African Journal of Science, and Technology Education (AJSTME). *12*(6), 1 - 6, Nov., 2026.
ISSN: 2251-0141 (Print), 2971-623 (Online) https://www.ajstme.com.ng

Culturally Responsive Pedagogy and Gender Differences in Mathematics Engagement among Senior High School Students in Northern Ghana

Karim Aninganigu [1], Bright E. Owusu[2], Francis K. Awuah[3], & Enoch D. Mwini[4]
[1-4] Kwame Nkrumah University of Science and Technology
Corresponding Author: kaninganigu@st.knust.edu.gh

Abstract

This explanatory sequential mixed-methods study examined gender differences in mathematics engagement among Senior High School (SHS) students in Ghana's Northern Region and their link to culturally responsive pedagogy (CRP). The population was 36,085 students and 186 mathematics teachers in ten public SHSs across seven districts. By stratified quota sampling, 380 students completed a Student Engagement Questionnaire; 40 teachers, selected by stratified purposive sampling, were observed in 120 lessons using an observation checklist; and ten teachers and ten students were purposively interviewed. Instruments were expert-validated, piloted and reliable (questionnaire α = .78–.93; checklist α = .90, ICC = .85). Welch's *t*-tests, correlations, cluster-robust regressions and thematic analysis showed that boys were more engaged than girls (d = 1.64), and observed CRP was associated with higher engagement for boys (r = .40) and girls (r = .49). The gap lay mainly in public participation; teachers should combine culturally relevant examples with participation-structuring practices.

Keywords: Culturally responsive pedagogy, Gender differences, Student engagement, Mathematics education

INTRODUCTION

Mathematics is a compulsory subject in Ghana's Senior High School (SHS) curriculum and a gateway to tertiary education and to careers in science, technology, engineering and mathematics (STEM) (Davis & Abass, 2023; Wang & Degol, 2017). Students' engagement in mathematics, their behavioural, emotional and cognitive involvement in learning (Fredricks et al., 2004), is therefore central to achievement. Culturally responsive pedagogy (CRP) is an approach to teaching that values students' cultural knowledge, languages and lived experiences as learning resources (Gay, 2018; Ladson-Billings, 1995). In mathematics, CRP supports engagement through meaningful, culturally relevant tasks (Matthews et al., 2022) and shared classroom authority (Engle & Conant, 2002; Langer-Osuna, 2017), and culturally relevant education is linked to greater engagement (Aronson & Laughter, 2016). For CRP to address students' cultural and learning needs, however, it must not be biased towards a particular gender. Equity requires not identical participation but suitable ways to engage (Esmonde, 2009); if culturally relevant examples draw only on activities associated with boys, or if discussion is dominated by those who answer fastest, CRP may reproduce rather than reduce gender differences.

In this study, gender refers to the socially constructed roles, behaviours and expectations associated with being male or female, as distinct from biological sex (West & Zimmerman, 1987); in the analysis, it was operationalised as students' identification as male or female. Gender norms are the shared social expectations about how males and females should behave (Cislaghi & Heise, 2020); in the mathematics classroom, they include expectations about who should speak, answer first or lead discussion. Although gender achievement gaps have narrowed, girls still report lower confidence and belonging than boys of similar performance (Else-Quest et al., 2010; Good et al., 2012), signalling inequitable recognition rather than lower ability (Kollmayer et al., 2018). Norms rewarding speed and competition favour boys (Garr-Schultz et al., 2023), while narratives casting mathematics as male shape students' self-image and motivation (Wang & Degol, 2017).

These dynamics are pronounced in Northern Ghana. Gender norms in Ghana shape expectations for girls' education (Nartey et al., 2025), and studies report gender differences in mathematics self-concept, attitudes and performance (Awoniyi et al., 2025); in the Northern Region, boys outperform girls in SHS mathematics and are perceived as more involved in mathematics activities (Asomah et al., 2026). The region's linguistic diversity, including Dagbani–English bilingual mathematics teaching (Amidu, 2026), and community practices such as weaving (Asinyo et al., 2021; Bukari, 2026) also offer cultural resources for connecting mathematics to students' lives.

