African Journal of Science, and Technology Education (AJSTME). *12*(6). 54 - 58, Nov., 2026.
ISSN: 2251-0141 (Print), 2971-623 (Online) https://www.ajstme.com.ng

Socioeconomic Factors as Correlates of Students' Engagement and Achievement in Mathematics in Senior High Schools in the Tamale Metropolis, Ghana

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Abstract

This study examined the relationship between socioeconomic factors and Senior High School students' engagement and achievement in mathematics in the Tamale Metropolis, Ghana. The study was guided by two research questions and two hypotheses. A descriptive-correlational cross-sectional survey design was adopted. Using proportionate stratified and simple random sampling, 327 Form 2 students were drawn from a population of 2,170 in two public Senior High Schools. A validated student questionnaire and a Mathematics Achievement Record Sheet were used for data collection. The findings showed that socioeconomic support and home learning conditions were strongly and positively related to engagement with r (325) = .66, and to mathematics achievement, r (325) = .69 (both $p < .001$). It was recommended among other things that parents, schools and policymakers should strengthen home learning support for students from less-resourced households.

Keywords: Socioeconomic factors, Student engagement, Mathematics achievement, Senior High School.

INTRODUCTION

Mathematics develops the logical reasoning, quantitative literacy and problem-solving skills that students need for further study, work and everyday decision-making (Boadu & Bonyah, 2024). In Ghana, Core Mathematics is compulsory for all Senior High School (SHS) students and it is required for admission into most tertiary programmes (Nchor et al., 2023). Yet, students' achievement in the subject remains unstable. The proportion of candidates obtaining credit passes (A1–C6) in the West African Senior School Certificate Examination (WASSCE) Core Mathematics rose from 48.15% in 2018 to 65.71% in 2020, fell to 54.11% in 2021, and stood at 62.23% in 2023 (Akendita et al., 2025). In each of these years, roughly one-third to half of the candidates did not obtain the credit pass that most tertiary programmes require.

Achievement in mathematics depends on more than ability. One construct that helps to explain differences in learning outcomes is students' engagement, which Fredricks et al. (2004) describe as having behavioural (participation, effort, attendance), emotional (interest, confidence, enjoyment) and cognitive (deep thinking, self-regulation, perseverance) dimensions. Engagement is significantly related to mathematics achievement (Maamin et al., 2021). However, how engaged students are, and how well they achieve, are both shaped by conditions outside the classroom, particularly the home.

Students enter Senior High School with unequal socioeconomic resources, such as learning materials, a quiet place to study and parents who can give academic support (Iddrisu & Alhassan, 2025; Tan, 2024). Meta-analytic evidence shows that socioeconomic status (SES) is positively associated with academic achievement in primary and secondary education (Liu et al., 2022; Yigiter, 2025). The size of the association, however, depends on how SES is measured. White (1982) reported a weak average correlation ($r \approx .22$) between SES defined by parents' income, education and occupation and achievement at the individual level, and a medium-sized average was later reported by Sirin (2005). Family characteristics such as home atmosphere, by contrast, correlated substantially with achievement (r = .55) in White's (1982) review.

This study was guided by Social Reproduction Theory (Bourdieu & Passeron, 1990), which holds that the economic, cultural and social capital available to a household shapes the learning opportunities of its children. Students from better-resourced homes have more of the time, materials and support that match the expectations of formal schooling, and so engaged learning and achievement are expected to be unevenly distributed across socioeconomic circumstances.

These concerns are particularly relevant in northern Ghana, where educational attainment has been lower and more unequal than in the south (Afoakwah et al., 2023). The 2021 Population and Housing Census recorded 1,072,926 persons aged six years and older in the Northern Region who were not literate, 123,455 of them in the Tamale Metropolis (Ghana Statistical Service [GSS], 2021), which limits the academic help many parents can give at home. Existing Ghanaian studies have examined parents' socioeconomic status and students' performance in the Northern Region (Iddrisu & Alhassan, 2025) as well as family background and the mathematics performance of female SHS students in Tamale (Karim et al., 2024), but without students' engagement. Little is known about how strongly socioeconomic circumstances relate to engagement, on one hand, and to achievement, on the other, within the same sample of SHS students in the Tamale Metropolis. This study addressed that gap.

