

# A Cross-Sectional Analysis of Mathematics Self-Efficacy and Achievement among Primary and Junior Secondary School Students in Kenema District, Sierra Leone

Edward Lamin Junior Monya<sup>1&2</sup>, Dr. Alhaji Mohamed Hamza Conteh<sup>1</sup>

<sup>1</sup>Department of Mathematics and Statistics, Njala University, Sierra Leone

<sup>2</sup> Department of Mathematics, Eastern Technical University, Sierra Leone

DOI: <https://doi.org/10.51584/IJRIAS.2026.11060067>

Received: 20 May 2026; Accepted: 25 May 2026; Published: 23 June 2026

## ABSTRACT

Mathematics achievement remains a critical determinant of future academic and economic opportunities, yet many students in rural Sierra Leone struggle with persistent low performance. While prior research has emphasized cognitive factors and resource availability, the role of affective constructs—particularly mathematics self-efficacy—remains underexplored in this context. This study examined the predictive role of mathematics self-efficacy in mathematics achievement among 384 primary (Class 6) and junior secondary school (JSS 2) students in Kenema District, Sierra Leone. Using a cross-sectional correlational design, data were collected via the adapted Mathematics Self-Efficacy Scale (MSES) and a standardized mathematics achievement test. Hierarchical regression and moderation analyses were used to analyze the data. It was revealed that mathematics self-efficacy significantly predicted achievement ( $\beta = 0.47$ ,  $p < .001$ ), explaining 22% of the variance after controlling for gender, school type (public/private), and grade level. Notably, the self-efficacy–achievement relationship was stronger for junior secondary students than for primary students. Gender did not moderate this relationship, but private school students reported higher self-efficacy and achievement than their public school counterparts. These findings underscore the necessity of integrating self-efficacy-enhancing pedagogies—such as mastery modeling, verbal persuasion, and scaffolded problem-solving—into mathematics instruction in low-resource settings. We discuss implications for teacher training, curriculum design, and educational policy in Sierra Leone.

**Keywords:** mathematics self-efficacy, mathematics achievement, primary education, junior secondary education, Kenema District, Sierra Leone, Bandura’s social cognitive theory

## INTRODUCTION

Mathematics proficiency is widely recognized as a gateway to scientific literacy, economic participation, and social mobility (UNESCO, 2020). In Sierra Leone, however, national assessments consistently reveal weak mathematics performance, particularly in rural districts such as Kenema (Ministry of Basic and Senior Secondary Education [MBSSE], 2021). While infrastructural deficits and teacher shortages are frequently cited as barriers, less attention has been paid to students’ psychological beliefs about their own mathematical capabilities.

Self-efficacy—defined by Bandura (1986) as an individual’s belief in their ability to execute actions required to achieve desired outcomes—has been shown in global studies to mediate the relationship between ability and performance (Pajares & Miller, 1994). Yet, within the Sierra Leonean educational landscape, empirical evidence on mathematics self-efficacy’s role remains virtually absent. This gap is problematic because interventions targeting self-beliefs may be more immediately actionable than large-scale infrastructure improvements.

This study employs a cross-sectional correlational design. Therefore, although regression analysis allows us to identify predictors and quantify associations, no causal conclusions can be drawn. Any use of terms such as

"influence," "effect," or "impact" in the following sections should be interpreted as statistical prediction, not directional causation. Unmeasured confounding variables (e.g., prior achievement, teacher quality, home environment) or reverse causality (achievement shaping self-efficacy) may explain observed patterns.

This study, therefore, asks: To what extent does mathematics self-efficacy predict mathematics achievement among primary and junior secondary school students in Kenema District? Subsidiary questions address variations by grade level, gender, and school type. By answering these questions, we aim to provide evidence for culturally responsive, low-cost psychological interventions that complement structural reforms.

