# Examining the Nexus between High School Students' Mathematics Performance and their Self-efficacy, Interest, and Motivation

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**Abstract:** The study investigates the nexus between high school students' mathematics performance and their self-efficacy, interest, and motivation. The study sampled 280 students from two selected senior high schools in the Ashanti Region of Ghana. The study employed purposive and convenience random sampling techniques. A structured questionnaire with closed-ended questions was used as an instrument for data collection. The study used multiple linear regression analysis run in SPSS (ver. 23) to assess the various research questions. The results indicate that students' self-efficacy, students' interest, and motivation had a significant positive effect on students' mathematics performance. Therefore, it is recommended that educational stakeholders should consider students' self-efficacy, interest, and motivation into account to have a significant impact on their mathematics performance.

**Keywords:** Self-efficacy, Interest, Motivation, Mathematics performance

## 1. Introduction

Mathematics is universally recognized as a foundational subject essential to the intellectual development of learners and the overall advancement of societies. It plays a critical role in shaping cognitive abilities such as logical reasoning, problem-solving, and abstract thinking, skills that are vital in nearly every domain of life (Hakim et al., 2023). In the educational context, mathematics forms the backbone of many academic disciplines, including science, engineering, technology, economics, and even the social sciences. As such, proficiency in mathematics is not only a prerequisite for success in these fields but also a key determinant of career readiness and employability in the 21st-century global economy (National Council of Teachers of Mathematics [NCTM], 2020; OECD, 2022). Moreover, standardized international assessments like PISA and TIMSS have repeatedly highlighted the importance of mathematical competence as a predictor of students' future academic performance and life outcomes (OECD, 2019). Beyond the classroom, mathematics is deeply embedded in everyday life. Individuals rely on basic and advanced mathematical concepts to make informed decisions about finances, health, time management, and technology usage. From budgeting household expenses to interpreting data in the news, citizens are continually required to apply mathematical reasoning in real-world contexts (Barwell & Kuntze, 2021). Furthermore, in an increasingly data-driven society, mathematical literacy is essential for critical engagement with issues such as climate change, economic inequality, and public health issues that require the ability to analyze trends, assess risks, and evaluate quantitative evidence (Kolawole & Temilade, 2025). Consequently, developing strong mathematical skills not only benefits the individual learner but also contributes to a more informed, analytical, and productive society (Methkal, 2022).

Despite the critical role mathematics plays in educational and societal development, persistent underachievement in mathematics remains a significant concern among Senior High School students globally. Various international assessments, including the Programme for International Student Assessment (PISA), have consistently reported declining or stagnant mathematics scores among high school students, particularly in low- and middle-income countries (OECD, 2019). For instance, in the 2018 PISA results, over 76% of students from Sub-Saharan Africa scored below the minimum proficiency level in mathematics, indicating a widespread lack of essential skills needed for further education and the workforce (UNESCO, 2020). Similarly, the Trends in International Mathematics and Science Study (TIMSS) 2019 report indicated that many students in developing regions, including parts of Asia and Africa, perform significantly below the international benchmark (Rjosk, 2022). These findings suggest that traditional teaching methods, curriculum misalignment, lack of qualified teachers, and insufficient instructional time may contribute to consistently poor outcomes in mathematics education (Buabeng & Amo-Darko, 2025). In the context of Ghana, for example, the persistent underperformance in mathematics at the Senior High School level has been well-documented in national assessments and West African Examinations Council (WAEC) reports. According to the WAEC Chief Examiners' Reports (2021, 2023), a large proportion of students continue to score below average in core mathematics, with frequent complaints about poor conceptual understanding, procedural errors, and fear of the subject. The Ghana National Education Assessment (NEA) of 2022 further revealed that only 22% of Senior High School students demonstrated proficiency in basic mathematical concepts, raising alarm about the readiness of these students for tertiary education and competitive job markets (Ghana Education Service, 2022).

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Scholars have emphasized that such outcomes are often linked to students' lack of motivation, low self-confidence, negative attitudes toward mathematics, and limited use of interactive and context-based teaching strategies (Deveci & Karteri, 2022). Addressing these challenges requires targeted interventions that enhance students' psychological readiness and engagement with mathematics.

