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Relevance without Redistribution: Culturally Responsive Teaching and Gendered Patterns of Teacher Questioning in Mathematics Classrooms 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 study examined whether culturally responsive pedagogy (CRP) is associated with gendered patterns of teacher questioning in Senior High School (SHS) mathematics in Ghana's Northern Region, using a cross-sectional observational design. The accessible population was 186 mathematics teachers in ten public SHSs. Schools were selected by proportionate stratified random sampling, and 40 teachers were sampled proportionately by school and gender; each was observed in three lessons (120 lessons) using an expert-validated observation checklist and tally sheet. Inter-rater reliability (κ = .655; ICC = .75–.85) and internal consistency (α = .80–.85) were acceptable. Binomial logistic regression with clustered standard errors showed that girls (50.5% of students present) received only 43.2% of teacher-directed questions (OR = 0.74), although they answered, asked, explained and led group work proportionately. Allocation did not respond to class composition, and neither form of CRP predicted fairer allocation. Teachers should combine culturally relevant content with deliberate questioning routines.

Keywords: Culturally Responsive Teaching, Gender Equity, Teacher Questioning, Mathematics Classrooms, Ghana

INTRODUCTION

Culturally responsive teaching, also referred to as culturally responsive pedagogy (CRP), is an approach that uses students' cultural knowledge, prior experiences, languages and communication styles as conduits for teaching and learning (Gay, 2018; Ladson-Billings, 1995). Culturally relevant education has been linked to students' motivation, engagement and achievement across subject areas, including mathematics (Aronson & Laughter, 2016). The aim of promoting CRP and ethnomathematics in sub-Saharan Africa is to broaden participation, as school mathematics is somewhat remote from the sociocultural practices of learners (Kabuye Batiibwe, 2024; Kyeremeh et al., 2025). Teachers' questioning is a central means by which participation and learning opportunities are distributed in mathematics lessons: the questions teachers pose, and the students to whom they direct them, determine who is invited to explain, justify and refine their mathematical thinking in public (Franke et al., 2009; Walshaw & Anthony, 2008). Directed questioning is revealing because teachers wholly control it. The mathematics self-concept of students is formed over time based on decisions made about who speaks (Cobb et al., 2009).

Mathematics gender gaps are increasingly attributed to social and cultural conditions, not ability (Breda et al., 2018; Leyva, 2017; Wang & Degol, 2017). The lack of participation in mathematics discussion is evident even at similar achievement levels, and this can be attributed to classroom interaction (Aguillon et al., 2020; Ernest et al., 2019). Teachers interact somewhat more with boys than with girls (Jones & Dindia, 2004; Ortega et al., 2021), and participation gaps narrow when participation is structured (Aguillon et al., 2020). Even equitable teachers may miss cumulative patterns, such as who has not been asked (van Es et al., 2017).

In Ghana's Northern Region, norms casting mathematics as male (Awoniyi et al., 2025; Nartey et al., 2025) and large classes may shape Senior High School (SHS) mathematics participation. Empirical work on culturally grounded mathematics teaching in Ghana and other African settings has examined ethnomathematics-based instruction in relation to students' attitudes, participation and cultural connections (Asare, 2026; Bukari, 2026; Saputra et al., 2026), yet Ghanaian CRP research has rarely examined observed classroom behaviours (Saputra et al., 2026). The underlying promise, which is largely untested, is that relevance equates with equitable participation (Aronson & Laughter, 2016; Sleeter, 2012). However, relevance and redistribution are different (Ladson-Billings, 2014): content-focused practices involve what is being taught (Gay, 2018), while participation-focused practices involve who is speaking (Reinholz & Shah, 2018; Tanner, 2013). Typically, equity is assessed based on raw counts without considering the composition of classes (Reinholz & Shah, 2018). Research has focused on minority status (Dasgupta et al., 2015) but not as much on whether teachers reallocate as composition varies (Ortega et al., 2021). It therefore remains unknown whether culturally responsive teaching translates into more equitable questioning opportunities for girls and boys in mathematics classrooms. This matters because, if relevance does not redistribute questioning, CRP initiatives and teacher education in Ghana will need to address who is asked to reason publicly, and not only what is taught.