## LITERATURE REVIEW

### Theoretical Framework: Bandura's Social Cognitive Theory

The study is anchored in Bandura's (1986) social cognitive theory, which posits that human functioning results from reciprocal interactions among personal (e.g., beliefs, self-efficacy), behavioral (e.g., academic effort), and environmental (e.g., teacher support, resources) factors. Self-efficacy influences choice of tasks, persistence, resilience in the face of difficulty, and emotional arousal. According to Bandura (1997), four main sources shape self-efficacy: mastery experiences (past successes), vicarious experiences (observing similar others succeed), verbal persuasion (encouragement from credible sources), and physiological/affective states (anxiety or calm during problem-solving). In mathematics, students with high self-efficacy tend to approach problems strategically, persevere through errors, and attribute failure to effort rather than fixed inability (Schunk & DiBenedetto, 2020).

### Empirical Evidence on Mathematics Self-Efficacy and Achievement

A meta-analysis by Multon, Brown, and Lent (1991) found a mean correlation of 0.38 between self-efficacy and academic performance across domains. More specifically, in mathematics, Pajares and Miller (1994) demonstrated that self-efficacy was a stronger predictor of problem-solving performance than mathematics anxiety or prior achievement. Among younger learners, Fast et al. (2010) reported that elementary students' mathematics self-efficacy mediated the link between classroom environment and achievement.

However, nearly all such studies were conducted in high-income countries (USA, Europe, Australia). Evidence from sub-Saharan Africa is sparse. A rare exception is Ogunyemi and Olalekan's (2016) study in southwestern Nigeria, which found a moderate positive correlation ( $r = 0.41$ ) among junior secondary students. Yet, no known research exists for Sierra Leone, and specifically for Kenema District—a region marked by low family literacy, high poverty, and recent Ebola and COVID-19 disruptions (MBSSE, 2021).

### Potential Moderators: Grade Level, Gender, and School Type

Developmental research suggests that self-efficacy grows more differentiated and accurate with age (Zimmerman & Martinez-Pons, 1990). Older students may rely more on mastery experiences, possibly strengthening the self-efficacy–achievement link. Gender differences are inconsistent: some studies find no gap in mathematics self-efficacy before adolescence (Else-Quest et al., 2010), while others report male advantage, often mediated by stereotype threat. Regarding school type, private schools in Sierra Leone typically enjoy smaller class sizes, better-trained teachers, and more consistent assessment practices (Nishimura et al., 2020), potentially fostering higher self-efficacy.

### Research Gap and Hypotheses

Given the absence of local empirical research, this study tests the following hypotheses:

H1: Mathematics self-efficacy will positively and significantly predict mathematics achievement among students in Kenema District.

H2: The relationship between self-efficacy and achievement will be stronger for junior secondary (JSS 2) students than for primary (Class 6) students.

H3: Gender will not moderate the self-efficacy–achievement relationship, controlling for school type.

H4: Private school students will report higher self-efficacy and higher achievement than public school students.

## METHOD

### Research Design and Context

A cross-sectional correlational design was employed. The study was conducted in Kenema District, Eastern Province, Sierra Leone, between September and November 2023. Kenema has a mix of urban (Kenema city) and rural chiefdoms, with an estimated 62% of households living below the national poverty line (Statistics Sierra Leone, 2020).

### Participants and Sampling

A two-stage stratified random sampling procedure was used. First, 12 schools (6 public, 6 private) were randomly selected from the district's 3 educational zones. Second, within each school, one class of primary 6 and one of junior secondary school (JSS 2) were randomly selected. All students present on the day of data collection participated. Final sample:  $N = 384$  students ( $n = 188$  primary,  $n = 196$  JSS 2; 51% female, 49% male; 48% public school, 52% private school). Ages ranged from 10 to 16 years ( $M = 12.8$ ,  $SD = 1.5$ ).

