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Gender-Based Comparative Analysis of Pre-Service Teachers' Mathematics Performance at The Colleges of Education in Ghana

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Abstract
The study sought to find out the difference in mathematics achievement between males and females at the Presbyterian College of Education. The study employed the use of secondary data, that is, students' WASSCE entry results against their Final GPA at the College of Education were used for the data analysis. The population of the study was all students of Akropong Presbyterian College of Education, who were admitted in 2015 and 2016 and completed all the required courses and examinations in 2018 and 2019 respectively with the Diploma in Basic Education awarded by the University of Cape Coast. The sample size was 1024 and this comprised all the past students of Akropong Presbyterian College of Education, Akropong Presbyterian who graduated with the Diploma in Basic Education from 2016 to 2019. The results of the analysis proved that males entered with slightly better results than their female counterparts and the final GPA was in the same manner. The researcher therefore recommends that the college must move beyond the normal training and put in measures to ensure that most of the students can improve their performance to be at par with the current demands of a world-class teacher. More importantly, there should be enough gender-sensitive and female- friendly measures to ensure that the females catch up with the males in terms of academic achievement.

Keywords: Gender Sensitive, Self-efficacy, Preservice Teachers, Mathematics, Colleges

Introduction

As stated in the UN, 2015, the 2030 Agenda and the Global Action Programme are the bedrock upon which education stands (Liang et al., 2015). Education is prioritised because of its usefulness in global peace and development. To ensure proper education, we must ensure inclusive, quality education for all and empower everyone to support sustainable development (Brown & Alexandersen, 2020). More importantly, there is a need to enhance the competencies of education multipliers. Global unemployment, cyber fraud, road accidents, insecurity, natural disasters, and pandemics have increased (Agyei Brantuo et al., 2023; Atta & Bonyah, 2023). As a result, our very survival on this earth has become a challenge. Only through education can we surmount some of these challenges, if not all. Nevertheless, how do we position teacher education to respond to these challenges? The National Teaching Council in Ghana was set by an ACT of Parliament (Education ACT 778) to improve the professional standards of teachers and register and license teachers in Ghana. Research has revealed that the programmes offered at the college started from a 2-year post-primary and navigated through 3-year post-primary, 4-year post-primary, 4-year post-middle, 2-year specialist, 2-year post-secondary, 3-year post-secondary, 3-year certificate "A", 3-year diploma in Basic Education and 2-year diploma in Basic Education and now 4-year B.Ed (Adu-Gyamfi & Otami, 2020). This is a result of various policy reforms and educational reviews. As observed by Anamuah-Mensah and Benneh, as cited by Asare and Nti, (2014), teacher education was following a traditional system that was not dynamic enough to produce quality teachers to face the challenges posed by emerging technologies. As posited by the Ministry of Education, the reforms after independence yielded little impact on students' learning outcomes. This is because

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students' achievement and development of critical values like problem-solving, innovative thinking and creative skills were deficient.

Two pieces of significant legislation related to teacher education preparation aimed at transforming the country's educational system were passed to rectify the curriculum's ills and implementation. The Education ACT 2008 (ACT 778) gave birth to the National Teacher Council (NTC). The NTC is mandated to register and license teachers and also see to the professional development of the Ghanaian teacher. The Education ACT 778 is bent on making teaching in Ghana a profession with clear codes of ethics and minimum acceptable competencies of those who teach at the country's pre-tertiary institutions. This is to ensure that teachers in the country get the needed pedagogical content knowledge and skills to train the young to compete anywhere in the world. Another move was the passage of the Colleges of Education Act 2012, Act 847, which provided the legal background for elevating the status of TTCs to COEs. This has placed the CoEs under the National Council for Tertiary Education (NCTE) tutelage. The colleges have since been under the NCTE, a role which was previously the reserve of the Ghana Education Service (GES). Even though the legislation was passed in 2012, the full implementation took effect in 2018. Research has shown that females face many challenges that can affect their academic performance (Ajai & Imoko, 2015; Brown & Alexandersen, 2020). These challenges, if left unattended, can have a debilitating impact on the country's education sector. There have been several legislations to ensure the protection of the girl child against any form of harassment, abuse or discrimination all these aim at helping the girl child compete favourably with their male counterparts regarding academic performance. For instance, the Ministry of Education, its agencies and stakeholders have put strategies in place to deal with existing and future challenges of gender in the education sector. Notable among these is the Education Strategic Plan, 2010-2020, which has Gender Equity (GE) and Women Empowerment (WE) concerns, such as girls' educational issues at all levels of education, particularly the basic level, the use of female roles models among others (Anokye-Poku & Ampadu, 2020).

