Original Article

Gender Inequalities in Primary School Achievement in Ghana: Do School Regions Matter?

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Abstract

The study examined how learners' gender affected their performance in a national standardized test in Ghana. Achievement data collected through a census method from 318,254 primary grade 4 learners in 9,619 public schools were used for the study. The instrument for data collection was a standardized test. The data were analyzed using a multilevel modeling technique. The study found significant gender-based differences in mathematics and English achievement, with girls generally performing better. Girls outperformed boys in both subjects in six regions and excelled in English in six others, and boys outperformed girls in mathematics in one region. The study's findings confirm gender-based inequalities in learning outcomes in public primary schools, challenging Ghana's efforts to achieve the set targets of the United Nations' Sustainable Development Goal 4. Therefore, it is imperative for the government, in collaboration with other stakeholders, to implement pragmatic nationwide policies to eliminate the significant gender inequalities in schools. At the same time, teachers must implement gender-re sponsive pedagogies to foster equitable and inclusive learning for all learners.

Keywords: achievement, gender, Ghana, English language, mathematics

Introduction

The quality of school learning and achievement among primary level children has been the focus of governments, researchers, and policymakers across the globe (Schleicher, 2023; Mullis & Kelly, 2022; RTI International, 2015). The importance of this level of education is reflected in the periodic assessment of children's achievement in various national, regional, and international examinations in selected school subjects across Europe, such as the Programme for International Student Assessment (PISA) (Schleicher, 2023). Others are Progress in International Reading Literacy Study (PIRLS) and Trends in International Mathematics and Science Study (TIMSS) (Mullis & Martin, 2022). In sub-Saharan Africa, regional assessments by the Southern and Eastern African Consortium Monitoring of Educational Quality [SEACMEQ, formally SACMEQ] and Programme for the Analysis of Education Systems [PASEC] are conducted for learners at different grade levels (Howie, 2022; Hungi et al., 2010). Similarly, RTI International, in collaboration with the Ghanaian government, has conducted several national education assessments for early grade and primary school learners (Ministry of Education [MoE], 2016; RTI International, 2015).

 A key issue consistently observed from these examinations is the varying yet enduring gender differences in achievement in the subjects assessed (Howie, 2022). The causes or reasons for these differences vary. Whereas some studies attribute the gender differences in achievement to differences in attitude, effort, self-efficacy, and motivation by boys and girls toward specific school subjects (Rodríguez et al., 2020; Wang, 2024), others attribute them to differential teaching and learning opportunities for boys and girls in schools, especially in mathematics, science and technology subjects (Rosén et al., 2022; UNESCO, 2017). In other study contexts, gender achievement differences are reinforced by teachers, societal expectations, and stereotypes (Rosén et al., 2022). Moreover, some studies attribute gender achievement differences to contextual factors, such as a country's socioeconomic status, culture, and educational systems (van Hek et al., 2019; Marc Jackman et al., 2019). Despite the diverse causes and explanations, the dynamics of learners' gender in influencing the quality of learning outcomes in school subjects remains complex and entirely unresolved (Parker et al., 2018; Rosén et al., 2022; van Hek et al., 2017).

Evidence from Ghana suggests educationally important learning gaps between socio-economically disadvantaged rural and advantaged urban school children in foundational reading and numeracy skills (Nyatsikor et al., 2020). However, little is known about how school regions moderate gender-based achievement differences in the Ghanaian and global contexts (Murphy, 2018; Gray et al., 2019). Consequently, this study offers fresh evidence from the Ghanaian perspective by examining the effects of learners' gender on mathematics and English language achievements and how these effects were moderated by their school regions. It is essential to understand how macro-level influences impact gender equality in education in Ghana. This assessment is crucial for evaluating the country's progress toward the United Nations' Sustainable Development Goal (SDG) 4, which aims to provide gender-inclusive and equitable education for girls and boys.

Bioecological Theory of Human Development

This study anchors on the bioecological theory of human development developed by Urie Bronfenbrenner. The theory suggests that human development occurs through increasingly complex interactions between an active child and their environment (Bronfenbrenner, 2005; Bronfenbrenner & Morris, 2007). According to Bronfenbrenner (2001), human development is a product of four elements: (i) Process, (ii) Person, (iii) Context (i.e., microsystem, mesosystem, exosystem, and macrosystem), and (iv) Time (chronosystem). The proximal process is the progressively more complex reciprocal interaction between an active, evolving bio-psychological human organism and the persons, objects, and symbols in their immediate external environment (Bronfenbrenner, 1989). In schools, the quantity and quality of interactions between a child and teachers, other learners, and learning materials typify proximal processes. These processes or interactions are directly moderated by the child's traits like disposition and ability (Bronfenbrenner & Evans, 2000).