The purpose of this study was therefore to examine whether culturally responsive teaching is associated with gendered patterns of teacher questioning, that is, with an equitable distribution of teacher-directed questions and other participation opportunities between boys and girls, in SHS mathematics lessons in the Northern Region of Ghana.

Theoretical Framework

The study is grounded in the theory of culturally relevant pedagogy (Ladson-Billings, 1995), as extended in Gay's (2018) framework of culturally responsive teaching, and in social constructivist theory (Vygotsky, 1978). Culturally relevant pedagogy emphasises academic success, cultural competence and critical consciousness (Ladson-Billings, 1995). Social constructivism assumes that understandings are developed through the process of articulating and refining concepts by communicating with others, and that the opportunities to communicate are resources for reasoning and mathematical identity (Vygotsky, 1978). Culturally relevant content can "capture" girls' attention but may not provide them with the same opportunity to participate in public reasoning. The two viewpoints point to both what is being taught and who is having the opportunity to do the reasoning.

Research Questions

1. To what extent do girls receive and produce a proportional share of participation behaviours in SHS mathematics lessons?
2. Does teachers' allocation of directed questions to girls respond to class gender composition?
3. Are content-focused and participation-focused CRP associated with girls' share of teacher-directed questions?

Hypotheses

The following null hypotheses were tested at the .05 level of significance:

1. Girls' share of each participation behaviour does not differ significantly from their share of students present.
2. Girls' share of teacher-directed questions does not respond to class gender composition differently from proportional allocation.
3. Content-focused and participation-focused CRP are not significantly associated with girls' share of teacher-directed questions.

METHOD

The study adopted a cross-sectional observational design (Cohen et al., 2018) using classroom observation data from a wider study of culturally responsive pedagogy and gender equity in SHS mathematics, to address questions on teachers' allocation of participation not examined there. Ten public SHSs in urban, peri-urban and rural districts of the Northern Region were selected by proportionate stratified random sampling, which ensures that each location is represented in proportion to its size (Cohen et al., 2018). These schools had 186 mathematics teachers, who formed the accessible population, and 40 of them were sampled proportionately by school and gender. Each teacher was observed three times between February and July 2026, yielding 120 lessons (60 SHS 1, 60 SHS 2; 72 urban, 24 peri-urban, 24 rural), 45 of which were taught by female teachers. Lessons averaged 50.8 students (*SD* = 8.0), of whom 50.5% were girls (range 31.4%–68.1%).

Using a structured observation checklist based on culturally responsive practice (Gay, 2018), eleven items were rated from 0 (not observed) to 3 (clearly observed). Content-focused CRP was the mean of four items (community examples, real-life tasks, community reasoning and cultural affirmation); participation-focused CRP was the mean of seven items (mixed-gender grouping, rotating leadership, fair questioning, inviting explanations, equitable support and feedback, and intervening when one gender dominates). An additional item was recorded for the teacher's explicit challenge of a gender stereotype. Following approaches that quantify participation by student group (Reinholz & Shah, 2018), a tally sheet recorded questions directed to boys and to girls, and the numbers of boys and girls who answered, asked questions, explained solutions, led group work, and received praise or correction. Content validity was established through expert review: specialists in mathematics education, culturally responsive teaching and educational evaluation judged the fidelity of the items to their intended constructs and their suitability for Ghanaian SHS classrooms, and their feedback led to revised item wording and refined indicators. Two types of reliability were determined. Internal consistency (Cronbach's alpha) was computed for the two rating composites, because each combines several items intended to measure a single construct: $\alpha = .80$ for content-focused CRP and $\alpha = .85$ for participation-focused CRP, both above the commonly used threshold of .70 (Taber, 2018). Inter-rater reliability was also determined, because the ratings depend on observers' judgement and each main-study lesson was rated by a single observer.