Empirical studies, mainly interventions, show that gender gaps shrink under gender-sensitive instruction (Dilor, 2025; Vuai et al., 2026). CRP can be gender-responsive when it redistributes participation (Reinholz & Shah, 2018) and attends to girls' silences, which may mask engagement (Šeďová & Navrátilová, 2020) or reflect gendered exclusion from classroom talk (Kuchah et al., 2024). Ghanaian CRP research, however, has concentrated on southern and central contexts and has seldom treated gender as an explicit dimension of cultural responsiveness (Bonney et al., 2026; Gyamerah, 2025).

Consequently, whether naturally occurring CRP in Sub-Saharan African classrooms supports the engagement of both boys and girls, and through which participation structures, remains understudied, particularly in Northern Ghana. This study therefore examined gender differences in mathematics engagement among SHS students in Ghana's Northern Region and their relationship with culturally responsive teaching practices.

Theoretical Framework

Social Constructivist Theory (Vygotsky, 1978) treats participation as a product of social interaction, so it reflects teaching practice rather than a fixed feature of male or female students. In Culturally Responsive Pedagogy (Gay, 2018; Ladson-Billings, 1995), cultural competence legitimises multiple ways of participating, including written and non-verbal ones, and critical consciousness challenges inequitable classroom patterns such as the distribution of opportunities to speak (Reinholz & Shah, 2018). Together, they imply that CRP should support the engagement of both boys and girls, albeit in different visible ways.

Conceptual Framework: The conceptual framework, drawn from both theories, is presented in Figure 1.

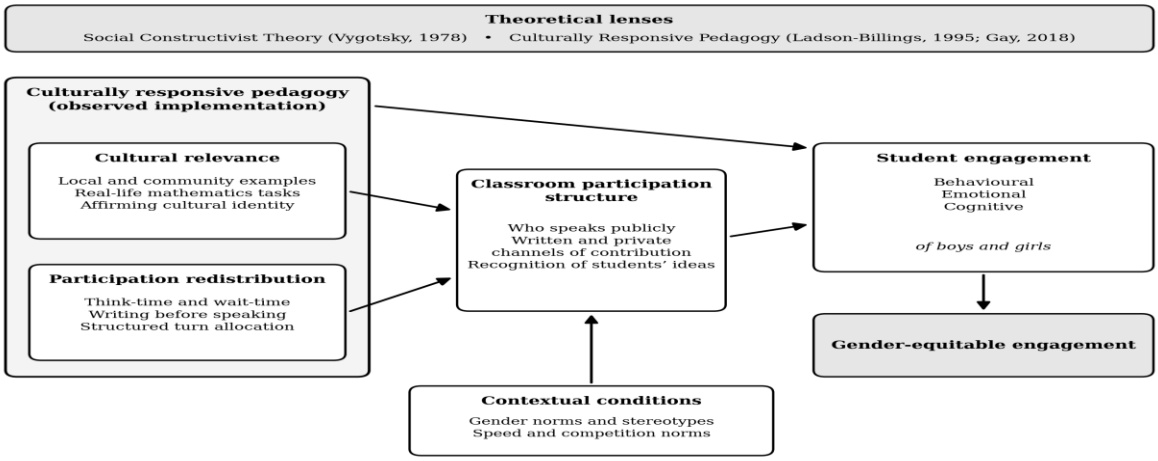


Figure 1: Conceptual Framework of the Study. *Source:* Researcher's construct (2026).

In Figure 1, CRP implementation has two dimensions, cultural relevance and participation redistribution, which shape engagement directly and through the classroom participation structure; contextual conditions (gender norms and stereotypes, and norms of speed and competition) influence this structure and thus whether engagement is gender-equitable.

Research Questions

1. How different is the self-reported engagement in mathematics for males compared to females?
2. What is the relationship between observed CRP implementation and the engagement of males and females in mathematics lessons?
3. How do teachers and students explain gender differences in engagement and the role of CRP?