Regarding the person element, Bronfenbrenner (2001) believed that the child's characteristics, such as IQ level and gender, influence their levels of engagement and achievement in a social milieu like the school setting. The child engages actively with a social context that impacts their development and learning opportunities. The theory suggests that based on societal norms, boys and girls engage differently in their social environments. Bronfenbrenner (2001) explains that individuals possess attributes that

invite, inhibit, or prevent engagement in sustained, progressively more complex interactions in the immediate environment. The theory categorizes personal attributes into demand, resource, and force characteristics (Bronfenbrenner & Morris, 2007). Demand characteristics are immediate stimuli, like age and gender, that influence initial social interactions in social settings like schools. Resource characteristics include a person's mental, social, and emotional strengths, limitations, and material resources that influence their cognitive, affective, and psychomotor development. The third characteristic involves the child's temperament, motivation, and persistence. Variations in these resources contribute to differences in individuals' achievement in different domains, including academic achievements. The theory identifies the microsystem as the most important area of influence regarding the context element, encompassing environments such as the home (family), school, and peer groups. It is where direct bi- or multi-lateral interactions occur with important social agents, such as parents, other household members, teachers, peers, and playmates at school and in the neighborhood (Sudbery & Whittaker, 2018; Newman & Newman, 2022). The mesosystem connects two or more different microsystems or contexts, such as the home, playground, and school (Bronfenbrenner, 2005). An example is when teachers (school microsystem) and parents (home microsystem) collaborate effectively to support a child's learning (Christensen, 2010). The exosystem consists of micro and mesosystems that impact the well-being of those interacting with the child. It involves connections between environments, at least one of which typically does not include the child; however, events in that environment can affect the child's immediate surroundings (Bronfenbrenner, 2005; Bronfenbrenner & Morris, 2007).

The theory describes the macrosystem as a psychological environment that encompasses the overall societal culture in which individuals live, influencing all other lower-level layers (Bronfenbrenner & Morris, 2007). It includes any group with similar values, belief systems, resources, risks, lifestyles, opportunity structures, life course options, and social interaction patterns (Bronfenbrenner, 2005; Tudge et al., 2009). The time element of the theory encompasses various aspects such as chronological age, duration, and the nature of the periodicity of a child's environment. According to Bronfenbrenner & Morris (2007), the impact of time on academic achievement could be external (e.g., variations in a child's socioeconomic background) or internal (e.g., developmental changes within the learner).

In line with this study's focus on examining gender effects on academic achievement at national and regional levels, this review emphasizes the person (i.e., gender) and context (specifically macrosystem), which constitute school regions in the context of this study. Therefore, inferring from the theory, the authors argue that learners' achievement differences could be explained by their gender (person element), which may further be influenced by the respective school regions (macrosystem component of the context element) in which they operate. This proposition is made against the backdrop that the regions in Ghana vary in their developmental, educational, and sociocultural heritages. These varying macro-level regional characteristics are thought to respectfully provide varied psychological environments that encompass the overall societal culture and the learning opportunities available to schools and learners within each region.

State of the Art in the Field

Research on the causes and reasons for gender achievement differences in specific subjects has yielded mixed results, making it difficult to reach a consensus. This is partly due to the various biological and genetic (Baron-Cohen, 2003; Halpern, 2000) and socio-cultural (Eagly & Wood, 2016) perspectives that explain how gender differences in cognitive domains are initiated, maintained, narrowed, or widened. Despite the diverse perspectives, some international studies indicate that, on average, girls from an early grade possess a significant academic advantage over boys, particularly in literacy (Marc Jackman et al., 2019; Meinck & Brese, 2019; Howie, 2022). Moreover, these gender gaps are more acute, particularly for learners from less advantaged backgrounds (Eriksson & Lindvall, 2023; Strietholt & Strello, 2022). For instance, analyses of PISA results from its inception show substantial reading achievement gaps favoring girls throughout all OECD countries (Meinck & Brese, 2019; van Hek et al., 2019). In contrast, boys had an advantage over girls in mathematics, though the gap between girls' and boys' language achievement was greater than boys' and girls' mathematics achievement (van Hek et al., 2019; Delaney & Devereux, 2021).