Self-efficacy, interest, and motivation are widely recognized as pivotal psychological constructs that significantly shape students' academic performance, especially in challenging subjects like mathematics. Self-efficacy, as conceptualized by Bandura (1993), refers to an individual's belief in their capacity to successfully perform specific tasks. In mathematics education, students with high self-efficacy are more likely to engage in problem-solving activities, persist in the face of difficulty, and demonstrate higher academic achievement (Holenstein et al., 2022). Studies have consistently demonstrated a strong positive correlation between mathematics self-efficacy and students' performance across various educational levels (Yang et al., 2024). These beliefs influence not only the effort students invest in learning but also their resilience and strategic thinking when confronted with complex mathematical problems. In addition to self-efficacy, interest and motivation play vital roles in driving students' engagement and success in mathematics. Interest represents a psychological state of focused attention and enjoyment during learning, which can evolve into a deeper individual predisposition toward a subject over time (Tan et al., 2021). Mathematics interest has been found to mediate the relationship between classroom experiences and long-term performance outcomes (Hendrawijaya, 2022). Meanwhile, motivation, particularly intrinsic motivation, the internal desire to learn for its own sake, has been linked to deeper cognitive engagement, better problem-solving skills, and higher academic performance in mathematics (Zhang et al., 2023). Together, these constructs not only determine how students approach mathematics learning but also influence their persistence, emotional reactions to failure, and long-term attitudes toward the subject. Enhancing students' self-efficacy, fostering their interest, and sustaining their motivation are therefore crucial strategies for improving mathematics achievement at the Senior High School level.

Despite the growing body of research emphasizing the importance of psychological factors in academic achievement, there remains a notable gap in the integration and contextual application of self-efficacy, interest, and motivation as a combined framework in mathematics education, particularly within Senior High School settings in sub-Saharan Africa. Most existing studies tend to focus on these constructs in isolation, neglecting the interactive or mediating effects they may have on one another and students' mathematics performance (Okenyi, 2023; Yu & Singh, 2018). Additionally, a significant proportion of the literature draws heavily from Western educational contexts, which may not fully capture the socio-cultural and educational dynamics influencing students' learning behaviors in African or low-resource settings (Areepattamannil & Caleon, 2017; Nyavor & Mensah, 2024). As such, empirical evidence that holistically examines the intertwined roles of self-efficacy, interest, and motivation in mathematics performance at the high school level, especially in developing countries, remains limited and underexplored (AlAli & Wardat, 2024; Zuo et al., 2024).

Moreover, educational interventions and policies often overlook the integration of affective and motivational dimensions into the mathematics curriculum, which continues to focus primarily on cognitive skill acquisition and exam-oriented instruction (Ghaleb, 2024; Yasmin et al., 2023). There is a lack of localized studies that explore how enhancing students' belief in their mathematical abilities, sparking interest, and sustaining motivation could serve as strategic levers to improve performance. Furthermore, while international reports such as those from TIMSS and PISA ( OECD, 2019) have emphasized the role of motivation and self-belief in shaping student achievement, few studies have operationalized these findings into actionable insights for educational practice in specific countries like Ghana. Thus, this study seeks to fill this gap by empirically examining how the synergy of self-efficacy, interest, and motivation affects mathematics performance among Senior High School students in a context that has been largely understudied. The findings are expected to inform not only academic discourse but also targeted pedagogical strategies and interventions in mathematics education.

### 1.1. Research Questions

1. What is the effect of self-efficacy on high school students' mathematics performance?
2. Does mathematical interest affect high school students' mathematics performance?
3. What is the effect of motivation on high school students' mathematics performance?

## 2. Literature Review

### 2.1. Effect of Self-efficacy on High School Students' Mathematics Performance

Students' confidence in their capacity to comprehend and complete mathematical problems is known as their self-efficacy in mathematics learning. This concept is based on Bandura's social cognitive theory, which highlights that people are more willing to participate in and stick with tasks even when they are difficult if they think they can do well. Self-efficacy is noted as an important component of educational outcomes since it has been demonstrated in numerous research studies to have a substantial correlation with academic performance and motivation in mathematics (Usher, 2009). Self-efficacy has a dynamic role in mathematics learning at different educational levels, according to recent empirical studies. The use of metacognitive methods and overall performance in mathematics examinations were found to be significantly influenced by students’ mathematics self-efficacy, for instance, according to a study by Gu (2019). Moreover, the classroom settings, peer interactions, teacher feedback, and past learning experiences all have an impact on the development of self-efficacy. Several empirical studies have underscored the effect of self-efficacy on students' mathematics performance. For instance, Assouline et al. (2021) examined high school students’ self-efficacy in several geographical areas and found that, irrespective of gender ot socioeconomic background, individuals with stronger self-efficacy performed better in mathematics. Similarly, Zhu and Kaiser (2022) integrated data from more than 60 studies in a meta-analysis and found that students’ math achievement was moderately to strongly impacted by self-efficacy. In addition, Oppong-Gyebi et al. (2023) on their study of improving STEM mathematics achievement through self-efficacy, student perception, and mathematics connection: The mediating role of student interest withsampled 385 general science respondents from eight selected senior high schools in the Kumasi metropolis for this study reveald that self-efficacy had a significant positive effect on mathematics achievement. Moreover, Abdulai and Arthur (2024) on their study of enhancing student mathematics performance through teaching quality, motivation, and students self-efficacy with a sample size of 355 students students pressuring agric, business, general science, and general arts at Ambariya Senior High School revealed that self-efficacy had a insignificant positive effect on mathematics performance with an effective size of 0.006. Again, Akendita et al. (2025) conducted a study on the moderating effect of teacher efficacy on the relationship between students' perception of mathematics and students' mathematics achievement with a sample of 300 form 1 and form 2 senior high school students from Bolgatanga Senior High School and Zamse Senior High Technical School in Ghana. Their study was collated through a structured questionnaire and analyzed utilizing Structural Equation Modeling (SEM) run from Amos (v. 23). The study results revealed that teacher efficacy had a significant direct positive effect on students' mathematics achievement, ($\beta = .077; CR = 1.041$). In conclusion, Appiah et al. (2023) in their study on “Teacher-student relationship and students’ mathematics achievement: Mediating roles of students’ perception of mathematics, students’ self-efficacy, and cooperative learning strategies” revealed that students' self-efficacy had a significant negative effect on their mathematics achievement ($\beta = -.143$).