Moreover, the National Council for Tertiary Education has developed a framework to help students of public colleges of education live free from sexual harassment (ncte.edu.gh). All these are measures to ensure that the female gets a conducive atmosphere to learn. The Ghana MDG report (2013) observed that Ghana continues to make progress towards achieving gender parity at all levels of formal education. To eliminate gender disparity in primary and secondary education, preferably by 2005, and in all levels of education no later than 2015, the Ghana MDG report (2013) further states that Gender Parity in schools in Ghana is closest to being achieved at the primary level, where the net enrolment rate in 2011 was 84.04 for girls and 83.77 for boys. The literacy rate for young women has increased considerably with these policies: from 66% in 2000 to 79.9% in 2010. The overall literacy rate for females was 61.2% in 2010 due to regional disparities National Gender Policy, 2015 (Adu-Baffoe & Bonney, 2021)

Even though empirical studies have shown that males outperform females in mathematics-related courses, this is because, according to studies conducted in most nations, gender inequalities in mathematics ability favoured males. However, there have been new developments in recent studies that seem to counter this widely accepted belief. Some researchers believe that girls surpass boys in mathematics at the elementary and middle school levels, while at the high school and college levels, boys exceed girls. Some studies in most nations, including the US, also affirm that female and male students perform similarly in mathematics. Concerning reports from international assessments, many countries have closed this performance disparity between males and females. Unfortunately, much of this research has not been undertaken at Ghanaian teacher Colleges of Education. Invariable, the few ones that have been undertaken (Tetteh et al., 2018) observed no statistically significant difference in mathematics performance between male and female pre-service teachers in the public college of education in Brong-Ahafo, Ghana. A study Pajares and Miller (1994) using path analysis found that math self-efficacy was more predictive of problem-solving than self-concept, perceived usefulness, prior experience, or gender. Self-efficacy also mediated the effect of gender and prior experience on self-concept, perceived usefulness, and problem-solving. Men had higher performance, self-efficacy, and self-concept, but lower anxiety. Asante (2014) states that the Ghanaian government need mathematics at the elementary and secondary levels because of its importance to national development. This promoted arithmetic literacy and logical and abstract thinking for living, problem-solving, and education. According to literature, teachers feel Science, Mathematics, and Technology are largely for boys and give boys more attention in math class than girls. Thus, girls are discouraged from studying mathematics and generally mocked when they make mistakes or can't answer problems. Brown and Alexandersen's (2020) teaching and student performance literature shows that teachers are one of the most

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important elements affecting student achievement, especially in developing countries. Trakulphadetkrai (2022), conducted a survey study examining teachers' mathematical epistemic beliefs and found no significant effect of gender on their beliefs. The study, involving 745 primary teachers, used the Thai Teachers' Mathematics Education-related Beliefs (TTMEB) questionnaire. The findings suggest that exogenous factors like socio-economic settings should also be considered when examining beliefs. The study dispels myths about gender differences in mathematics teaching and student perceptions, emphasizing the importance of considering teachers' gender, teaching experience, and socio-economic settings.