In a different context, Guiso et al. (2008) reported that fourth-grade girls had higher average reading scores than boys in all 40 countries participating in the 2006 wave of PIRLS. Additionally, more girls than boys achieved scores within the top quartile. A

similar pattern of results was observed in the 2011 wave of PIRLS (Mullis et al., 2012). The superiority of girls to boys in language subjects and reading scores is equally confirmed in the USA (Lei & Lundberg, 2020). For mathematics and science (TIMSS 2011), ninth-grade girls outperformed their boys in Botswana, whereas eighth-grade boys outperformed their girls in Ghana (Bashir et al., 2018; Mullis et al., 2016). However, Ghasemi and Burley (2019) analyzed the TIMSS 2015 wave mathematics achievement data and found statistically insignificant gender differences in fourth and eighth-grade mathematics achievement and the number of high achievers.

In Africa, the SACMEQ III assessment project, which involved fifteen Eastern and Southern countries, revealed small and mostly insignificant gaps between genders in literacy and numeracy (Hungi et al., 2010; Howie, 2022). However, in six of the fifteen participating countries, girls did significantly better than boys in reading, except for two countries where boys did better.

In comparison, boys outperformed girls in mathematics in seven countries, while girls excelled over boys in only one country (Hungi et al., 2010). However, there was a statistically insignificant gender difference in mathematics achievement in seven countries. The seemingly inconsistent gender-related achievement differences suggest that no particular gender has absolute global intellectual prowess in specific subjects, as suggested by some biological perspectives of gender differences in achievement (Baron-Cohen, 2003; Halpern, 2000).

Intriguingly, achievement data from international assessments such as TIMSS and PIRLS (von Davier et al., 2024; Oberleiter et al., 2023), SEACMEQ (Howie, 2022), and PISA (Schleicher, 2023) show a trend in the similarity of performance between males and females within countries compared to the same between countries. This is unsurprising because each country serves as a macrosystem encompassing similar values, belief systems, resources, risks, lifestyles, opportunity structures, life course options, and social interaction patterns of the learners (Bronfenbrenner, 2005; Tudge et al., 2022). Numerous studies relying on achievement data from these assessments have explained differences in international assessment achievement by the differences in country-specific (macrosystem) values, systems, and socioeconomic and cultural conditions (van Hek et al., 2019; Rosén et al., 2022). Within countries, variations in learners' achievement exist across different school regions (National Council for

Curriculum and Assessment [NaCCA], 2021) and states in the case of federal countries like the USA (Irwin et al., 2024) and Nigeria (Azubuike et al., 2024). School regions (states, provinces, and counties) act as macrosystems. Their resources and influences, both favorable and unfavorable, impact schools and learners within these regions (Azubuike et al., 2024). Globally, the similarities or differences between school regions correspondingly reflect the similarities or differences in learners' achievement assessments. This is evidenced by studies using achievement data from Australia (Hillman et al., 2023), the USA and Europe (Schleicher, 2023), and Sub-Saharan Africa (Howie, 2022; Meyer & UNESCO, 2018).

In Ghana, there are significant variations in primary school achievement, first among the regions and second between genders within the regions (NaCCA, 2021; MoE, 2016). These gender achievement differences are undeniably influenced by various observable and unobservable factors operating at different levels (Sudbery & Whittaker, 2018; Bronfenbrenner & Morris, 2007). Nonetheless, some studies explain that the observed differences are linked to the differing socioeconomic and educational resources and opportunities and, to an extent, cultural practices associated with specific regions (Ghana Statistical Service [GSS], 2021). In contrast, insignificant gender differences in achievement are linked primarily to national policies, societal values, and practices that ensure equitable resources and access to educational and learning opportunities for both genders (Kattan et al., 2023). Thus, more egalitarian societies tend to have insignificant gender differences (Inglehart & Welzel, 2005).