### 2.2. Effect of Students' Mathematics Interest on High School Mathematics Performance

The term “student interest in mathematics” describes their emotional propensity and internal drive to interact with mathematical ideas, problems, and activities. Both situational interest, which is sparked by particular aspects of the learning environment, and individual interest, as a more persistent inclination toward mathematics, are included in these psychological constructs. A strong interest in mathematics tends to make students more involved, inquisitive, and open to exploring mathematical concepts, all of which improve learning outcomes and academic achievement. According to Morano et al. (2021), interest can be used as a motivating tool to lower fear, boost perseverance, and encourage the growth of mathematical thinking. Empirical studies have established mathematics interest as a key factor influencing students’ achievement, choice of STEM careers, and long-term academic trajectories. For instance, a study by Bright et al. (2024) on the effect of using technology in teaching and learning mathematics on students' mathematics performance. In their study, students’ mathematics interest was used as a mediating variable. The sample size for their study comprises 216 students from three selected SHS in Kumasi, Ghana. Data was collated through a structured questionnaire and analyzed using structural equation modeling run from Amos (v. 23). Their result found that students' mathematics interest had a significant positive effect on their mathematics performance with an effect size of 0.487. From their result, students ' interest had a 48.7% positive significant effect on their mathematics performance. Comparing the current result to the result from Bright et al.'s (2024) study, there was a higher effective size difference of .098 (9.8%) compared to the previous study. This shows that, current study results in a difference of 9.8% effect of students' mathematics interest on their mathematics performance, when using 280 students from two selected senior high schools in the Ashanti Region of Ghana. From this point of view, Kaku and Arthur (2024) study on mediting role of students interest on the relationship between students mathematics perception and performance with a sample size of 290 students selected through stratified and simple random sampling methods and data was analyzed using structural equation modeling via Amos (v. 23) reavled that student interest significantly and positively predicts mathematics performance with an effect size of 0.275. In a similar vein, Fosu et al. (2022) examined the mediation and moderation effects of mathematics interest and teachers' quality between self-concept and mathematics achievement. The targeted participants, comprising 300 students who offered general arts, general science, and home economics, were randomly selected from a population of 1,200. The data collected for their study was analyzed using structural equation modeling (SEM) via Amos (v. 23). Their study result revealed that students' interest had a significant positive effect on their mathematics achievement with an effect size of 0.773. In this context, Arthur et al. (2022) also conducted a study on enhancing performance in mathematics through motivation, peer-assisted learning, and teaching quality, as mediated by student interest. Their study was conducted on 373 first-year undergraduate students of Akenten Appiah-Menka University of Skills Training and Entrepreneurial Development (AAMUSTED), who studied on the Kumasi campus. The data was gathered using a structured questionnaire during lecturing hours. Their study hypothesized paths were analyzed by structural equation modeling (SEM), using Amos (v. 23) software. Their analysis result revealed that students' mathematics interest had a significant positive effect on their performance in mathematics, with an effect size of 0.618. By comparing their result to the current study's result, the effective size was higher than the current study's effective size.