Some study contradicts the widespread belief that men are better in math For over three decades, numerous nations have studied gender issues in mathematics education (Haroun et al., 2016). Haroun et al. (2016) investigated gender differences in teachers' teaching knowledge in Saudi Arabia and discovered that female teachers scored significantly higher than male teachers in content knowledge. Over the last three decades, various theories and frameworks have tried to uncover characteristics that influence mathematics performance to eliminate gender discrepancy in mathematics success (Christel, 2020). As observed (Abu-Shanab, 2020), biological variables, mathematics learning styles, sex hormones on brain organisation, and symbolic gender explain gender variations in mathematics success. However, experts vary on which part of teachers' subject area knowledge most affects student success. Several studies have used proxy teacher knowledge measures to establish this link (e.g., the number of university courses taken). Teacher knowledge has also been conceptualised as domain-neutral. Thus, teacher knowledge must be reconceived as domain-specific and directly measurable. Female Education in Mathematics and Science in Africa (FEMSA, 1997) as cited (Tetteh et al., 2018) found that girls have few role models in science and math professors. Male mathematics teachers outnumber girls, which may inspire boys to choose math classes (Baah-Duodu et al., 2022). The Assessment and Performance Unit's 1985 study on UK mathematics education affirmed this. Girls rarely see or hear female mathematicians and scientists outside school. Most parents believe girls are housewives and should study for their future roles. It is worth noting that the pre-service teachers are the teachers who will be training the future leaders of the country. As foundation builders, there is a need for them to have a firm grip on the mathematics content as well as the skills needed to deliver the lessons. If the training given to the pre-teachers can build their self-efficacy, irrespective of gender, they stand a better chance to inspire Learning and build a formidable mathematics base for the country. Hence the need for this study to find if gender disparity in mathematics performance exists at the colleges of education in Ghana.

Aim and Objectives of the Study

The study sought to find out the difference in mathematics achievement between males and females at the Presbyterian College of Education. The objectives of the study were to find out the following;

1. if there is a gender gap in terms of enrolment at the Colleges of Education in Ghana
2. if there is a gender gap in terms of mathematics performance at the colleges of education in Ghana

Methodology

The researchers used purposive sampling (Bakkalbasioglu, 2020) because the research was about a category of students. That is the students of Akropong Presbyterian College of Education, who were admitted in 2015 and 2016 and completed all the required courses and examinations in 2018 and 2019 respectively with the B.Ed Basic Education awarded by the University of Cape Coast. The sample size was 1024 and this comprised all the past students of Akropong Presbyterian College of Education, Akropong Presbyterian who graduated with the Diploma in Basic Education from 2016 to 2019. Due process and due diligence guided the process of securing the data for the studies. Formal letters were written to the authorities involved to request the data. Since the data was already collected the researcher made sure the ethical considerations like confidentiality and others are duly observed. No result was tempered and the identity of the students involved to a greater extent remained anonymous.

Results

Batch 1: 2015 – 2018 – Gender of students

477 students were admitted and the same number graduated. 298 (62.5 %) were males representing the majority and 179 (37.5 %) were females.

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Table 1: Total Number of Male and Female Students Admitted in 2015.

	Number	Percentage (%)
Male	298	62.5
Female	179	37.5

Source: Akropong Presbyterian College of Education.

Table 2: Mean and standard deviation of WASSCE and CGPA for 2015-2018 set

	Mean	St. Deviation	N
CGPA	2.763	0.541	477
WASSCE	23.45	5.210	477

From Table 2 the mean WASSCE entry score for admission into Akropong Presbyterian College of Education in the year 2015 was 23 with the corresponding mean graduating CGPA of 2.763 in 2018.

Batch 2: 2016 – 2019 - Gender of students

547 students were admitted and 547 completed. 290 (53.0 %) were males and 257 (47.0 %) were females.

Table 3: Total Number of Male and Female Students Admitted in 2016.

	Number	Percentage (%)
Male	290	53.0
Female	570	47.0

Source: Akropong Presbyterian College of Education

Table 4: Mean and standard deviation of WASSCE and CGPA for 2016-2019

	Mean	St. Deviation	N
CGPA	2.797	0.487	547
WASSCE	23.90	5.756	547

From Table 4 the mean WASSCE entry score for admission into Akropong Presbyterian College of Education in the year 2016 was 24 with the corresponding mean graduating CGPA of 2.797 in 2019.