In this study, socioeconomic factors refer to the support and conditions for learning available to the student at

home, including parental academic support, access to learning resources, household financial circumstances and conditions for study. Student's engagement refers to behavioural, emotional and cognitive involvement in mathematics learning; and mathematics achievement refers to the verified Core Mathematics percentage score from official school records.

The foregoing shows that although Core Mathematics is compulsory and decisive for further education in Ghana, achievement in the subject fluctuates and differs widely among students. Differences in engagement and achievement have been linked to students' socioeconomic circumstances, a concern that is pressing in the Tamale Metropolis, where students come from households with very different resources. Available Ghanaian studies have not examined, with the same sample, how strongly socioeconomic factors are related to students' engagement and to their mathematics achievement. The problem of this study, therefore, was to determine the extent to which socioeconomic factors are related to the engagement and the mathematics achievement of SHS students in the Tamale Metropolis.

Specifically, the study was to determine the:

1. extent socioeconomic factors associate with Senior High School students' engagement in mathematics in the Tamale Metropolis
2. extent socioeconomic factors associate with Senior High School students' mathematics achievement in the Tamale Metropolis.

Research Questions

The following research questions guided the study:

1. To what extent are socioeconomic factors associated with Senior High School students' engagement in mathematics in the Tamale Metropolis?
2. To what extent are socioeconomic factors associated with Senior High School students' mathematics achievement in the Tamale Metropolis?

Hypotheses

- The following hypotheses were tested at the .05 level of significance:
- $H0_1$: There is no significant relationship between socioeconomic factors and Senior High School students' engagement in mathematics in the Tamale Metropolis.
- $H0_2$: There is no significant relationship between socioeconomic factors and Senior High School students' mathematics achievement in the Tamale Metropolis.

METHODS

The study adopted a descriptive-correlational cross-sectional survey design. The design was suitable because the study sought to establish the strength and direction of the relationship between socioeconomic factors and students' engagement; and between socioeconomic factors and students' achievement in mathematics, as they occur naturally and at a single point in time, without manipulating any variable (Creswell & Creswell, 2017).

The study was conducted in the Tamale Metropolis, the capital of Ghana's Northern Region, in two public mixed-sex SHSs with day and boarding systems. The population comprised all 2,170 Form 2 students in the two schools (Anbariya, 1,037; Business, 1,133; 1,047 boys and 1,123 girls). Form 2 was chosen because students at this level have enough experience of SHS mathematics teaching and assessment but are not yet under the pressure of the final examination. A sample of 327 students was determined using the Krejcie and Morgan (1970) formula at a 95% confidence level and a 5% margin of error. The sample was allocated proportionately by school, residential status and sex (Anbariya, n = 156; Business, n = 171), and students were selected by simple random sampling within each stratum. The sample comprised 157 males (48.0%) and 170 females (52.0%); 249 students (76.1%) were boarders.

Two instruments were used. The first was a Student Questionnaire with a 12-item scale on socioeconomic support and home learning conditions (for example, availability of learning materials, parental academic support, financial capacity to meet school needs and conditions for study at home) and a 24-item mathematics engagement scale, with eight items each for behavioural, emotional and cognitive engagement (Fredricks et al., 2004). Items were rated on a four-point scale (Strongly Agree = 4 to Strongly Disagree = 1). Three negatively worded items were reverse-scored, and mean scores were computed for each scale. The second was a Mathematics Achievement Record Sheet, used to extract each sampled student's verified Core Mathematics score, expressed as a percentage, from official school records. Each entry was endorsed by an authorised school officer and linked to the questionnaire through a unique research code, so that achievement was not self-reported.

The instruments were subjected to face and content validation by the research supervisor and experts in mathematics education and in educational measurement and evaluation, and were revised on their comments. They were then pilot-tested with 33 Form 2 students from a public SHS outside the study sample. Cronbach's alpha in the pilot was .84 for socioeconomic support and ranged from .78 to .81 for the engagement subscales. In the main study, alpha was .89 for socioeconomic support and .94 for overall engagement (Table 1).