In Ghana, descriptive data and statistics on regional gender achievement differences abound (MoE, 2016). However, studies and literature quantifying the variance in achievement attributable to learners' gender while simultaneously determining their varying effects at school and district levels are limited (NaCCA, 2021; MoE, 2016). This study, therefore, explores an uncharted aspect of gender educational studies in the Ghanaian context. First, we explored the gendered effects nationally and, second, regionally. The national estimates of gender-based achievement differences in primary education provide insights into the country's progress towards achieving gender equality in education, as outlined by SDG 4. Conversely, the regional level effects provide insights into how different regions widened or narrowed gender effects on achievement to influence the national-level effects. Gaining knowledge and understanding of this important educational issue will provide stronger evidence for

implementing region-specific, gender-responsive strategies and practices to promote gender equality in achievement. To achieve these objectives, the following research questions were answered.

1.How much variance in learners' mathematics and English language achievement can be attributed to gender?

2.There are no significant gender differences in mathematics and English achievement across the regions of Ghana.

Contex of the Study

Ghana is a unitary state with 16 administrative regions implementing the same primary school education curriculum nationwide. According to the GSS (2021), 56.7% of the population is urban, while 43.3% is rural. Urban localities have a population of 5,000 or more, while rural areas have less than 5,000. The Greater Accra Region is the most urbanized, whereas the Upper East is the least. According to the GSS (2021), seven regions (i.e., Greater Accra, Ashanti, Bono, Central, Bono East, Western, and Eastern) are urbanized because more than half of the population in those regions live in urban areas. In contrast, the Ahafo, Northern, Volta, Oti, North East, Western North, Savannah Upper West, and Upper East are rural. Each region has its peculiar cultural heritage and socioeconomic dynamics (GSS, 2021). According to GSS (2021), there were some similarities and notable differences in children's education and literacy rates between 6 to 10 years across the 16 regions (see Table 1). The GSS (2021) report defines "literacy as the ability to read and write with understanding in any language," while formal education refers to "the process of giving and receiving standardized, systematic instruction from a recognized and accredited institution to individuals for knowledge acquisition and skill development" (p.24).

In comparison to the national education and literacy rate of 69.8% for children aged 6 to 10 years, nine regions, Ahafo, Bono East, North East, Northern, Oti, Savanna, Upper East, Upper West, and Western North, had lower rates, whereas seven regions: Ashanti, Bono, Central, Eastern, Accra, Volta and Western had higher rates. Regarding gender, both had lower rates than their national rates for males (74.1%) and females (65.6%) in eight regions: Bono East, North East, Northern, Oti, Savannah, Upper East, Upper West, and Western North.

In contrast, both genders had rates higher than their respective national rates in seven regions: Ashanti, Bono, Central, Eastern, Greater Accra, Volta, and Western. The only region where the male rate exceeded the national average but the females did not was the Ahafo. Comparatively, the Greater Accra region, the most urbanized in the country, leads in most of the literacy rate parameters, whereas the Northern, Savannah, and North East regions had lower rates. Percentagewise, there were educationally significant gender inequalities in education and literacy rates across the regions. The Greater Accra had the least (6.2%), whereas the Northern Region had the most (13.3%).

Table 1

Education and Literacy rates of ages 6-10 children across the regions in Ghana

Variables/Regions	National/Regional	
Total (%)	National/ regional (%)	Urban literacy rate (%)
		Male
National	69.8	74.1
Ahafo	68.6	72.5
Ashanti	78.0	82.0
Bono	71.5	75.8
Bono East	56.3	60.5
Central	75.2	79.9
Eastern	75.7	79.7
Gt. Accra	87.9	91.1
North East	35.9	41.3

In 2015, Ghana introduced an inclusive education policy to eliminate gender-based inequalities in educational access, learning opportunities, and outcomes (MoE, 2015). However, evidence from previous studies (Blampied et al., 2018; Nyatsikor et al., 2020) and educational reports (MoE, 2018; GSS, 2021) indicate significant achievement differences among regions. These studies attribute these regional differences to factors including unequal levels of socioeconomic development and quantity and quality of educational resources available. Segregating the achievement differences on a gender basis equally showed varying degrees of differences (NaCCA,

2021). Given Ghana's commitment to achieving the goals set for Sustainable Development Goal (SDG) 4, which emphasizes gender equality in access to education, opportunities, and learning outcomes, the results of this study will provide evidence regarding the success or shortcomings of the country's efforts to eliminate gender inequalities in educational achievement.