METHODS

An explanatory sequential mixed-methods design was used (Creswell & Plano Clark, 2018): quantitative data were collected and analysed first, followed by interviews to explain the quantitative results. The study took place in ten public Senior High Schools (SHSs) across the Northern Region. Using the Krejcie and Morgan (1970) table, 380 students (190 male, 190 female; SHS 1 and SHS 2) completed the engagement questionnaire. Forty mathematics teachers (four per school) were each observed in three lessons, giving 120 lessons with a mean duration of 87.6 minutes and a mean of 25.2 boys present. For the interviews, ten teachers (three female, seven male; 4 to 20 years of experience) and ten students (five female, five male), each from a different school, were purposively selected; student recruitment continued until saturation.

The 18-item Student Engagement Questionnaire, adapted from Fredricks et al. (2004) and Skinner et al. (2009), measured behavioural, emotional and cognitive engagement (six items each) on a five-point scale. The Classroom Observation Checklist rated CRP implementation on eleven items scored 0 (not observed) to 3 (consistently observed); the composite is the item mean. The checklist also recorded tallies on 18 engagement indicators, separately for boys and girls, parallel to the questionnaire subscales. Semi-structured interview guides for teachers (11 questions) and students (8 questions) covered participation, peer interaction, cultural examples and classroom practice.

Experts in mathematics education and educational evaluation reviewed the instruments for the sufficiency, precision and fidelity of the items to their intended constructs and for their suitability for SHS mathematics classrooms in Ghana; their feedback led to revised item wording and the removal of ambiguous statements. The instruments were then pilot-tested at two Senior High Schools that shared characteristics with the study sites but lay outside the study area: the questionnaire with SHS 1 and SHS 2 students, the observation checklist in ten mathematics lessons, and the teacher interview guide with four teachers. The pilot checked item clarity, language suitability, section order and completion time, and led to minor revisions of wording and order. Internal consistency was acceptable to good for behavioural (α = .78, ω = .79), emotional (α = .89, ω = .89), cognitive (α = .87, ω = .87) and total engagement (α = .93, ω = .93), and for observed CRP implementation (α = .90). The researcher and two assistants independently rated the ten pilot lessons, and agreement on CRP items was substantial (mean weighted κ = .69; Landis & Koch, 1977); the

ICC(2,1) of .85 indicated good composite reliability. Females' attendance and the participation tallies were not available in verified form and were not analysed.

One observer, seated at the back, observed each lesson; interviews followed, with teacher interviews lasting 30 to 45 minutes. Two students responded in Dagbani; two trained native speakers independently transcribed and translated their responses, with no substantive differences. Ethical approval was obtained from the Humanities and Social Sciences Research Ethics Committee, College of Humanities and Social Sciences, Kwame Nkrumah University of Science and Technology, Kumasi (Ref: HuSSREC/Ap/323/VOL.4), and the Northern Regional Directorate of the Ghana Education Service granted access to the schools. Informed consent was obtained from teachers, and parental consent and student assent were obtained for students.

Research Question 1 was answered with Welch's *t*-tests and Cohen's *d*. Research Question 2 was answered with Pearson correlations and regressions of each gender's lesson engagement total on CRP implementation, with standard errors clustered on the 40 teachers using the CR2 small-sample correction (Bell & McCaffrey, 2002; Cameron & Miller, 2015; Pustejovsky & Tipton, 2018). Research Question 3 was answered through thematic analysis (Braun & Clarke, 2006) of interview transcripts.

RESULTS

Research Question 1: Gender Differences in Self-Reported Engagement

Male and female students' mean engagement scores were compared using Welch's *t*-tests (Table 1).