The observations were made by three trained field assistants. In a 10-lesson pilot, three raters independently scored the same lessons. Agreement on the rating items was substantial (mean weighted $\kappa = .655$; Landis & Koch, 1977); weighted kappa was used because the items are ordinal (0–3). Single-rater intraclass correlations, ICC(2,1), were .75 and .85 (Koo & Li, 2016); ICC(2,1) was used because each main-study lesson had one observer. Tally data were checked for internal consistency before analysis. Ethical approval was granted by the Research Ethics Committee of the College of Humanities and Social Sciences, Kwame Nkrumah University of Science and Technology, and the Ghana Education Service; teachers gave written informed consent, in line with established guidelines for educational research (British Educational Research Association, 2018).

Each behaviour was analysed as girls' events out of all events per lesson, using binomial logistic regression (Agresti, 2012) with an offset equal to the logit of girls' proportion present, so that an odds ratio (OR) of 1 indicates a share equal to girls' presence. Responsiveness to composition was expressed as an elasticity (1 = proportional adjustment; 0 = none). Teacher gender, school location, observation number and class size were included as controls, and standard errors for every lesson were clustered by teacher (Cameron & Miller, 2015).

RESULTS

To test Hypothesis 1, girls' and boys' events for each of the seven behaviours were summed across the 120 lessons, and girls' share of each behaviour was compared with their share of students present (Table 1).

Table 1: Girls' Share of Participation Behaviours Relative to Their Share of Students Present

Behaviour	Girls	Boys	Girls' share (%)	*OR* [95% CI]	*p*
Questions directed by teacher	534	703	43.2	0.74 [0.68, 0.81]	< .001
Answered questions	668	649	50.7	1.01 [0.93, 1.11]	.776
Asked questions	366	390	48.4	0.93 [0.81, 1.05]	.239
Explained solutions	352	384	47.8	0.90 [0.80, 1.02]	.106
Led group work	260	279	48.2	0.91 [0.80, 1.05]	.180
Received praise	422	445	48.7	0.94 [0.83, 1.07]	.336
Received correction or support	310	313	49.8	0.97 [0.87, 1.08]	.619

Table 1 shows that girls received 534 of the 1,237 teacher-directed questions (43.2%), despite constituting 50.5% of students present. The odds ratio of 0.74 (95% CI [0.68, 0.81], $p < .001$) indicates that girls' odds of being directed a question were about 26% lower than their presence would predict. Conversely, girls' shares of the six student-driven behaviours ranged from 47.8% (explained solutions) to 50.7% (answered questions), with no odds ratio differing significantly from 1 ($p = .106$ to .776). Hypothesis 1 was therefore rejected for teacher-directed questions and retained for the other six behaviours.

To test Hypothesis 2, the 120 lessons were grouped into thirds (40 lessons each) by girls' proportion present: girl-minority lessons (the third with the lowest proportion of girls present), balanced lessons (the middle third) and girl-majority lessons (the third with the highest proportion of girls present). Girls' shares of questions and answers were then compared across the three groups (Table 2).

Table 2: Girls' Share of Teacher-Directed Questions and Answers by Class Composition

Class composition (40 lessons each)	Girls present (%)	Girls' share of directed questions (%)	Girls' share of answers (%)
Girl-minority	40.1	44.5	38.5
Balanced	50.3	42.4	51.4
Girl-majority	61.0	39.7	60.4

Table 2 shows that girls' share of answers rose closely with their presence, from 38.5% in girl-minority lessons to 51.4% in balanced and 60.4% in girl-majority lessons. Their share of directed questions, however, fell from 44.5% to 42.4% and then 39.7%. Girls thus received slightly more than their share when a minority (+4.4 percentage points), but 7.9 points less in balanced and 21.3 points less in girl-majority lessons. The composition elasticity for directed questions was −0.15 (95% CI [−0.36, 0.06]), significantly below the proportional value of 1 ($p < .001$), whereas that for answers was 1.07 (95% CI [0.83, 1.30]). Hypothesis 2 was therefore rejected: teachers' allocation did not respond to class composition, leaving girls most under-served where most numerous.