Materials and Methods

The study utilized the 2021 National Standardized Test (NST) for all Ghana's public school primary grade 4 learners. The NST assessed learners' performance and proficiency on the curriculum content standards in Mathematics and English. It also assessed knowledge, skills, values, and attitudes central to the new pre-tertiary education curriculum (NaCCA, 2021). The overarching objective of the NST is to assess the quality of education inputs to learning outcomes in fulfilling Sustainable Development Goals 4.1.1 and 4.1.2 and the Global Proficiency Framework (GPF), which calls for the administration of a national learning assessment during the primary, at the end of primary and the end of lower secondary. Each subject consisted of thirty-five multiple-choice questions based on the standards-based curriculum for each subject. The domains for the English language assessment consisted of reading, grammar usage at word and phrase levels, and writing. The mathematics domains consisted of number operations, algebra, geometry and measurement, and data handling. Learners who correctly answered up to 17 questions (i.e., 49% and below) were judged to have achieved below basic proficiency; scores between 18-22 (i.e., 50%-65%) were interpreted as basic proficiency, while scores between 23 and 27(66%-79%) meant proficiency in a subject. Learners who correctly answered at least 28 out of the total 35 items were deemed to have advanced knowledge (highly proficient) in the subject. According to NaCCA (2021), these performance cut-points were developed in line with the National Pre-tertiary Learning Assessment Framework (2020). According to the technical report on the examinations:

The West African Examination Council developed and pilot-tested the test items. There were 6 parallel forms of the test for both Mathematics and English Language. The test items were moderated before they were finalized to ensure that individual items within the test would measure the intended cognitive skills with reliability and an appropriate range of difficulty (NaCCA Report, 2021, p. 3).

Independent, Dependent, and Covariates

The independent variable in this study is the learners' gender, which was a dichotomous variable coded 0 (for boys) and 1 (for girls). This study's sample comprised 161,433 (50.7%) boys and 156,821 (49.3%) girls, a difference of 4,612 (1.4%) more boys. The dependent variables for the study are learners' raw achievement scores for mathematics and English. Two variables, class size, and school regions, were controlled.

Data Population, Sample, and Sampling

The study population comprised all grade 4 learners in public primary schools in Ghana. According to the technical report on the examination, 14,883 primary schools comprising 431,206 primary 4 learners registered to participate in the NST on December 17, 2021(NaCCA, 2021). Of this number, 398,698 and 399,486 learners took part in the English language and Mathematics tests, respectively. Correspondingly, 32,508 and 31,720 learners were absent from the English and Mathematics tests. However, this study utilized data on 318,254 learners from 9,619 schools. Two exclusion criteria were applied to determine the final sample size. First, the researchers were interested in only learners who participated in both subjects. Therefore, learners who participated in only one subject were excluded from the study. The second criterion was excluding schools with class sizes of less than 10 learners to appropriately apply the multilevel modeling (MLM) technique (Hox et al., 2017; O'Connell et al., 2022; Heck et al., 2022). The number of schools, learners, and achievement levels are presented in Table 2.

Table 2

Characteristics of schools, learners, and achievement

Number of schools		9,619
Number of learners		318,254
Male		161,433(50.7%)
Female		156,821(49.3%)
Mean class size		46.26
Mean achievement	English Language	19.03
	Mathematics	16.20
Mean gender achievement	Male	18.82
(English Language)	Female	19.25

Mean gender achievement (Mathematics)	Male	16.15
	Female	16.25
Below Basic Proficiency	Mathematics	195,007(61.3%)
	English Language	149,491(47.0%)
Basic Proficiency	Mathematics	45,926(14.4 %)
	English Language	47,937(15.1%)
Proficiency	Mathematics	41,602(17.1%)
	English Language	54,072(17.0%)
Advanced proficiency	Mathematics	35,719(11.2%)
	English Language	66,754(20.9%)

Data Analysis Strategy

The data were analyzed using a three-level MLM technique recognizing the nested nature of the data where learners were nested in schools and schools in regions. The independent, covariates and dependent variables were grand mean-centered, ensuring that the variances of the intercept and the slopes in the regression have a clear interpretation when all explanatory variables are equal to zero (Hox et al., 2017; O'Connell et al., 2022; Heck et al., 2022). The analyses were done in four stages. First, an unconditional baseline model with no predictors was specified to compute the Intra-class Correlation Coefficient (ICC) to determine the proportion of variance accounted for by clustering in the data. The ICC signals whether the multilevel modeling technique is required to analyze the data (O'Connell et al., 2022; Heck et al., 2022). In addition, the unconditional model helps to establish the extent to which the deviances of subsequent models improve over the initial deviance (-2 Log Likelihood [-2LL]) (O'Connell et al., 2022; Heck et al., 2022). At stage two, two covariates (school regions and class sizes) were controlled to account for their confounding effects on achievement in both subjects. The third stage of the analysis introduced learners' gender as the independent variable to estimate its fixed effects on achievement. The fourth stage explored the differential effects of gender on achievement in both subjects for each of the 16 regions regarding research question 2. The coefficients derived for the variables and their respective standard errors (in barracks) are presented in Tables 3 and 4.

