that mathematics motivation partially mediated the relationship between usefulness of mathematics and students' mathematics achievement.

RECOMMENDATIONS

- It was recommended that all the stakeholders of education, government, teachers, parents and so on must intrinsically and extrinsically motivate students when it comes to the study of mathematics.
- The management of the school must periodically organize workshops and seminars to sensitize students on the usefulness of mathematics in both their daily lives and future.
- Teachers must professionally upgrade themselves from time to time in order to become abreast with the new motivational teaching strategies in our technologically-oriented world.
- It was recommended that further studies be carried out in other parts of the country to investigate the mediating role of motivation on the usefulness of mathematics and the interest of students owing to the fact that this present study focused on only three schools in the Kumasi metropolis of the Ashanti region.

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