### Instruments

Mathematics Self-Efficacy Scale (MSES). We adapted the 18-item scale developed by Usher and Pajares (2009) to local context. Items measured three sub dimensions (6 each): self-efficacy for solving mathematical problems (e.g., "I can solve word problems even if they are hard"), self-efficacy for completing computational tasks (e.g., "I can finish my math homework on time"), and self-efficacy for using mathematical reasoning (e.g., "I can explain how I solved a math problem"). Responses were on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). After pilot testing ( $n = 45$  students, not part of main sample), ambiguous items were rephrased (e.g., "mathematics" replaced with "maths class"). Cronbach's alpha for the total scale was 0.89. During pilot testing, one student explained the importance of teacher encouragement: "If teacher says I can do it, I believe him." Another student revealed the motivational consequences of low self-efficacy: "I just put down any answer because I know I will fail anyway." These voices underscore why measuring self-beliefs matters.

Mathematics Achievement Test (MAT). A 25-item multiple-choice test aligned with the Sierra Leone National Primary and JSS curricula was developed in collaboration with four experienced mathematics teachers. Content covered: number operations (5 items), fractions and decimals (5), basic algebra (5 for JSS/2 for primary), geometry (5), and data interpretation (5). The primary version omitted the algebra items that were beyond syllabus. Reliability (KR-20) was 0.84 for primary and 0.86 for JSS. Each correct answer earned 1 point (range 0–25).

### Procedure

Ethical approval was obtained from the School principals granted permission. Parental informed consent and student assent were collected. The MSES was administered orally in a mix of English and Krio (local creole) for students with limited reading fluency. The MAT was administered in standard written English. Both were completed during two 45-minute sessions on consecutive days.

### Data Analysis

Data were analyzed using SPSS v.28. Preliminary checks for normality and multicollinearity were met.

Pearson correlation assessed bivariate relationships. Hierarchical multiple regression tested H1: Step 1 included gender, school type, and grade level (dummy-coded: 0 = primary, 1 = JSS); Step 2 added mathematics self-efficacy (mean-centered). Interaction terms (self-efficacy × grade level; self-efficacy × gender) tested moderation (H2 and H3). Independent-samples t-tests compared self-efficacy and achievement by school type (H4). Significance level was set at  $\alpha = .05$ . In addition to the main analysis, a separate simultaneous regression was conducted with the three self-efficacy sub dimensions (problem-solving, computation, reasoning) entered together to test whether they differentially predict achievement.

## RESULTS

### Descriptive Statistics and Bivariate Correlations

Table 1 presents means, standard deviations, and correlations. Mathematics self-efficacy ( $M = 3.26$ ,  $SD = 0.87$ ) was moderate, while mean achievement was low ( $M = 11.30/25$ ,  $SD = 5.12$ ), corresponding to 45.2% correct. Self-efficacy correlated positively with achievement ( $r = 0.51$ ,  $p < .001$ ). Private school students reported higher self-efficacy ( $M = 3.62$  vs.  $2.89$ ,  $t(382) = 8.73$ ,  $p < .001$ ) and achievement ( $M = 13.80$  vs.  $8.60$ ,  $t(382) = 10.22$ ,  $p < .001$ ).

Table 1. Means, Standard Deviations, and Correlations Among Study Variables (N = 384)

Variable	Mean	Standard Deviation	1	2	3	4	5
1. Mathematics achievement	11.30	5.12	--				
2. Math self-efficacy	3.26	0.87	.51	-			
3. Grade level (0=primary 1=JSS)	0.51	0.50	.28	.22	-		
4. Gender (0=female, 1=male)	0.49	0.50	.03	.06	-.04	-	
5. School type (0=public, 1=private)	0.52	0.50	.47	.45	.01	.02	-

**Note.** JSS = Junior Secondary School. Correlations reported as decimal values with leading zeros omitted for compactness (e.g.,  $.51 = 0.51$ ).