Results and Discussion

This section presents the results of this study alinign with the key research questions.

Table 3

Gender Effects on P4 Mathematics and English Language Achievement

Fixed part Intercept	*Mathematics*			*English Language*		
	Model 0 *Coeff/SE*	*Model 1* *Coeff/SE*	*Model 2* *Coeff/SE*	*Model 0* *Coeff/SE*	*Model 1* *Coeff/SE*	*Model 2* *Coeff/SE*
	.235(.069)	-.003(.077)	.073(.077)	.050(.075)	.004(.081)	.239(.081)
Controlled variables						
Region	-	-.495(.015)	-.495(.015)		-.684(.015)	-.684(.015)
Class size	-	-.024(.003)	-.024(.003)		-.011(.003)	-.011(.003)
Predictor variable						
Gender (Male)	-	-	-.145*** (.016)	-	-	-.464*** (.017)
Random part						
Pupil (%)	18.941(29.4)	18.941(31.9)	18.936(31.8)	21.166(28.3)	21.166(32.3)	21.119(32.2)
School (%)	38.634(59.9)	33.626(56.6)	33.626(56.6)	50.614(67.6)	41.281(63.1)	41.356(63.2)
District (%)	6.875(10.7)	6.852(11.5)	6.855(11.6)	3.057(4.1)	3.009(4.6)	2.947(4.6)
-2LL (deviance)	1879923	1878813	1878723	1915761	1913950	1913177
Change in deviance *(-2LL)*	-	1110	90		1811	773
X^2 (0.001)	-	13.816	10.828	-	13.816	10.828
df	-	2	1	-	2	1

***$p < 0.001$; **$p < 0.01$; *$p < 0.05$.

Table 4

4 Random Effects of Gender on Mathematics and English Language Achievements Across the Regions in Ghana

Region/ Coefficients	*Mathematics*			*English Language*		
	Intercept *Coeff/SE*	*Class size* *Coeff/SE*	*Gender (Male)* *Coeff/SE*	*Intercept* *Coeff/SE*	*Class size* Coeff/SE	*Gender (Male)* *Coeff/SE*

Ahafo	3.416	-.040	-.261**	3.753	-.057	-.312***
	(.684)	(.029)	(.100)	(.673)	(.029)	(.103)
Ashanti	2.571	-.037	-.208***	3.590	-.036	-.496***
	(.164)	(.007)	(.038)	(.160)	(.006)	(.040)
Bono	3.172	.003	.053	4.451	.002	-.387***
	(.409)	(.016)	(.080)	(.375)	(.015)	(.086)
Bono East	.848	-.038	-.017	.427	-.045	-.138
	(.544)	(.023)	(.101)	(.605)	(.025)	(.102)
Central	1.460	-.031	-.193***	2.392	-.035	-.678***
	(.251)	(.011)	(.052)	(.243)	(.010)	(.056)
Eastern	-2.562	.001	-.190***	-4.493	-.005	-.220***
	(.223)	(.009)	(.040)	(.233)	(.009)	(.038)
Gt. Accra	-.858	.017	-.325***	.705	.020	-1.224***
	(.131)	(.005)	(.050)	(.136)	(.005)	(.058)
North East	3.125	.006	-.090	3.806	.011	0.000
	(.762)	(.030)	(.131)	(.763)	(.030)	(.124)
Northern	3.458	-.041	-.033	3.949	-.009	-.208***
	(.321)	(.012)	(.063)	(.290)	(.011)	(.065)
Oti	1.917	-.050	.206*	2.801	-.031	.094
	(.558)	(.022)	(.095)	(.552)	(.022)	(.098)
Savannah	3.939	-.003	-.220	4.355	.082	-.224*
	(.761)	(.029)	(.123)	(.858)	(.033)	(.112)
Upper East	-1.581	.018	-.396***	-.779	.021	-.688***
	(.362)	(.017)	(.074)	(.364)	(.017)	(.080)
Upper West	-1.193	-.048	.044	-1.454	-.018	-.309***
	(.472)	(.019)	(.089)	(.526)	(.022)	(.085)
Volta	-6.559	.002	-.009	-6.948	.003	-.245***
	(.120)	(.005)	(.045)	(.205)	(.008)	(.048)
Western	-6.018	-.001	.033	-7.235	.008	-.070
	(.210)	(.009)	(.036)	(.296)	(.012)	(.041)
Western North	-1.887	-.017	-.066	-9.006	.022	-.109*
	(.697)	(.030)	(.089)	(.439)	(.019)	(.053)