Table 1: Self-Reported Engagement by Gender

Dimension	Male M (SD)	Female M (SD)	Mean diff. [95% CI]	Welch t (df)	p	d [95% CI]
Behavioural	4.13 (0.44)	3.42 (0.41)	0.71 [0.63, 0.80]	16.42 (376.55)	< .001	1.69 [1.45, 1.92]
Emotional	4.38 (0.62)	3.48 (0.52)	0.90 [0.78, 1.01]	15.34 (367.44)	< .001	1.57 [1.34, 1.80]
Cognitive	4.30 (0.63)	3.70 (0.60)	0.59 [0.47, 0.72]	9.46 (377.29)	< .001	0.97 [0.76, 1.18]
Total	4.27 (0.47)	3.53 (0.43)	0.74 [0.64, 0.83]	15.95 (374.84)	< .001	1.64 [1.40, 1.87]

Table 1 shows that male students reported significantly higher engagement than female students on all three dimensions and on total engagement ($p < .001$). The total engagement difference was 0.74 points on the five-point scale, a very large effect ($d = 1.64$). The pattern held in both forms and in urban, peri-urban and rural schools.

Research Question 2: CRP Implementation and Engagement by Gender. Correlations and cluster-robust regressions across the 120 lessons are presented in Table 2.

Table 2: Observed CRP Implementation and Engagement by Gender

Outcome	r [95% CI]	Slope (SE)	p	Teacher-level r
Boys: lesson engagement total	.40 [.24, .54]	35.4 (9.4)	.001	.50
Boys: engagement per boy present	.61 [.49, .71]	1.54 (0.23)	< .001	.68
Girls: lesson engagement total	.49 [.35, .62]	42.9 (8.5)	< .001	.61

Table 2 shows that observed CRP implementation, which averaged 1.62 on the 0–3 scale ($SD = 0.66$) and varied mainly between teachers (ICC = .86), was positively associated with engagement among both boys ($r = .40$) and girls ($r = .49$). These associations held when observer and lesson duration were controlled, across all three engagement subscales (boys $r = .30$–$.37$; girls $r = .39$–$.46$; all $p < .001$), and when lessons were averaged by teacher.

Research Question 3: Participants' Explanations. Table 3 summarises the themes and the number of participants who raised each.

Table 3: Themes from Teacher and Student Interviews

Theme	Students	Teachers	Illustration
Boys answer first or dominate discussion	10	10	Boys shout answers before the question is finished (F1)
Withholding known answers	10 (girls repeatedly, boys once)	—	Girls write answers privately (S1, S3)
Fear of ridicule	7	6	Boys laugh or comment on wrong answers (S1, S9)
Norms of modesty	3	8	Speaking loudly is "too forward" for girls (S7)

Theme	Students	Teachers	Illustration
Community examples help both genders	10	10	Market, farming and grain-measuring examples
Girls respond to domestic examples.	—	5	Girls explain knowledge from household tasks (M7)
Practices that change who speaks	10 favoured at least one	10 used at least one	Think-time, writing first, direct calling, small groups

Key: F = female teacher; *M* = male teacher; S = student. The number identifies the individual participant (e.g., F1 = female teacher 1; M7 = male teacher 7; S1 = student 1).

As shown in Table 3, all ten students and all ten teachers described boys as answering first or dominating whole-class discussion. All five male students described withholding a known answer once, whereas four of the five female students described doing so many times. One female student explained: "If I know the answer, by the time I get up to raise my hand, one of the boy[s] has done it already and I keep my mouth shut" (S1). All participants reported that community examples benefited boys and girls, and five teachers said they particularly benefited girls because they drew on home activities. All ten teachers described practices for changing who spoke: direct or random calling (six) and protected time before oral answers through wait-time, think-pair-share or writing first (five). As one teacher put it, working on paper before answering aloud means "there is less of a benefit of having to be the loudest student in class" (M5).