Table 5 Descriptive Statistics for mean CPGA for females and males (2015 – 2018 data set)

GENDER		N	Mean	St. Deviation	Std. Error mean
CGPA	Female	179	2.6835	0.5682	0.04247
	Male	298	2.8113	0.5197	0.03011

The descriptive statistics for mean CGPA for females and males for the 2015 -2018 data set indicate that the 179 females had an average CGPA score of 2.68, while the 298 males had an average CGPA score of 2.81. The mean CGPA of the males for this data set is also higher than the females' CGPA.

Table 6 Independent-samples t-test for females and males CGPA for 2015 – 2018 data set

	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Equal variances assumed	2.508	475	0.012	0.12767	0.05091
Equal variances not assumed	2.452	349.010	0.015	0.12767	0.05205

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The independent–sample t-test indicated that mean CGPA were significantly higher for males (M = 2.81, SD = 0.520) than for females (M = 2.68, D = 0.568), (475)=2.51, p<0.05. Hence the mean CPGA for males and females are significantly different.

Table 7: Descriptive Statistics for mean CPGA for females and males for 2016 -2019 data set (2016 – 2019 data set)

GENDER		N	Mean	St. Deviation	Std. Error mean
CGPA	Female	257	2.7491	0.4734	0.02953
	Male	290	2.8389	0.4962	0.02914

The descriptive statistics for mean CGPA for females and males for the 2016 -2019 data set shows that 257 females had an average CGPA score of 2.75, and 290 males had an average CGPA score of 2.84. The mean CGPA of the males is higher than the females' CGPA.

Table 8 Summary of results

Graduating year	Number of graduates			Mean CGPA		Standard deviation	
	Males	Females	Total	Males	Females	Males	Females
2018	298	179	477	2.8111	2.5835	0.5197	0.5682
2019	290	257	547	2.8369	2.7491	0.4962	0.4734

Table 9: Independent Sample T-Test for Equality of Means for 2016-2019 data set

		t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
CGPA	Equal variances assumed	2.160	545	0.031	0.08986	0.04160
	Equal variances not assumed	2.166	542.02	0.031	0.08986	0.04148

The independent–sample t-test indicated that the mean CGPA were significantly higher for males (M = 2.84, SD = 0.50) than for females (M = 2.75, SD = 0.47), (545)=2.160 , p<0.05. Hence the mean CGPA for males and females are significantly different.

Discussion

The study has revealed the number of males admitted to college is more than the number of females. More so performance of males is significantly higher than that of females. This confirms other studies (Ajai & Imoko, 2015; Armah et al., 2020; Brown & Alexandersen, 2020; Tetteh et al., 2018). The study therefore concludes that in all the various groups of data set, there was a significant difference between average CGPA scores of males and females and this was in favour of the males.

Conclusion

The results revealed a consistent trend across the years, with a higher number of male students admitted compared to females. Moreover, the study found a significant difference in academic performance between male and female students, with males consistently achieving higher CGPA scores than their female counterparts. The implications of these findings suggest a need for further exploration into the factors contributing to the observed gender gap in academic achievement. Moreover, educational institutions may benefit from implementing targeted interventions aimed at addressing disparities in performance and promoting equal opportunities for all students. This study emphasizes the importance of ongoing research and initiatives aimed at promoting gender equality in education, ultimately contributing to the creation of more inclusive and equitable learning environments.

Recommendations

Based on the findings, the study recommends the following;

1. The admission requirements must be maintained, however, the ratio of males to females admitted must be looked at since it affects the academic performance of the students.

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2. Special attention must be paid to gender issues to bring females in line with their male counterparts in terms of academic achievement.

References

Abu-Shanab, E. A. (2020). Students' perceptions of flipped classrooms, gender, and country difference. International *Journal of Web-Based Learning and Teaching Technologies (IJWLTT), 15*(4), 36–56.