Permission was obtained from the heads of the two schools. Students gave assent or consent (with parental or guardian consent where required), participation was voluntary, and responses were anonymous. The questionnaires were administered to the selected students under supervision at school, and all 327 were completed, giving a dataset without missing values. Mathematics Achievement Record Sheet was used to extract each sampled student's verified Core Mathematics score from official school records. Each student's score was endorsed by an authorised school officer and linked to the questionnaire through a unique research code.

Means, standard deviations and Cronbach's alpha described the variables, and the Pearson product-moment correlation was used to test the two null hypotheses at the

.05 level of significance. Before the analysis, the data were screened: no case lay beyond ±3.29 standardised units, skewness values were within ±0.27, and scatterplots showed linear relationships, which supported the use of Pearson's r. The size of r was interpreted with Cohen's (1988) benchmarks (.10 as small, .30 as medium, .50 as large), r^2 was used to express shared variance, and 95% confidence intervals were computed with Fisher's z transformation.

RESULTS

Table 1: Descriptive statistics and reliability coefficients of the study variables

Variable	Items	M	SD	Cronbach's α
Socioeconomic support and home learning conditions	12	2.46	0.53	.89
Behavioural engagement	8	2.41	0.52	.85
Emotional engagement	8	2.41	0.51	.82
Cognitive engagement	8	2.52	0.52	.84
Overall engagement	24	2.45	0.49	.94
Mathematics achievement (%)	—	57.92	14.86	—

***Source**: Field data (2026)*

Table 1 shows that the mean scores for socioeconomic support (M = 2.46, SD = 0.53) and overall engagement (M = 2.45, SD = 0.49) were close to the midpoint of the four-point scale, while the mean achievement score was 57.92% (SD = 14.86; range = 12–97%). All scales had good to excellent internal consistency (α = .82 to .94).

Research Question One
To what extent are socioeconomic factors associated with Senior High School students' engagement in mathematics in the Tamale Metropolis?

Table 2: Pearson correlations between socioeconomic support and students' engagement

Relationship Constructs	df	r	r^2	95% CI	P
Socioeconomic support – Behavioural engagement	325	.62	.38	[.55, .68]	< .001
Socioeconomic support – Emotional engagement	325	.61	.37	[.54, .67]	< .001
Socioeconomic support – Cognitive engagement	325	.65	.42	[.58, .71]	< .001
Socioeconomic support – Overall engagement	325	.66	.44	[.59, .72]	< .001

***Source**: Field data (2026)*

Table 2 shows that socioeconomic support and home learning conditions was positively and strongly related to overall engagement in mathematics, r (325) = .66, p < .001, 95% CI [.59, .72]. The coefficient of determination (r^2 = .44) indicates that about 44% of the variance in engagement is shared with socioeconomic support. The relationship was of similar size for behavioural (r = .62), emotional (r = .61) and cognitive engagement (r = .65), all significant at p < .001.

Hypothesis One: There is no significant relationship between socioeconomic factors and Senior High School students' engagement in mathematics in the Tamale Metropolis.
The correlation was significant, r (325) = .66, p < .001, and since p was less than .05, the null hypothesis was rejected. Students who reported more socioeconomic support and better home learning conditions also reported higher engagement in mathematics.

Research Question Two: To what extent are socioeconomic factors associated with Senior High School students' mathematics achievement in the Tamale Metropolis?

Table 3: Pearson correlations between socioeconomic support and mathematics achievement

Relationship	df	r	r^2	95% CI	p
Socioeconomic support ↔ Mathematics achievement	325	.69	.48	[.63, .74]	< .001

***Source**: Field data (2026)*

As shown in Table 3, socioeconomic support and home learning conditions was positively and strongly related to mathematics achievement, r(325) = .69, p < .001, 95% CI [.63, .74], with about 48% shared variance (r^2 = .48).

Hypothesis Two: There is no significant relationship between socioeconomic factors and Senior High School students' mathematics achievement in the Tamale Metropolis.