DISCUSSION

Boys' higher engagement is consistent with evidence that girls report less confidence and belonging despite similar performance (Else-Quest et al., 2010; Good et al., 2012), reflecting a lack of recognition rather than ability (Kollmayer et al., 2018), and mirrors Ghanaian evidence on gendered expectations and mathematics outcomes (Asomah et al., 2026; Awoniyi et al., 2025; Nartey et al., 2025). However, the gap is considerably larger than cross-national estimates (Else-Quest et al., 2010) and needs confirmation with other engagement measures. Because emotional engagement, where the gap was largest, reflects interest, confidence and belonging (Fredricks et al., 2004), girls' disadvantage appears to lie less in effort than in how they feel about mathematics. Where norms reward speed and competition (Garr-Schultz et al., 2023), girls repeatedly overtaken may feel unrecognised yet keep thinking about the work, as the smaller cognitive gap suggests.

The interviews located the gap primarily in voice that is, speaking in public. Reports of ridicule and modesty norms support the view that girls' silence reflects exclusion caused by gender norms against speaking publicly (Kuchah et al., 2024), while teachers' reports that girls privately knew the answers show that silence can conceal genuine engagement (Šeďová & Navrátilová, 2020); both processes appear to operate in these classrooms. As Esmonde (2009) argues, equitable engagement does not mean that all students engage in the same way, but that their ways of engaging are recognised and valued.

Stronger CRP implementation was associated with more engagement among both boys and girls, supporting the premise that treating students' cultural knowledge as a resource strengthens engagement (Aronson & Laughter, 2016; Gay, 2018; Ladson-Billings, 1995). As Matthews et al. (2022) and Bukari (2026) suggest, community activities such as measuring grain and market trading made mathematics relevant for both girls and boys. The association was at least as strong for girls, extending largely interventionist evidence that gender-sensitive instruction reduces gender gaps (Dilor, 2025; Vuai et al., 2026) to naturalistic Ghanaian classrooms. Domestic examples, to which girls reportedly responded strongly, legitimise knowledge girls already hold and can give them a voice (Gay, 2018).

Participants saw culturally relevant activities as involving the whole class, and participation-structuring practices as changing who speaks; CRP therefore needs explicit redistribution of participation, not cultural relevance alone, to be gender-responsive (Reinholz & Shah, 2018). Think-time, writing before speaking and direct turn allocation share classroom authority more widely, a condition for productive mathematical engagement (Engle & Conant, 2002; Langer-Osuna, 2017). From a social constructivist perspective (Vygotsky, 1978), when meaning is negotiated mainly through public discussion, silent students lose access to that mediation; protected time and written input restore it. CRP that does not alter participation structures may thus be relevant but not redistributive, as the conceptual framework predicts (Figure 1).

CONCLUSION

Male SHS students in Northern Ghana reported significantly higher mathematics engagement than female students, a gap located mainly in public participation. Observed CRP implementation was associated with higher engagement for both boys and girls. Culturally relevant content appeals to a wide range of students, while participation-structuring practices alter who participates; gender-equitable engagement therefore requires CRP that explicitly considers who is heard.

Recommendations

Mathematics teachers should combine culturally relevant examples, including domains where girls have expertise, with wait-time, writing before speaking and structured turn allocation. Professional development programmes, head teachers, and supervisors should treat cultural

relevance and participation redistribution as two distinct CRP competencies, explicitly teach the second, and judge engagement by who participates, not only by verbal responses. Future studies should record attendance by gender and use independent observers so that the effects of CRP per student can be compared by gender.

Limitations

The cross-sectional design, with one observer rating CRP and engagement in each lesson, may inflate associations. Girls' engagement was analysed as lesson totals, preventing per-student gender comparisons, and participation evidence is qualitative. Questionnaires could not be associated with observed teachers, and only ten public schools in one region were examined.

REFERENCES

Amidu, A.-S. (2026). The impact of Dagbani-English bilingual instruction on the mathematics performance of the senior high school students in Tamale Metropolis in Ghana. *East African Journal of Education Studies, 9*(1), 459–469. https://doi.org/10.37284/eajes.9.1.4439

Aronson, B., & Laughter, J. (2016). The theory and practice of culturally relevant education: A synthesis of research across content areas. *Review of Educational Research, 86*(1), 163–206. https://doi.org/10.3102/0034654315582066

Asinyo, B. K., Howard, E. K., & Seidu, R. K. (2021). Weaving traditions of Daboya and Yendi communities in Northern Ghana. *Journal of Arts & Humanities, 10*(4), 39–48.