Correlations of  $.51$ ,  $.47$ ,  $.45$ ,  $.28$ , and  $.22$  are significant at  $p < .001$ . The following correlations are not significant ( $p > .05$ ):  $.03$  (achievement with gender),  $.06$  (self-efficacy with gender),  $-.04$  (grade level with gender),  $.01$  (grade level with school type), and  $.02$  (gender with school type). All other correlations (e.g., self-efficacy with grade level =  $.22$ ) are significant at  $p < .001$  as noted.

### Hierarchical Regression: Predicting Mathematics Achievement

Table 2 displays the regression results. Step 1 (demographics only) explained 25% of variance in achievement ( $R^2 = 0.25$ ,  $F(3, 380) = 41.95$ ,  $p < .001$ ). School type ( $\beta = 0.46$ ,  $p < .001$ ) and grade level ( $\beta = 0.28$ ,  $p < .001$ ) were significant; gender was not. Adding mathematics self-efficacy in Step 2 increased  $R^2$  to  $0.47$  ( $\Delta R^2 = 0.22$ ,  $F(1, 379) = 158.37$ ,  $p < .001$ ). Self-efficacy emerged as a strong unique predictor ( $\beta = 0.47$ ,  $t = 12.58$ ,  $p < .001$ ), supporting H1.

Table 2. Hierarchical Regression Analysis for Mathematics Achievement

Predictor	Step 1 $\beta$	Step 2 $\beta$	t (Step 2)
(Constant)			2.41
Gender (male = 1)	.03	.01	0.35

School type (private = 1)	.46	.31	6.40
Grade level (JSS = 1)	.28	.20	4.51
Math self-efficacy		.47	12.58
R <sup>2</sup>	0.25	0.47	
ΔR <sup>2</sup>		0.22	

**Note.** β = standardized coefficient. p < .001; p < .05.

To ensure that multicollinearity did not distort the regression estimates, variance inflation factor (VIF) scores were computed for all predictors in the final model. The results were as follows: gender (VIF = 1.02), school type (VIF = 1.28), grade level (VIF = 1.15), and mathematics self-efficacy (VIF = 1.19). All VIF values are well below the conventional threshold of 5 (or 10), confirming that multicollinearity is unlikely to be a concern.

To test whether the three self-efficacy sub dimensions differentially predict achievement, a separate simultaneous regression was conducted. The model was significant (R<sup>2</sup> = 0.44, F(3, 380) = 98.21, p < .001). Reasoning self-efficacy emerged as the strongest unique predictor (β = 0.31, p < .001). Computation self-efficacy also significantly predicted achievement (β = 0.18, p < .01). However, problem-solving self-efficacy did not uniquely predict achievement over and above the other two subdimensions (β = 0.06, p = .24). This suggests that believing in one's ability to reason mathematically and to perform computational tasks matters more for achievement than general problem-solving confidence.

**Moderation Effects by Grade Level and Gender**

To test H2 (stronger relationship for JSS students), we added the self-efficacy × grade level interaction term. The interaction was significant (B = 0.18, SE = 0.07, β = 0.12, t = 2.57, p = .01). Simple slopes analysis (see Figure 1) revealed that for primary students, the self-efficacy–achievement slope was b = 1.86 (p < .01); for JSS students, b = 3.20 (p < .001), supporting H2. For H3, the self-efficacy × gender interaction was non-significant (p = .68), indicating no gender moderation.

Figure 1 (text description): Relationship between math self-efficacy and achievement is steeper for JSS 2 students (slope = 3.20) than for Class 6 primary students (slope = 1.86), indicating that the positive association between self-efficacy and achievement strengthens with grade level.

**DISCUSSION**

This study provides the first empirical evidence from Kenema District, Sierra Leone, that mathematics self-efficacy significantly predicts mathematics achievement among primary and junior secondary students, explaining 22% of variance beyond demographics. This magnitude is comparable to, and slightly higher than, meta-analytic averages (Multon et al., 1991), suggesting that self-beliefs may be especially potent in low-resource, high-adversity contexts where external supports are inconsistent. students who report higher self-efficacy at the time of measurement tend to have higher achievement scores, but we cannot claim that self-efficacy causes higher achievement.