### 2.3. Effect of Motivation on High School Students' Mathematics Performance

The term "student motivation" in mathematics education refers to the inner motivation and outside factors that stimulate, guide, and maintain students' interest in mathematical problems and ideas. Intrinsic motivation (doing math for personal fulfillment or interest), extrinsic motivation (doing math for rewards or recognition), and goal orientations like mastery (learning for understanding) and performance (showing off ability to others) are all parts of motivation in this context. Resilient problem-solving, the use of successful learning techniques, and perseverance are all traits of motivated students. According to Benden and Lauermann (2022), students' attitudes, willingness to take intellectual risks, and long-term dedication to learning mathematics are all significantly influenced by their motivation. Students' success in mathematics is greatly influenced by their motivation. A motivated student is more likely to participate fully in their education, overcome obstacles, and eventually do better in mathematics (Ozkal, 2019). Students who are motivated learn maths more actively (Yu & Singh, 2018). Prolonged effort and a drive to study for the sake of learning might result from intrinsic motivation, which is derived from a sincere interest in and pleasure in mathematics (Ashton, 2018). Since students aren't driven just by incentives from outside sources, this kind of motivation frequently leads to improved performance. Students who are driven frequently have clear objectives for their academic work. These objectives can provide students with direction and act as a learning road map for maths.

An increasing number of studies have shown that students' motivation and their performance in mathematics are significantly correlated. Motivation has an impact on students' approach to learning assignments, perseverance in the face of adversity, and overall academic performance. Strongly motivated students are more likely to use successful study techniques, persevere longer, and approach mathematics with excitement, all of which have a beneficial effect on their performance. For example, a longitudinal study by Lazarides and Watt (2017) demonstrated that both intrinsic and utility motivation were high predictors of secondary students' ability in mathematics, with motivation levels in earlier grades influencing academic achievements over the long term. Moreover, Arthur et al. (2022) conducted a study on enhancing performance in mathematics through motivation, peer-assisted learning, and teaching quality, as mediated by student interest. Their study was conducted on 373 first-year undergraduate students of Akenten Appiah-Menka University of Skills Training and Entrepreneurial Development (AAMUSTED), who studied on the Kumasi campus. The data was gathered using a structured questionnaire during lecturing hours. Their study hypothesized paths were analyzed by structural equation modeling (SEM), using Amos (v. 23) software. Their analysis result revealed that students' mathematics interest had a significant positive effect on their performance in mathematics, with an effect size of 0.618. According to a study conducted by Zhou and Wang (2023) utilizing PISA data from 13 different nations, motivational attitudes, such as goal orientation, task value, and self-concept, had a direct and significant impact on mathematical achievement. Similarly, a study by Middleton et al. (2023) highlighted that students who were highly intrinsically motivated demonstrated greater interest and confidence in math-related tasks in addition to performing better on standardized tests. More recently, Wong and Wong (2021) demonstrated that motivation mediates the association between arithmetic achievement and classroom environment, indicating that motivational interventions can act as a stimulant to increase math classroom performance.

## 3. Methodology

### 3.1. Research Design

The study used a cross-sectional survey design and a quantitative research methodology. The researchers chose this approach because it made it possible to gather and analyze numerical data in a methodical manner, which allowed them to find trends and connections between different variables. A cross-sectional survey helps analyze the relationship between dimensions within a population at a particular moment in time, as Creswell (2014) points out. Accordingly, study data were collected from participants at a single point in time, giving a snapshot of the variables of interest free from the effects of time variations.

### 3.2. Population

The study's population comprises 933 first- and second-year students who were selected from two senior high schools in Ghana's Ashanti Region. These pupils are representative of a varied population actively involved in secondary education in the area. Since mathematics is a core topic for all of the students in the study, it is a required component of their academic path. The participants' regular exposure to mathematics teaching is guaranteed by this shared academic prerequisite, which is crucial for the study's focus.

### 3.3. Sample Size

The researcher can not study the entire students selected from the two senior high schools in the Ashanti Region of Ghana. For that matter, a sample size needed to be taken from the selected population. This makes the researcher use Yamane's (1967) sample size determination formula, which is given as;

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

Where n signified the unknown sample size, N signified the total population (set as 421), and e signified the error margin (set as 0.05).

By method of substitution, eqn (1) becomes;

$$n = \frac{N}{1+Ne^2} = \frac{933}{1+933(0.05)^2} = 280$$

**Table 1.** Demographics

| Demographics | Frequency(N) | Percentages (%) |
|---|---|---|
| **Gender** | **280** | **100.0** |
| Male | 108 | 38.6 |
| Female | 170 | 61.4 |
| **Age** | **280** | **100.0** |
| 11-15 years | 50 | 17.9 |
| 16-20 years | 220 | 78.6 |
| 21-25 years | 9 | 3.2 |
| 26 years and above | 1 | 0.4 |
| **Level of Education** | **280** | **100.0** |
| Form 2 | 138 | 49.3 |
| Form 3 | 142 | 50.7 |
| **Program of Study** | **280** | **100.0** |
| General Arts | 142 | 50.7 |
| General Science | 84 | 30.0 |
| Home Economics | 54 | 19.3 |