Asomah, R. K., Abdul Aziz, M., Gabriel-Wettey, F. K. N., Abonyi, U. K., Ashun, E. A., Assamah, G., & Aweso, D. M. (2026). Gender differences in high school students' mathematics performance, attitudes, and career aspirations in Northern Ghana: The mediating roles of equal chance, equal treatment, and caliber of instruction. *Frontiers in Education, 11*, Article 1752558. https://doi.org/10.3389/feduc.2026.1752558

Awoniyi, F. C., Brenya, E. K., Asomah, R. K., & Donkor, P. B. K. (2025). The influence of gender disparities on high school students' mathematics performance. *Journal of Research and Advances in Mathematics Education, 10*(2), 120–134. https://doi.org/10.23917/jramathedu.v10i2.7052

Bell, R. M., & McCaffrey, D. F. (2002). Bias reduction in standard errors for linear regression with multi-stage samples. *Survey Methodology, 28*(2), 169–182.

Bonney, E. A., Akosah, E. F., Tawiah-Mensah, J. E., Tetteh, A. A., & Kafu, G. Y. (2026). Culturally responsive pedagogy: Leveraging ethno-cultural approaches to enhance mathematics and science teaching in Ghana's early childhood development programs. *Early Childhood Education Journal, 54*(5), 3717–3734. https://doi.org/10.1007/s10643-025-02089-1

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Bukari, H. I. (2026). Ethnomathematics for sustainable and culturally responsive mathematics education in Ghana: An ethnographic exploration. *Sustainable Education and Digital Transformation, 1*(2), Article e35703. https://doi.org/10.33902/SEDT.202635703

Cameron, A. C., & Miller, D. L. (2015). A practitioner's guide to cluster-robust inference. *Journal of Human Resources, 50*(2), 317–372. https://doi.org/10.3368/jhr.50.2.317

Cislaghi, B., & Heise, L. (2020). Gender norms and social norms: Differences, similarities and why they matter in prevention science. *Sociology of Health & Illness, 42*(2), 407–422. https://doi.org/10.1111/1467-9566.13008

Creswell, J. W., & Plano Clark, V. L. (2018). *Designing and conducting mixed methods research* (3rd ed.). SAGE.

Davis, E. K., & Abass, A. T. (2023). The attributes senior high school mathematics teachers and their students value in mathematics learning. *Asian Journal for Mathematics Education, 2*(2), 183–203. https://doi.org/10.1177/27527263231179745

Dilor, I. D. (2025). Culturally responsive pedagogy in mathematics: Effects on achievement, engagement, perceptions and attitudes of SHS students in Ghana. *International Journal of Mathematics and Mathematics Education, 3*(3), 157–176. https://doi.org/10.56855/ijmme.v3i3.1501

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. https://doi.org/10.1037/a0018053

Engle, R. A., & Conant, F. R. (2002). Guiding principles for fostering productive disciplinary engagement: Explaining an emergent argument in a community of learners classroom. *Cognition and Instruction, 20*(4), 399–483. https://doi.org/10.1207/S1532690XCI2004_1

Esmonde, I. (2009). Ideas and identities: Supporting equity in cooperative mathematics learning. *Review of Educational Research, 79*(2), 1008–1043. https://doi.org/10.3102/0034654309332562

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research, 74*(1), 59–109. https://doi.org/10.3102/00346543074001059

Garr-Schultz, A., Muragishi, G. A., Mortejo, T. A., & Cheryan, S. (2023). Masculine defaults in academic science, technology, engineering, and mathematics (STEM) fields. *Psychological Science in the Public Interest, 24*(1), 1–9. https://doi.org/10.1177/15291006231170829

Gay, G. (2018). *Culturally responsive teaching: Theory, research, and practice* (3rd ed.). Teachers College Press.