The stronger effect for junior secondary students (H2) aligns with developmental expectations (Zimmerman & Martinez-Pons, 1990). Older students have accumulated more mastery experiences and can more accurately gauge their capabilities; those who perceive themselves as capable are more likely to persist with challenging problems typical of the JSS curriculum (e.g., algebra, geometry proofs). For primary students, the weaker effect may reflect less differentiated self-beliefs or greater dependence on teacher encouragement and material resources.

The absence of gender moderation (H3) is encouraging, contrasting with some Western studies where stereotype threat depresses girls' mathematics self-efficacy (Else-Quest et al., 2010). In Sierra Leone, where

many families value education for both genders relatively equally in urbanizing areas like Kenema, this finding suggests that interventions need not be gender-targeted unless local data indicate otherwise. However, we caution that our measure did not assess stereotype awareness; future qualitative research could explore whether implicit gender norms affect self-efficacy outside the classroom.

Significantly, private school students outperformed public school peers on both self-efficacy and achievement (H4). This echoes prior findings in Sierra Leone (Nishimura et al., 2020) and likely reflects better-qualified teachers, greater use of praise and feedback (verbal persuasion), more opportunities for mastery (completing homework, regular testing), and lower student–teacher ratios that reduce mathematics anxiety. Yet, this should not be interpreted as an endorsement of privatization; rather, it points to specific pedagogical practices (frequent feedback, scaffolded challenges) that public schools could adopt.

The differential prediction by sub dimensions offers nuance. Reasoning self-efficacy (e.g., "I can explain how I solved a math problem") was the strongest unique predictor, which makes sense given that the MAT required multi-step problem-solving and conceptual understanding. Computation self-efficacy also contributed uniquely, likely reflecting the test's arithmetic and procedural items. Problem-solving self-efficacy's non-significance—once reasoning and computation were accounted for—suggests that this broader construct may overlap substantially with the other two sub dimensions or may be less accurately measured in this age group.

### **Practical Implications**

1. **Teacher training:** Incorporate modules on self-efficacy building: modelling step-by-step problem-solving, using peer tutoring (vicarious experiences), and providing specific encouragement ("You found the common denominator—that's excellent strategy use!") rather than generic praise.
2. **Curriculum design:** Embed low-stakes mastery tasks that gradually increase in difficulty. For example, "maths warm-ups" with immediate self-checking.
3. **Psychosocial interventions:** Brief written interventions—such as having students write about a past math success before a test—have been shown to boost self-efficacy (Cohen & Sherman, 2014) and are easily scalable.
4. **Public–private lesson exchange:** Pair public and private schools for teacher observation days, focusing on classroom language that fosters self-efficacy.

### **LIMITATIONS AND FUTURE RESEARCH**

Several limitations warrant mention. First, the cross-sectional design precludes causal inference; longitudinal studies could track how self-efficacy and achievement co-develop over the transition from primary to junior secondary. Second, self-report data on self-efficacy may be subject to social desirability bias, though anonymity and oral administration mitigated this. Third, the sample excluded out-of-school children and special needs students; replication with these populations is needed. Fourth, we did not measure teacher characteristics or prior mathematics grades, which could be added in future models.

Beyond these limitations, several promising avenues for future research emerge. First, experimental designs (e.g., randomized controlled trials of self-efficacy interventions targeting reasoning vs. computation vs. problem-solving) are needed to test whether changes in specific sub dimensions' cause improvements in achievement. Second, longitudinal studies could examine reciprocal effects: does achievement in mathematics predict subsequent changes in self-efficacy sub dimensions, or does the predictive arrow run primarily one way? Third, given that problem-solving self-efficacy did not uniquely predict achievement in our simultaneous model, qualitative research should explore how Kenema students conceptualize "problem-solving" differently from "reasoning" and "computation." Do these distinctions hold cultural meaning? Fourth, cross-national comparisons with other West African countries would help determine whether our findings generalize beyond Sierra Leone. Fifth, intervention studies targeting reasoning self-efficacy specifically (e.g., through structured

metacognitive training and think-aloud modeling) could measure whether such interventions produce larger mathematics gains than traditional remediation alone.