From Table 1, 170 (61.4%) were women, and 108 (38.6%) were men. 50 (17.9%) of the participants were between the ages of 11 and 15. 220 (78.6%) of the participants were between the ages of 16 and 20. Nine people, or 3.2% of the total, were between the ages of 21 and 25. One individual (0.4%) was older than 26. Of the students, 138 (49.3%) were enrolled in Form 2, 142 (50.7%) in Form 3, and 142 (50.7%) in the General Arts program. Thirty-eight (30.0%) were enrolled in the General Science program. The number of students enrolled in the home economics program was 54 (19.3%).

### 3.4. Sampling Techniques

The study utilized two sampling techniques: stratified sampling and simple random sampling. Stratified sampling was first employed by dividing the population into distinct subgroups, or strata, based on relevant characteristics, specifically, the students' courses of study and their levels of education. This approach helps reduce sampling error by ensuring that each subgroup is adequately represented, resulting in more accurate and reliable findings than using simple random sampling alone. Once the stratification was done, simple random sampling was applied within each stratum to select the respondents. This ensured that every individual within the population had an equal chance of being chosen.

### 3.5. Questionnaire and Measures

A structured questionnaire was employed as the primary instrument for data collection in this study. The questionnaire comprised two main sections. Section A focused on collecting demographic information, including respondents' gender, age, educational level, and program of study. Section B contained items designed to measure four key constructs: self-efficacy, interest, motivation, and mathematics performance, each aligned with the study's research objectives. To assess self-efficacy, six (6) items were adapted from the work of Oppong-Gyebi et al. (2023). Interest was measured using six (6) items adapted from Arthur et al. (2017), while student motivation was assessed through five (5) items drawn from Habók et al. (2020). Additionally, six (6) items from Ukobizaba et al. (2021) were utilized to evaluate mathematics performance. All items were measured using a five-point Likert scale, ranging from 1 (strongly agree) to 5 (strongly disagree). The questionnaire statements are presented in Table 2.

**Table 2.** Measurement Scale of the Variables

| Items | Statement | Source |
|---|---|---|
| **Self-Efficacy** | | Oppong-Gyebi et al. (2023) |
| SE1 | I am confident in my ability to solve mathematical problems in science, technology, and engineering. | |
| SE2 | I have the necessary skills and abilities to learn mathematics. | |
| SE3 | I am concerned that the other students are better at mathematics | |
| SE4 | Even when a math problem is hard, I can usually find a way to solve it. | |
| SE5 | I am confident I can explain math concepts to others. | |
| SE6 | I feel capable of getting good grades in mathematics. | |
| **Motivation** | | Habók et al. (2020) |
| MOT1 | I am motivated to do well in mathematics because I see its value in everyday life. | |
| MOT2 | I feel a sense of satisfaction when I solve a difficult mathematics problem. | |
| MOT3 | I study mathematics because I want to improve my skills, not just to pass exams. | |
| MOT4 | Even if I get a low score in math, I stay motivated to do better next time. | |
| MOT5 | Mathematics is one of the subjects I look forward to in school. | |
| **Interest** | | Arthur et al. (2017) |
| INT1 | Mathematics is one of my favorite subjects in school. | |
| INT2 | look forward to attending mathematics classes. | |
| INT3 | I feel excited when I learn something new in mathematics. | |
| INT4 | I am curious to understand how mathematical concepts work. | |
| INT5 | I find mathematics lessons interesting and engaging. | |
| INT6 | I often think about how mathematics applies to real life. | |
| **Mathematics Performance** | | Ukobizaba et al. (2021) |
| MP1 | I meet or exceed the expected performance level in mathematics. | |
| MP2 | I find it easy to complete mathematics classwork on my own. | |
| NP3 | I can explain mathematical solutions clearly to others. | |
| MP4 | I usually rank among the top students in my class in mathematics. | |
| MP5 | I feel confident during mathematics exams and tests. | |
| MP6 | I can apply mathematical knowledge in real-life situations. | |

The use of a pre-validated questionnaire enhanced the reliability, validity, and comparability of the findings, consistent with recommendations from Martin-Cook et al. (2021) and Sekhon et al. (2022). As emphasized by Aithal and Aithal (2020), employing established measurement scales minimized the need to develop and validate new instruments. While the items were adapted from previous studies, they were carefully modified to ensure cultural appropriateness, linguistic clarity, and contextual relevance within Ghana's educational environment. These adaptations aimed to align the items precisely with the study's objectives while maintaining their original theoretical integrity.