Girls' share was regressed on both standardised CRP scores, explicit stereotype challenges, class composition, teacher gender, school location, observation number and class size to test Hypothesis 3 (Table 3).

Table 3: Predictors of Girls' Share of Teacher-Directed Questions

Predictor	*OR* [95% CI]	*p*
Intercept (girls' odds vs fair share)	0.71 [0.60, 0.84]	< .001
Content-focused CRP (per *SD*)	1.02 [0.87, 1.19]	.792
Participation-focused CRP (per *SD*)	1.04 [0.89, 1.21]	.621
Teacher challenged a gender stereotype	1.09 [0.86, 1.38]	.468
Class composition (centred logit)	0.32 [0.25, 0.40]	< .001

Predictor	*OR* [95% CI]	*p*
Female teacher	0.94 [0.77, 1.16]	.574
Rural school (vs urban)	1.08 [0.83, 1.42]	.553
Peri-urban school (vs urban)	1.08 [0.86, 1.36]	.518
Class size (per *SD*)	0.96 [0.88, 1.05]	.385

Table 3 shows that neither form of CRP was significantly associated with girls' share of directed questions. For content-focused CRP, the odds ratio was 1.02 (95% CI [0.87, 1.19], p = .792) and for participation-focused CRP, it was 1.04 (95% CI [0.89, 1.21], p = .621), both of which included 1. Challenging a gender stereotype (OR = 1.09, p = .468), teacher gender, school location and class size were also non-significant. Only class composition was significant (OR = 0.32, p < .001), reflecting the fixed allocation reported under Research Question 2. After adjustment, girls' odds of receiving a directed question remained 29% below fair share (OR = 0.71, p < .001). Hypothesis 3 was therefore retained. Results held in random-intercept models, within each observer's lessons (ORs 0.68 to 0.81), and when each school was excluded (ORs 0.73 to 0.76).

DISCUSSION

The first finding is that girls responded, asked, explained and led group work in proportion to their attendance, but their teachers directed fewer questions to them. Because directed questions are not filtered through volunteering, the gap reflects teachers' allocation rather than girls' reluctance. The result contradicts deficit explanations based on girls' confidence or interest (Leyva, 2017) and supports explanations that focus on social and instructional conditions rather than ability (Breda et al., 2018; Wang & Degol, 2017). It is notable given that SHS students in the region regard mathematics as a male domain (Awoniyi et al., 2025; Nartey et al., 2025): girls here did not withdraw from opportunities they could initiate. Unlike Aguillon et al. (2020), who found gaps in volunteered responses, the shortfall appeared in the behaviour teachers controlled, consistent with evidence that girls take part in fewer teacher-initiated interactions (Ortega et al., 2021) and that teachers interact somewhat more with boys (Jones & Dindia, 2004).

The second finding is that allocation did not respond to class composition. Girls received about 40–45% of directed questions whether they were a minority (40%) or a majority (61%) of the class. In contrast, their answers rose with their numbers, in line with evidence that participation rises with the number of same-gender peers (Dasgupta et al., 2015). This is consistent with Ortega et al. (2021) and suggests that questions are allocated by routine rather than by attention to who is present. The lack of difference between teachers indicates a classroom norm rather than the behaviour of a few teachers.