***p < 0.001; **p < 0.01; *p < 0.05.

The unconditional models revealed strong evidence of grouping effects on achievement in both subjects. For mathematics, school and district-level differences accounted for 59.9% and 10.7% of achievement variances, with the remaining 29.4% as a residual, unexplained variance. Regarding the English language, schools and districts accounted for 67.6% and 4.1% achievement variances, while 28.3% was unexplained at the pupil level. Controlling the two covariates (i.e., school regions and class sizes) led to significant drops in the -2LL of the mathematics (from 1879923 to 1878813, equating to a difference test of chi-square = 1110 on 2 df, p < 0.001) and English language (from 1915761 to 1913950, equating to a difference test of chi-square = 1811on 2 df, p < 0.001) models, signaling their statistically significant contributions to achievement differences in both subjects.

In this study, school regions and class sizes had a negative impact on mathematics and English language learning outcomes. The contributions of school regions (Azubuike et al., 2024; Nyatsikor et al., 2020) and class size (Blatchford & Russel, 2021; Konstantopoulos & Shen, 2023) to learning outcomes have long engaged the attention of researchers. School regions affect the performance of schools and students due to the common characteristics shared among schools in the region (Bronfenbrenner & Morris, 2007; Tudge et al., 2022; Azubuike et al., 2024). The cumulative effects of the class sizes of schools negatively impacted teaching and learning outcomes in both subjects. Although the debate about the impact of class size on student achievement remains unresolved, evidence supporting the idea that smaller class sizes enhance achievement is more compelling (Laitsch et al., 2021; Finn, 2019). The adverse effects of the two covariates urge stakeholders to implement effective strategies and policies to mitigate their negative impact on achievement.

Introducing the predictor variable (gender) to the model as a fixed effect resulted in substantial decreases in the -2LL for mathematics (from 1878813 to 1878723, equating to a difference test of chi-square = 90 on 1 df, $p < 0.001$) and English language (from 1913950 to 1913177, equating to a difference test of chi-square = 773 on 1 df, $p < 0.001$) models, signaling its statistically significant contribution to achievement differences in both subjects.

The results indicate that boys performed worse than girls in both mathematics (β = -0.145) and English language (β = -0.464) assessments. This suggests that boys faced disadvantages in both subjects. Overall, girls outperformed boys, consistent with findings from other studies conducted in sub-Saharan Africa (Howie, 2022; Hungi et al., 2010) and European countries (Schleicher, 2023). In contrast, the results challenge findings from other studies showing that boys' achievement in maths (Xie & Liu, 2023; OECD, 2021) and English (Sandsør & Brevik, 2024; Schleicher, 2023) was better than girls. The statistically significant impact of gender indicates that it plays a crucial role in primary school achievement in Ghana, particularly in English, where male learners scored, on average, half a mark lower than their female counterparts. This reality challenges the nation's ability to achieve gender equality in learning outcomes as promoted by SDG 4. The differential impacts of gender on mathematics and English language achievement were also evidenced across the three levels of the data's hierarchy. Comparing the explained variance derived for the respective levels after

controlling the two covariates and those derived after introducing the independent variables shows that gender explained 0.03% of mathematics achievement variance between pupils, none between schools, and -0.04% variance between districts. For the English language, gender explained 0.22% of the pupil-level variance, -0.15% between schools, and 2.02% between districts. The negative estimate is explained by the fact that the predictor variable (gender) had more group-level variance than a random sampling process would produce. As a result, the apparent within-group variance may increase, leading to a negative estimate for the explained variance at the school level in mathematics and the district level in English (Hox, 2010).