### 3.6. Validity and Reliability

The instruments employed in the study underwent a comprehensive validation process to ensure their alignment with the research objectives. Initially, content validity was assessed by experts specializing in self-efficacy, mathematics interest, motivation, and mathematics performance. These experts evaluated each item for clarity, relevance, and comprehensiveness, providing valuable feedback that informed the refinement and revision of the instruments to ensure they accurately captured the intended constructs. Furthermore, reliability analysis was conducted using Cronbach's alpha in SPSS (v.23). According to Anggraini et al. (2020), a construct is considered reliable if its Cronbach's alpha value is at least 0.7. Table 2 displays the reliability results for the study.

**Table 2.** Reliability Results

| Variable | Number of Item(s) | Cronbach's Alpha ($\alpha$) |
|---|---|---|
| Self-Efficacy (SE) | 5 | 0.956 |
| Interest (INT) | 6 | 0.896 |
| Motivation (MOT) | 5 | 0.877 |
| Mathematics Performance (MP) | 6 | 0.887 |

Based on Table 2, self-efficacy was measured using seven (7) items with a Cronbach's alpha of 0.956, mathematics interest with eight (8) items yielding an alpha of 0.896, motivation with seven (7) items scoring 0.877, and mathematics performance with seven (7) items scoring 0.887. All Cronbach's alpha values exceeded the minimum acceptable threshold of 0.7, indicating strong internal consistency and high reliability among the measurement items for each construct.

### 3.7. Inter-Correlation Analysis among Predictor Variables and High School Students' Mathematics Performance

The result from the correlation analysis in Table 3 indicates that the predictor variables significantly relate to the dependent variable, which is the high school student's mathematics performance. The study of the correlation analysis reveals that some of the independent variables relate positively and significantly to each other. The study further built a regression model for the high school students' mathematics performance to ascertain how well the independent variables predict high school students' mathematics performance.

**Table 3.** Inter-correlation analysis among predictor variables and high school students' mathematics performance

| Variables | SE | INT | MOT |
|---|---|---|---|
| MP | $.437^{***}$ | $.646^{***}$ | $.342^{***}$ |
| SE | | $.463^{***}$ | $.233^{***}$ |
| INT | | | $.414^{***}$ |

*Note:* $^{***}$ Correlation is significant at the .01 level (2-tailed)

## 4. Results

The study used multiple linear regression analysis to evaluate the effect of self-efficacy, interest, and motivation on students' mathematics performance. Moreover, the study also examined three distinct paths involving four key variables to explore the relationships outlined in the research framework. Each path was designed to address specific aspects of the research questions, focusing on how the variables interact and influence one another. The analyses were conducted using SPSS (version 23), allowing for a systematic and reliable approach to answering the research questions based on the collected data. The multiple regression model for the current study is given below:

$$\text{Math Performance} = \beta_0 + \beta_1(\text{Self} - \text{Efficacy}) + \beta_2(\text{Interest}) + \beta_3(\text{Motivation}) + \varepsilon$$

Where;

$$\beta_0 = \text{intercept (baseline performance when all independent variables are zero)}$$

$$\beta_1, \beta_2, \beta_3 = \text{regression coefficient (how much each variable influence performace)}$$

$$\varepsilon = \text{error term (unexplain variation)}$$

### 4.1. Research Question 1: What is the effect of self-efficacy on students' mathematics performance?

Table 4 seeks to examine the effect of self-efficacy on high school students' mathematics performance.

**Table 4.** Effect of Self-Efficacy on High School Students' Mathematics Performance

| Coefficients | | | | | | | |
|---|---|---|---|---|---|---|---|
| Model | *Unstandardized Coefficients* | | *Standardized Coefficients* | *t* | *Sig.* | *95.0% Confidence Interval for B* | |
| | B | Std. Error | Beta | | | Lower Bound | Upper Bound |
| (Constant) | 1.959 | .250 | | 7.838 | .000 | 1.467 | 2.451 |
| SE | .482 | .066 | .402 | 7.317 | .000 | .353 | .612 |

*Note.* Dependent: High School Students' Mathematics Performance (SMP); Independent: Self-Efficacy (SE).

From Table 4, self-efficacy (SE) has a coefficient of 0.482 and a standardized coefficient (Beta) of 0.402. This suggests that self-efficacy and mathematical performance are positively correlated. It is anticipated that students' performance in mathematics improves as their self-efficacy rises. At $p < .001$, the coefficient is extremely significant. According to the regression analysis, self-efficacy has a significant beneficial impact on how well they do in mathematics. Math performance is expected to rise by 0.482 units for every unit improvement in self-efficacy. The results of mathematics performance appear to be moderately positively impacted by self-efficacy, as indicated by the standardized coefficient (Beta) of 0.402. The constant and SE coefficients' 95% confidence ranges do not include 0, demonstrating the stability and dependability of the findings. This shows that differences in high school students' mathematics performance may be largely explained by their level of self-efficacy.