The third finding is that lessons rich in community examples and cultural affirmation were no more equitable in questioning than other lessons. This reflects the point that relevance and redistribution are different achievements (Ladson-Billings, 2014) and questions the largely untested assumption that culturally relevant mathematics ensures equitable participation (Aronson & Laughter, 2016; Sleeter, 2012). Content-focused practices have been promoted in African classrooms for making mathematics meaningful (Asare, 2026; Bukari, 2026; Kabuye Batiibwe, 2024; Saputra et al., 2026), but they do not by themselves change who is asked to speak. The null result for participation-focused practices also suggests that observers' holistic judgements of fairness did not capture the counted distribution of questions: a teacher can appear inclusive while asking boys more often. Counts of who is asked may therefore be better indicators of equitable practice than global ratings (Reinholz & Shah, 2018).

These findings are socially constructivist in that opportunities to reason aloud are themselves a resource for learning (Vygotsky, 1978). Girls who are asked fewer questions have fewer opportunities to express and develop their mathematical thinking in public settings, which can influence their perceptions of their own mathematical abilities over time (Cobb et al., 2009; Ernest et al., 2019).

Practical Implications

Because the inequity lay in teachers' allocation, routines that make allocation deliberate, such as random or structured calling, wait time and brief pair discussion before a whole-class question, may reduce it directly. In teacher education in Ghana, culturally responsive pedagogy should be integrated with an explicit participation-structuring component, and supervision could include counting who is asked, particularly in classes where girls are the majority.

Limitations

Because the design is observational, the findings are associations rather than effects, and the null CRP association does not exclude an effect of CRP on other aspects of participation. Observer presence may have affected teaching, and one observer was used in each lesson. The cognitive demand of questions was not recorded, and the high correlation between the two CRP composites limited their separation.

Conclusion

Across the 120 lessons, girls engaged in all student-initiated behaviours proportionately to their presence, but were significantly underrepresented in teacher-directed questions, and the deficit increased with girls' prevalence. Neither content-focused nor participation-focused culturally responsive practice was associated with fairer allocation. Deliberate and monitored questioning routines, in addition to culturally relevant content, are also necessary to redistribute voice.

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REFERENCES

Agresti, A. (2012). *Categorical data analysis* (3rd ed.). Wiley.

Aguillon, S. M., Siegmund, G.-F., Petipas, R. H., Drake, A. G., Cotner, S., & Ballen, C. J. (2020). Gender differences in student participation in an active-learning classroom. *CBE—Life Sciences Education, 19*(2), Article ar12. https://doi.org/10.1187/cbe.19-03-0048

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

Asare, B. (2026). Influence of ethnomathematics-based instruction on students' attitudes, participation, and cultural connections in mathematics learning in Ghana. *Cogent Education, 13*(1), Article 2612395. https://doi.org/10.1080/2331186X.2025.2612395

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

Breda, T., Jouini, E., & Napp, C. (2018). Societal inequalities amplify gender gaps in math. *Science, 359*(6381), 1219–1220. https://doi.org/10.1126/science.aar2307

British Educational Research Association. (2018). *Ethical guidelines for educational research* (4th ed.). https://www.bera.ac.uk/publication/ethical-guidelines-for-educational-research-2018

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

Cobb, P., Gresalfi, M., & Hodge, L. L. (2009). An interpretive scheme for analyzing the identities that students develop in mathematics classrooms. *Journal for Research in Mathematics Education, 40*(1), 40–68. https://doi.org/10.5951/jresematheduc.40.1.004

Cohen, L., Manion, L., & Morrison, K. (2018). *Research methods in education* (8th ed.). Routledge.