Good, C., Rattan, A., & Dweck, C. S. (2012). Why do women opt out? Sense of belonging and women's representation in mathematics. *Journal of Personality and Social Psychology, 102*(4), 700–717. https://doi.org/10.1037/a0026659

Gyamerah, K. (2025). Towards an anti-colonial turn in science and mathematics education: Centering Indigenous Ghanaian knowledge. *Educational Considerations, 50*(3).

Kollmayer, M., Schober, B., & Spiel, C. (2018). Gender stereotypes in education: Development, consequences, and interventions. *European Journal of Developmental Psychology, 15*(4), 361–377. https://doi.org/10.1080/17405629.2016.1193483

Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement, 30*(3), 607–610. https://doi.org/10.1177/001316447003000308

Kuchah, K., Adamson, L., Dorimana, A., Uwizeyemariya, A., Uworwabayeho, A., & Milligan, L. O. (2024). Silence and silencing in the classroom: Rwandan girls' epistemic exclusion in English medium basic education. *Journal of Multilingual and Multicultural Development, 45*(10), 4301–4315. https://doi.org/10.1080/01434632.2022.2159031

Ladson-Billings, G. (1995). Toward a theory of culturally relevant pedagogy. *American Educational Research Journal, 32*(3), 465–491. https://doi.org/10.3102/00028312032003465

Landis, J. R., & Koch, G. G. (1977). The measurement of observer agreement for categorical data. *Biometrics, 33*(1), 159–174. https://doi.org/10.2307/2529310

Langer-Osuna, J. M. (2017). Authority, identity, and collaborative mathematics. *Journal for Research in Mathematics Education, 48*(3), 237–247. https://doi.org/10.5951/jresematheduc.48.3.0237

Matthews, L. E., Jones, S. M., & Parker, Y. A. (2022). *Engaging in culturally relevant math tasks, 6–12: Fostering hope in the middle and high school classroom*. Corwin.

Nartey, P. B., Nabunya, P., Tetteh, P. M., & Ssewamala, F. M. (2025). When families choose sons: Parental gender norms and girls' education in Ghana. *Populations, 1*(4), Article 25. https://doi.org/10.3390/populations1040025

Pustejovsky, J. E., & Tipton, E. (2018). Small-sample methods for cluster-robust variance estimation and hypothesis testing in fixed effects models. *Journal of Business & Economic Statistics, 36*(4), 672–683. https://doi.org/10.1080/07350015.2016.1247004

Reinholz, D. L., & Shah, N. (2018). Equity analytics: A methodological approach for quantifying participation patterns in mathematics classroom discourse. *Journal for Research in Mathematics Education, 49*(2), 140–177. https://doi.org/10.5951/jresematheduc.49.2.0140

Šeďová, K., & Navrátilová, J. (2020). Silent students and the patterns of their participation in classroom talk. *Journal of the Learning Sciences, 29*(4–5), 681–716. https://doi.org/10.1080/10508406.2020.1794878

Skinner, E. A., Kindermann, T. A., & Furrer, C. J. (2009). A motivational perspective on engagement and disaffection: Conceptualization and assessment of children's behavioral and emotional participation in academic activity in the classroom. *Educational and Psychological Measurement, 69*(3), 493–525. https://doi.org/10.1177/0013164408323233

Vuai, A. H., Swai, E., & Mnyanyi, C. (2026). Culturally responsive pedagogy in secondary mathematics education: Evidence from Zanzibar. *East African Journal of Education Studies, 9*(3), 981–998. https://doi.org/10.37284/eajes.9.3.5686

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.

Wang, M.-T., & Degol, J. L. (2017). Gender gap in science, technology, engineering, and mathematics (STEM): Current knowledge, implications for practice, policy, and future directions. *Educational Psychology Review, 29*(1), 119–140. https://doi.org/10.1007/s10648-015-9355-x

West, C., & Zimmerman, D. H. (1987). Doing gender. *Gender & Society, 1*(2), 125–151. https://doi.org/10.1177/0891243287001002002