Adu-Baffoe, E., & Bonney, S. (2021). The role of non-governmental organizations in basic education delivery in ghana: implications for theory, policy, and practice. *International Education Studies, 14*(4), 35–47.

Adu-Gyamfi, K., & Otami, D. C. (2020). In Search of an Effective Teacher: Ghana's Move towards Achieving Sustainable Education through Teacher Education Reforms. *International Journal of Higher Education, 9*(4), 216–232.

Agyei Brantuo, W., Amoako Atta, S., Kwasi Klu, T., & Ohene Amoako-Atta, S. (2023). Viability problem-solving approach in teaching mathematics at this era: retrospection of the six decades of mathematics education in ghana. mathematics letters. https://doi.org/10.11648/j.ml.20230901.11

Ajai, J. T., & Imoko, B. I. (2015). Gender differences in mathematics achievement and retention scores: a case of problem-based learning method. *International Journal of Research in Education and Science, 1*(1), 45–50.

Anokye-Poku, D., & Ampadu, E. (2020). Gender differences in attitudes and achievement in mathematics among Ghanaian JHS Students. *International Journal of Education, 12*(3), 84–95.

Armah, S. E., Akayuure, P., & Armah, R. B. (2020). A comparative study of male and female distance learners' mathematics achievement. *Contemporary Mathematics and Science Education, 2*(1), ep21001. https://doi.org/10.30935/conmaths/9288

Asante, E. (2014). *Theology and Society in Context: A Theologist's Reflections on Selected Topics*. SonLife Press.

Asare, K. B., & Nti, S. K. (2014). Teacher education in Ghana: A contemporary synopsis and matters arising. *Sage Open, 4*(2), 2158244014529781.

Atta, S. A., & Bonyah, E. (2023). Teaching Mathematics for Social Justice: The Challenges and the Prospects in The Ghanaian Senior High Schools. *Golden Ratio of Social Science and Education, 3*(1), 50–60. https://doi.org/10.52970/grsse.v3i1.231

Baah-Duodu, S., Borbye, S., Someah-Addae, E., Ennin, F. C., & Osei-Buabeng, V. (2022). Developing female pre-service teachers' mathematics self-efficacy by integrating history of mathematics into teaching during lesson study. *Social Education Research*, 91–102.

Bakkalbasioglu, E. (2020). How to access elites when textbook methods fail: challenges of purposive sampling and advantages of using interviewees as" fixers". *Qualitative Report, 25(*3).

Brown, G. R., & Alexandersen, K. (2020). Gender equality and gender gaps in mathematics performance. *Trends in Cognitive Sciences, 24*(8), 591–593. https://doi.org/10.1016/j.tics.2020.06.002

Christel, K. (2020). Gender disparities in ghana's tertiary education system. journal of student affairs, *New York University, 16*, 34–39.

Haroun, R. F., Ng, D., Abdelfattah, F. A., & AlSalouli, M. S. (2016). Gender difference in teachers' mathematical knowledge for teaching in the context of single-sex classrooms. *International Journal of Science and Mathematics Education, 14*(S2), 383–396. https://doi.org/10.1007/s10763-015-9631-8

Liang, G., Zhang, Y., Huang, H., Shi, S., & Qiao, Z. (2015). Professional development and student achievement: International evidence from the TIMSS data. *Journal of Postdoctoral Research, 3*(2), 17–31.

Pajares, F., & Miller, M. D. (1994). Role of self-efficacy and self-concept beliefs in mathematical problem solving: A path analysis. *Journal of Educational Psychology, 86*(2), 193–203. https://doi.org/10.1037/0022-0663.86.2.193

Tetteh, H. N. K., Wilmot, E. M., & Ashong, D. (2018). Gender differences in performance in mathematics among pre-service teachers in the Brong-Ahafo Region of Ghana. *International Journal of Education, Learning and Development, 6*(5), 38–45.

Trakulphadetkrai, N. V. (2022). Mathematical epistemic beliefs: through the gender lens. frontiers in education, 7. https://doi.org/10.3389/feduc.2022.832462

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