#### *4.1.1. Linear Regression Model for Research Question One*

$$\text{Math Performance} = \beta_0 + \beta_1(\text{Self} - \text{Efficacy}) + \varepsilon$$

$$\text{Math Performance} = 1.959 + .402(\text{Self} - \text{Efficacy})$$

### 4.2. Research question 2: Does mathematical interest affect high school students' mathematics performance?

Table 5 presents the analysis results for the effect of mathematics interests on high school students' mathematics performance.

**Table 5.** Effect of Interest on High School Students' Mathematics Performance

| Coefficients | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Model** | *Unstandardized Coefficients* | | *Standardized Coefficients* | *t* | *Sig.* | *95.0% Confidence Interval for B* | |
| | B | Std. Error | Beta | | | Lower Bound | Upper Bound |
| (Constant) | 1.725 | .175 | | 9.850 | .000 | 1.380 | 2.070 |
| INT | .570 | .047 | .585 | 12.018 | .000 | .476 | .663 |

*Note:* Dependent: High school Students' Mathematics Performance (SMP); Independent: Interest(INT).

From Table 5, interest (INT) has a coefficient of 0.570 and a standardized coefficient (Beta) of 0.585. This suggests that interest in mathematics and high school students' mathematical performance are strongly positively correlated. It is anticipated that high school students' mathematics performance considerably improves as their interest in the subject grows. At $p < .001$, the coefficient is deemed extremely significant. Regression research demonstrates a strong and favorable relationship between interest and high school students' mathematical ability. High school students' mathematics performance is expected to rise by 0.570 units for every unit increase in interest in the subject. Mathematical ability appears to be strongly positively impacted by interest, as indicated by the standardized coefficient (Beta) of 0.585. The results are reliable since there is no zero in the 95% confidence intervals for either the constant or the INT coefficient. This suggests that differences in students' mathematical ability may be largely explained by their enthusiasm for the subject.

#### *4.2.1. Linear Regression Model for Research Question Two*

$$\text{Math Performance} = \beta_0 + (\text{Interest}) + \varepsilon$$

$$\text{Math Performance} = 1.725 + .585(\text{Interest})$$

### 4.3. Research question 3: What is the effect of motivation on high school students' mathematics performance?

Table 6 presents the results for the effect of motivation on students' mathematics performance.

**Table 6.** Effect of Motivation on High School Students' Mathematics Performance

| Coefficients | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Model** | *Unstandardized Coefficients* | | *Standardized Coefficients* | *t* | *Sig.* | *95.0% Confidence Interval for B* | |
| | B | Std. Error | Beta | | | Lower Bound | Upper Bound |
| (Constant) | 2.678 | .207 | | 12.907 | .000 | 2.270 | 3.087 |
| MOT | .296 | .055 | .305 | 5.339 | .000 | .187 | .405 |

*Note:* Dependent: High School Students' Mathematics Performance (SMP); Independent: Motivation (MOT).

From Table 6, motivation has a coefficient of 0.296 and a standardized coefficient (Beta) of 0.305 for MOT. This suggests that motivation and high school students' mathematical performance are positively correlated.

High school students’ mathematics performance is predicted to rise with increased motivation. At $p < 0.001$, the coefficient is deemed extremely significant. In conclusion, the regression analysis demonstrates that motivation has a significant favorable impact on high school students' mathematics performance. High school students’ mathematics performance is expected to improve by 0.296 units for every unit increase in motivation. The results of high school students’ mathematics performance appear to be moderately positively impacted by motivation, as indicated by the standardized coefficient (Beta) of 0.305. The results are solid and trustworthy since neither the constant nor the MOT coefficient's 95% confidence intervals include zero. This shows that differences in high school students’ mathematics performance may be largely explained by motivation.

#### *4.3.1. Linear Regression Model for Research Question Three*

$$\text{Math Performance} = \beta_0 + \beta_3(\text{Motivation}) + \varepsilon$$

$$\text{Math Performance} = 2.678 + .305(\text{Motivation})$$

## 5. Discussion and Conclusions

Among the two selected senior high schools in Kumasi, the first research question seeks to examine the effect of motivation on students’ mathematics performance. The study results showed that students' mathematics performance was positively and significantly influenced by motivation. The results were confirmed with studies by Lo and Hew (2021), Liu et al. (2020), and Chen (2019). Their study found that mathematics motivation has a significant impact on students’ mathematics performance. Saka (2021) conducted a quasi-experimental design to determine the effect of teacher collaboration on students’ motivation and their mathematics performance. The result from their study indicates that teacher collaboration had a significant impact on students’ motivation, which resulted significant impact on students' mathematics performance. Aldalalah et al. (2019) in their study concluded that when students are motivated to learn mathematics either intrinsically or extrinsically, it stimulates their interest and performance in mathematics.