The correlation was significant, r (325) = .69, p < .001, and since p was less than .05, the null hypothesis was rejected. Students from homes with more support and better learning conditions tended to achieve higher scores in Core Mathematics.

DISCUSSION

The study found that socioeconomic support and home learning conditions were strongly and positively related to SHS students' engagement in mathematics (r = .66), and that the relationship was similar for behavioural, emotional and cognitive engagement (r = .61 to .65). This finding is consistent with Social Reproduction Theory (Bourdieu & Passeron, 1990), which holds that the economic, cultural and social capital of a household shapes children's opportunities to take part in schooling. It agrees with Qiu and Ye (2023), who found a positive relationship between family socioeconomic status and learning engagement among college students, and with Iddrisu and Alhassan (2025), who reported that parents' income, education and occupation were positively associated with students' educational outcomes in the Northern Region of Ghana. A plausible interpretation is that learning materials, a place to study and parents who check and encourage schoolwork make it easier for students to attend to mathematics work, feel confident and persevere with it. This is in line with evidence that parental involvement is related to students' mathematics performance (Jiang et al., 2023; Wang & Wei, 2024). Because the three dimensions correlated similarly with socioeconomic support, home conditions appear to be related to what students do, how they feel and how they think about mathematics, and not to one facet of engagement only (Fredricks et al., 2004).

Socioeconomic support and home learning conditions were also strongly and positively related to mathematics achievement (r = .69). This agrees with meta-analytic and cross-national evidence that socioeconomic status is positively associated with academic achievement in primary and secondary education (Liu et al., 2022; Tan, 2024; Yigiter, 2025), and with the finding of Iddrisu and Alhassan (2025) in the Northern Region of Ghana. The coefficients obtained here are larger than the average individual-level correlation of about .22 that White (1982) reported when SES was defined by parents' income, education and occupation, and larger than the medium-sized average reported by Sirin (2005). However, White (1982) also found that family characteristics such as home atmosphere correlated substantially with achievement at the individual level (r = .55). The scale used in this study focused on parental academic support, access to learning resources and conditions for study at home, rather than on income, education and occupation alone. So, it is closer to this second kind of measure, which may explain the high coefficients. The wide variation in household circumstances in northern Ghana (Afoakwah et al., 2023; GSS, 2021) may also have increased the spread of scores and, with it, the size of the correlations.

The coefficients for engagement and achievement that were close in size suggests that home learning conditions go with both outcomes about equally. This fits the view that engagement is one of the processes through which background conditions are linked to learning outcomes (Fredricks et al., 2004); although the present design cannot test that pathway. The findings must also be read with caution. They describe associations and not cause and effect. Thus, home support may foster engagement and achievement, but families may also support students who are already engaged and doing well, or a third factor such as parental education may influence both. Socioeconomic support and engagement were both self-reported by the same students, which may have inflated their relationship; although achievement was taken from school records. Only two schools were studied; so, generalisation to other settings should be made carefully.

CONCLUSION

Based on the findings, it is concluded that socioeconomic factors, measured as socioeconomic support and home learning conditions, are strongly and positively related to both the engagement and the mathematics achievement of Senior High School students in the Tamale Metropolis. Students from homes with better learning resources, parental academic support and conditions for study tend to be more engaged in mathematics and to achieve higher scores. These are associations, and future studies using longitudinal designs, more schools and tests of mediation by engagement are needed to establish how relationships arise.

Recommendations

Based on the findings, it was recommended that:

1. Parents and guardians should, within their means, provide mathematics textbooks, calculators, a quiet place to study as well as regular academic supervision and encouragement for their children.
2. Mathematics teachers and school heads should identify students from less-resourced homes and give them supervised preparation time, peer tutoring, mathematics clubs and in-school access to textbooks and calculators.

3. The Ghana Education Service and policymakers should extend as well as better target support under the Free SHS policy to cover learning resources for students from disadvantaged households.
4. School management and Parent–Teacher Associations should organise sessions that show parents, including those with little formal education, practical ways of supporting mathematics learning at home.

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