Dasgupta, N., Scircle, M. M., & Hunsinger, M. (2015). Female peers in small work groups enhance women's motivation, verbal participation, and career aspirations in engineering. *Proceedings of the National Academy of Sciences, 112*(16), 4988–4993. https://doi.org/10.1073/pnas.1422822112

Ernest, J. B., Reinholz, D. L., & Shah, N. (2019). Hidden competence: Women's mathematical participation in public and private classroom spaces. *Educational Studies in Mathematics, 102*(2), 153–172. https://doi.org/10.1007/s10649-019-09910-w

Franke, M. L., Webb, N. M., Chan, A. G., Ing, M., Freund, D., & Battey, D. (2009). Teacher questioning to elicit students' mathematical thinking in elementary school classrooms. *Journal of Teacher Education, 60*(4), 380–392. https://doi.org/10.1177/0022487109339906

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

Jones, S. M., & Dindia, K. (2004). A meta-analytic perspective on sex equity in the classroom. *Review of Educational Research, 74*(4), 443–471. https://doi.org/10.3102/00346543074004443

Kabuye Batiibwe, M. S. (2024). The role of ethnomathematics in mathematics education: A literature review. *Asian Journal for Mathematics Education, 3*(4), 383–405. https://doi.org/10.1177/27527263241300400

Koo, T. K., & Li, M. Y. (2016). A guideline of selecting and reporting intraclass correlation coefficients for reliability research. *Journal of Chiropractic Medicine, 15*(2), 155–163. https://doi.org/10.1016/j.jcm.2016.02.012

Kyeremeh, P., Awuah, F. K., & Orey, D. C. (2025). Challenges regarding the integration of ethnomathematical perspectives into geometry teaching: The faculty reflection. *Asian Journal for Mathematics Education, 4*(3), 416–430. https://doi.org/10.1177/27527263251326330

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

Ladson-Billings, G. (2014). Culturally relevant pedagogy 2.0: A.k.a. the remix. *Harvard Educational Review, 84*(1), 74–84. https://doi.org/10.17763/haer.84.1.p2rj131485484751

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

Leyva, L. A. (2017). Unpacking the male superiority myth and masculinization of mathematics at the intersections: A review of research on gender in mathematics education. *Journal for Research in Mathematics Education, 48*(4), 397–433. https://doi.org/10.5951/jresematheduc.48.4.0397

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

Ortega, L., Treviño, E., & Gelber, D. (2021). The inclusion of girls in Chilean mathematics classrooms: Gender bias in teacher–student interaction networks. *Journal for the Study of Education and Development, 44*(3), 623–674. https://doi.org/10.1080/02103702.2020.1773064

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

Saputra, J., Darta, & Rahman, T. (2026). Etnomatematika dalam pendidikan matematika di Afrika dan luaran matematika siswa: Telaah literatur sistematis [Ethnomathematics in mathematics education in Africa and students' mathematical outcomes: A systematic literature review]. *Symmetry: Pasundan Journal of Research in Mathematics Learning and Education, 11*(1), 68–78. https://doi.org/10.23969/symmetry.v11i1.56119

Sleeter, C. E. (2012). Confronting the marginalization of culturally responsive pedagogy. *Urban Education, 47*(3), 562–584. https://doi.org/10.1177/0042085911431472

Taber, K. S. (2018). The use of Cronbach's alpha when developing and reporting research instruments in science education. *Research in Science Education, 48*(6), 1273–1296. https://doi.org/10.1007/s11165-016-9602-2

Tanner, K. D. (2013). Structure matters: Twenty-one teaching strategies to promote student engagement and cultivate classroom equity. *CBE—Life Sciences Education, 12*(3), 322–331. https://doi.org/10.1187/cbe.13-06-0115

Van Es, E. A., Hand, V., & Mercado, J. (2017). Making visible the relationship between teachers' noticing for equity and equitable teaching practice. In E. O. Schack, M. H. Fisher, & J. A. Wilhelm (Eds.), *Teacher noticing: Bridging and broadening perspectives, contexts, and frameworks* (pp. 251–270). Springer. https://doi.org/10.1007/978-3-319-46753-5_15

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

Walshaw, M., & Anthony, G. (2008). The teacher's role in classroom discourse: A review of recent research into mathematics classrooms. *Review of Educational Research, 78*(3), 516–551. https://doi.org/10.3102/0034654308320292

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