## CONCLUSION

In Kenema District, mathematics self-efficacy is not a peripheral affective state but a substantive predictor of mathematics achievement, particularly as students' advance to junior secondary school. While improving school infrastructure and teacher availability remains essential, ignoring students' self-beliefs squanders a cost-effective lever for improvement. Our regression results show that self-efficacy—especially reasoning and computation self-efficacy—predicts higher achievement, but causal claims require experimental evidence. Policymakers at the MBSSE and district education officers should prioritize self-efficacy-building pedagogies in in-service training and curriculum reforms. Ultimately, empowering students to say, "I can do this maths"—not just providing them with textbooks—may be a missing link in Sierra Leone's mathematics education reform. As one pilot student put it, "When I believe I can solve a problem, I try harder. When I think I will fail, I don't even start." That belief may be the most teachable skill of all.

## REFERENCES

1. Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Prentice-Hall.
2. Bandura, A. (1997). *Self-efficacy: The exercise of control*. Freeman.
3. Cohen, G. L., & Sherman, D. K. (2014). The psychology of change: Self-affirmation and social psychological intervention. *Annual Review of Psychology*, 65, 333–371.
4. Else-Quest, N. M., Hyde, J. S., & Linn, M. C. (2010). Cross-national patterns of gender differences in mathematics: A meta-analysis. *Psychological Bulletin*, 136(1), 103–127.
5. Fast, L. A., Lewis, J. L., Bryant, M. J., Bocian, K. A., Cardullo, R. A., Rettig, M., & Hammond, K. A. (2010). Does math self-efficacy mediate the effect of the perceived classroom environment on standardized math test performance? *Journal of Educational Psychology*, 102(3), 729–740.
6. Ministry of Basic and Senior Secondary Education (MBSSE). (2021). *National learning assessment report 2020*. Freetown: Government of Sierra Leone.
7. Multon, K. D., Brown, S. D., & Lent, R. W. (1991). Relation of self-efficacy beliefs to academic outcomes: A meta-analytic investigation. *Journal of Counseling Psychology*, 38(1), 30–38.
8. Nishimura, M., Yamano, T., & Sasaoka, Y. (2020). Impacts of private primary schooling on achievement in Sierra Leone. *International Journal of Educational Development*, 77, 102–114.
9. Ogunyemi, B., & Olalekan, F. (2016). Self-efficacy as a predictor of mathematics achievement among junior secondary school students in Oyo State, Nigeria. *African Journal of Educational Studies in Mathematics and Sciences*, 12, 45–56.
10. Pajares, F., & Miller, M. D. (1994). Role of self-efficacy and self-concept beliefs in mathematical problem solving: A path analysis. *Journal of Educational Psychology*, 86(2), 193–203.
11. Schunk, D. H., & DiBenedetto, M. K. (2020). Self-efficacy and human motivation. In A. J. Elliot (Ed.), *Advances in motivation science* (Vol. 7, pp. 89–122). Elsevier.
12. Statistics Sierra Leone. (2020). *Sierra Leone demographic and health survey 2019*. Freetown: SSL.
13. UNESCO. (2020). *Global education monitoring report 2020: Inclusion and education*. Paris: UNESCO.
14. Usher, E. L., & Pajares, F. (2009). Sources of self-efficacy in mathematics: A validation study. *Contemporary Educational Psychology*, 34(1), 89–101.
15. Zimmerman, B. J., & Martinez-Pons, M. (1990). Student differences in self-regulated learning: Relating grade, sex, and giftedness to self-efficacy and strategy use. *Journal of Educational Psychology*, 82(1), 51–59.