Surprisingly, gender, a pupil-level variable, explained more achievement variance at level 3 (district) than at level 1, signaling that gender abilities in English are not exactly the same in all districts. However, the very small variance explained by gender at the district level reflects that learners' English language abilities are distributed almost equally across the districts (Hox, 2010).

Segregating gender achievement at the regional level highlighted girls' superior achievements in both subjects in six regions: Ahafo, Ashanti, Central, Eastern, Greater Accra, and Upper East. Additionally, they significantly outperformed boys in English only in six other regions: Bono, Northern, Savannah, Upper West, Volta, and Western North. On the other hand, boys' mathematics achievement was significantly better than girls' in the Oti region only. There were statistically insignificant gender achievement differences in both subjects in three regions: Bono East, North East, and Western North. The varied impacts of school regions on achievement in boys and girls in specific regions resonate with the theory's proposal of how different macrosystems influence their respective lower levels and actors differently. Though the reasons for these gender-linked achievement differences could not be directly ascertained from the data used for this study, evidence derived from prior studies suggests that gender differences in achievement are linked to differences in attitude, effort, self-efficacy, and motivation by boys and girls towards specific school subjects (Reilly et al., 2019; Reilly, 2023), differential teaching and learning opportunities for boys and girls in schools, especially mathematics, and science (Rosén et al., 2022; UNESCO, 2017), the teacher-learner relationships (Goldie & O'Connor, 2021) societal expectations and stereotypes (Rosén et al., 2022; Retelsdorf et al., 2015) and contextual factors such as the country's socioeconomic, cultural, and educational systems (van Hek et al., 2019;

Rosén et al., 2022). Other studies (e.g., Torppa et al., 2017) found differences in reading fluency, achievement behavior, leisure reading, and homework between boys and girls as variables sustaining gender achievement differences.

The diverse characteristics of the regions affected gender disparities by either narrowing or widening the differences compared to the national impact for both subjects. The strongest evidence of gender disparities in English language achievement was found in the Greater Accra Region, where, on average, boys were disadvantaged by a mark ($\beta = -1.224$). This is intriguing because this region has the least difference in male and female education and literacy rates (see Table 1). It thus appears, therefore, that gender equality in accessing education does not necessarily imply gender equality in achievement or learning outcomes. The diverse impacts indicate complex, region-specific educational and socio-cultural influences on boys' and girls' learning opportunities and achievements. This assertion is supported by the observation that girls' mathematics achievement was lower than boys' in the Volta Region, although they excelled in other subjects. The study's findings strongly suggest the need to reevaluate how macro-level factors impact learning opportunities for both male and female students.

Conclusion

The study examined how gender differences influenced mathematics and English achievement, revealing that gender significantly affected achievement levels among primary school children in Ghana. Girls outperformed boys with few exceptions, particularly in English. The varied effects of gender on both subjects suggest that the idea of a biologically determined advantage based on gender in specific subjects is not supported. Rather, the various macrosystems and their unique opportunities differently influenced male and female achievements in both subjects. The findings indicate significant gender inequalities in certain regions of the country that adversely affect the nation's pursuit of gender equality in educational outcomes. Girls can compete with and often outperform boys despite their lower national education and literacy rates. The findings demonstrate the importance of providing equitable opportunities for both boys and girls to excel.

The findings confirmed that Ghana is yet to achieve gender equality in learning outcomes fully, as mandated by the country's inclusive education policy and the United

Nations' SDG 4, which seeks to eliminate barriers to gender equality and equity. However, the insignificant gender achievement differences reported from some regions proved that progress had been made, and the challenge was within specific regions. Stakeholder consultations and actions are urgently needed to address existing inequalities by developing and implementing gender-inclusive curricula and teaching activities to achieve gender equality in educational outcomes. The varying influences of school regions on the academic achievement of male and female learners necessitate further investigation specific to each region, particularly through qualitative studies. This is crucial, as it greatly impacts both boy's and girls' completion, dropout, and literacy rates, ultimately affecting the quality-of-life choices available to males and females in Ghanaian society.

Declaration of Conflicting Interests

The authors declare no potential conflicts of interest concerning this article's authorship and publication.

Notes on the Contributors

All authors conceptualized the paper. Winston and Eric led the introduction and literature review sections, while Maxwell led the methodology and data analysis sections. All authors contributed to the discussion of results and the conclusion sections.

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