Moreover, research question two aimed to determine the effect of students’ self-efficacy on their mathematics performance. After the data analysis presented in Table 3, it was found that students’ self-efficacy had a positive and statistically significant effect on their mathematics performance. The current result agreed with a study by Özcan and Eren Gümüş (2019). The result from their study testified that students’ performance in mathematics is the result of their efficacy in mathematics learning. Manzano-Sanchez et al. (2018) conducted a study to determine the relationship between student self-efficacy and their mathematics performance. The analysis results demonstrate that there was a positive and significant relationship between students ' self-efficacy and their mathematics performance. Moreover, a study done by Skaalvik et al. (2015) shows that students' self-efficacy partially mediates the relationship between students' grades and motivation. This means that, with student efficacy, students’ grades have a significant impact on their motivation. That is, students are motivated based on their grades.

Finally, research question 3 aimed to determine the effect of mathematics interest on students’ mathematics performance. The analysis result presented in Table 4 showed that mathematics interest had a positive influence and a statistically significant effect on students’ mathematics performance. The current study supports the studies of Wong and Wong (2019) and Zhang and Wang (2020). They found that there exists a significant positive relationship between students' mathematics interest and their mathematics performance. Arthur (2022) found that students’ interest in mathematics significantly predicts their performance in mathematics.

In conclusion, the study validates the theoretical assertion that internal motivational factors, specifically, students' belief in their abilities (self-efficacy) and their interest in the subject, play pivotal roles in shaping their performance in mathematics. The quantitative approach and use of a cross-sectional survey design allowed for a precise snapshot of how these factors interact within a representative cohort of Ghanaian high school students. Based on the analysis of the study, it is evident that both self-efficacy and interest significantly influence high school students’ mathematics performance. The findings reveal a moderately strong positive effect of self-efficacy, with a standardized coefficient of 0.402, indicating that students who believe in their mathematical capabilities are more likely to perform better academically in mathematics. Additionally, a strong positive relationship was observed between mathematics interest and performance, with a standardized coefficient of 0.585. This suggests that students who find mathematics engaging and relevant are more motivated to invest effort, resulting in improved outcomes. The significant p-values ($p < 0.001$) across both predictors affirm the robustness of the results, underscoring the psychological and affective components of learning as critical drivers of academic success in mathematics. These findings have important implications for educators and policymakers, suggesting the need to implement instructional strategies and curricula that foster students’ confidence and curiosity in mathematics. Interventions that enhance self-efficacy and stimulate interest can serve as effective levers for improving students’ academic achievements and their long-term engagement with mathematics.

## 6. Recommendations

It is advised that math teachers actively include techniques meant to boost students' self-efficacy into their lessons, given the statistically significant positive impact that self-efficacy has on high school students' performance in mathematics. Teachers can accomplish this by fostering a growth mentality, giving prompt, helpful feedback, and establishing realistic academic goals. Furthermore, using formative evaluations and acknowledging minor victories might help students feel more confident in their capacity to tackle mathematical challenges. Students who have confidence in their ability to succeed are more likely to interact meaningfully with mathematical material, persevere through difficulties, and eventually perform better.

Additionally, schools should think about structured peer mentorship programs where high-achieving students or those who have a strong belief in mathematics can coach their colleagues, as self-efficacy is strongly linked to higher mathematical performance. Vicarious experiences, such as watching peers solve mathematics problems successfully, can boost self-efficacy in students who might otherwise lack confidence. Peer-led tutorials, cooperative problem-solving, or even unofficial study groups could be a part of these mentorship sessions. In addition to promoting self-efficacy, this peer dynamic creates a positive learning environment that inspires students to take charge of their education.

Lastly, math teachers need ongoing professional development centered on psychological and motivational techniques to help students' self-efficacy grow. The creation of inclusive and anxiety-free learning settings, the use of language that encourages self-belief, and the differentiation of instruction to accommodate a range of learner requirements should all be included in training. Giving educators these abilities guarantees that they can foster self-efficacy in students of all skill levels. Professional development that is in line with these objectives will probably have a long-lasting effect on both the quality of instruction and the mathematical achievement of students, since self-efficacy explains a significant amount of variation in mathematical performance.

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**Data Availability:** The corresponding author has access to the data supporting the findings of this study upon request.

**Conflict of Interest:** The author affirms that there were no conflicts of interest associated with the study.

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