

Self-efficacy and Teacher Education: Insights from Ghana's Four-Year Bachelor of Education Program

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ABSTRACT This study examined the self-efficacy of final-year pre-service science teachers in Ghanaian Colleges of Education, focusing on the influence of academic performance, micro-teaching, and macro-teaching experiences. Using a validated self-efficacy questionnaire, data were collected from 63 participants and analysed using descriptive statistics, multiple regression and t-test. Results indicated generally high self-efficacy levels, particularly in subject knowledge, pedagogical skills, instructional practices, and student engagement. CGPA had a significant and positive but small effect on self-efficacy, while micro- and macro-teaching scores showed slight, non-significant negative relationships. No gender differences were found. Despite strong overall self-efficacy, participants reported content knowledge gaps and anxiety teaching unfamiliar topics. These findings suggest that while the reformed Bachelor of Education program effectively enhances self-efficacy, further improvements are needed in content mastery and practical teaching exposure. The study emphasises the need to refine teacher education programs to equip pre-service science teachers for classroom challenges in Ghana.

INTRODUCTION

Since the dawn of the new millennium, Ghanaian Colleges of Education have undergone two significant reforms in teacher education. The first reform commenced in 2002, following recommendations by the Presidential Commission on Education, which advocated for a critical review of teacher education to align it with national development priorities (Tagoe et al. 2022). According to Tagoe et al. (2022), this review sought to ensure that teacher education institutions delivered comprehensive programs designed to produce competent, committed, and dedicated educators capable of enhancing the quality of teaching and learning in schools. Consequently, the Ministry of Education implemented a policy elevating the entry qualification for teaching in Ghanaian basic schools from the Teacher's Certificate 'A' to a Diploma in Education.

To meet these new policy demands, teacher training colleges restructured their programs. The minimum qualification for teaching at teacher training colleges was raised from a diploma in education to a bachelor of education degree, and a revised curriculum was introduced in 2004. This curriculum included a one-year school attachment program designed to let pre-service teachers practice under the guidance of experienced in-service teachers. The program aimed to boost pre-service

teachers' self-efficacy in teaching and, ultimately, to improve the quality of teaching and learning in basic schools (Opoku et al. 2025).

The second reform was more comprehensive than the first, largely due to substantial funding from the UK government through the UKAID-sponsored Transforming Teacher Education and Learning (T-TEL) initiative. This reform transformed the Ghana Education Service's Teacher Education Division into the National Teaching Council (NTC). The NTC was then decoupled from the Ghana Education Service. In collaboration with the National Commission for Tertiary Education (NCTE), the NTC developed the National Teacher Education Curriculum Framework (NTECF) to standardise teacher education programs across colleges of education and universities (Yidana 2025; Addae-Kyeremeh and Boateng 2024). Furthermore, the NTC introduced the first-ever National Teachers' Standards (NTS), which outlined the minimum professional and practice expectations for all trained teachers by the completion of their initial teacher training program. These standards applied to all pre-tertiary teachers in Ghana.

In 2012, five years prior to the development of the NTECF and NTS, the Colleges of Education Act (Act 847) was enacted, officially recognising colleges of education as tertiary institutions. In 2018, the first cohort of students en-

rolled in a four-year bachelor's education program, which was designed to align with the NTECF and NTS (Ananga 2021). This program introduced level and subject specialisations to address limitations in the previous curriculum, which prepared pre-service teachers to teach a broad range of foundation subjects across nine-year age groups. This prior approach often resulted in shallow subject-specific knowledge among pre-service teachers (Korang and Umbugadu 2020). To rectify this, the new program introduced level-specific specialisations in early grades, primary education, and junior high school education. Students pursuing primary or junior high school education specialisations were required to focus on a major subject and a minor subject, aiming to produce teachers with deeper content knowledge and higher self-efficacy in their areas of specialisation.

Additionally, the reformed curriculum incorporated field experiences, supporting teaching in schools and macro-teaching, to foster the development of teaching self-efficacy through the acquisition of level-specific pedagogical skills. From the first year to the third year's first semester, pre-service teachers participated in supported teaching experiences, attending partner schools weekly for six weeks per semester. During these visits, they observed teaching practices, classroom management, and school culture.

In the third year's first semester, pre-service teachers co-planned and co-taught lessons with their mentors, culminating in independent lesson delivery. The second semester of the third year included micro-teaching, in which pre-service teachers practiced teaching with their peers acting as students. Each lesson was followed by a reflective session to enhance awareness of effective teaching practices. The micro-teaching course prepared pre-service teachers for a semester-long macro-teaching experience in basic schools, where they practiced full-time teaching. This extended exposure to classroom practice positively influenced pre-service teachers' teaching self-efficacy (Addae-Kyeremeh and Boateng 2024; Ananga 2021).

Teaching self-efficacy is a critical determinant of teachers' readiness to teach. It reflects the extent to which educators possess the pedagogical skills and content knowledge required for effective teaching. Teachers with good self-

efficacy not only demonstrate confidence in their instructional abilities but also demonstrate greater motivation to teach, adopt innovative strategies, and provide constructive feedback to their students. Moreover, teaching self-efficacy is associated with sustained interest in one's subject area, a strong desire to support student learning, and a commitment to improving instructional practices. As such, assessing pre-service teachers' teaching self-efficacy indirectly evaluates the depth of their subject matter knowledge and pedagogical competence (Chan et al. 2023; Biçer and Yildirim 2023; Guler-Nalbantoglu and Aksu 2021).

This study did not seek to evaluate the overall quality of teachers produced by the four-year bachelor's degree program. Instead, its primary aim was to assess the self-efficacy of pre-service science teachers. Specifically, it sought to determine the extent to which micro-teaching, macro-teaching, and academic performance influenced pre-service teachers' self-efficacy. Additionally, the study investigated whether significant differences in teaching self-efficacy existed between female and male pre-service teachers.

Objectives of the Study

The primary objective of the study was to assess the science-teaching self-efficacy of pre-service science teachers enrolled in the 4-year Bachelor of Education program. Specifically, the study aimed to examine the extent to which practical teaching experiences, namely micro-teaching and macro-teaching, as well as academic achievement, as measured by Cumulative Grade Point Average (CGPA), influenced the self-efficacy beliefs of these pre-service teachers. Additionally, the study sought to explore whether there were statistically significant differences in teaching self-efficacy between male and female pre-service science teachers. Through this, the study intended to gain insight into the areas of the teacher education program that most effectively contribute to the development of teaching confidence among future science educators.

Theoretical Framework

This study is grounded in Bandura's concept of self-efficacy and social cognitive theory. According to Ignacio (2024), Bandura developed

social cognitive theory as a response to the limitations he observed in earlier theories of human agency, such as trait, behaviourist, and psychodynamic theories. These earlier frameworks posited a locus of agency that was either autonomous or mechanical, a perspective Bandura (1986) found insufficient. Bandura (1986) proposed that human agency is the result of a dynamic and interactive relationship among personal determinants, actions, and environmental factors, a phenomenon he termed reciprocal determinism. The interplay between these factors, however, varies depending on specific circumstances, individuals, and activities.

Expanding on the idea of reciprocal determinism, Bandura proposed the concept of self-efficacy, describing it as a person's belief in their ability to plan and carry out actions required to accomplish particular goals. According to Bandura's theory, an individual's perception of their capabilities significantly influences the actions they take and their persistence in the face of challenges (Warner and French 2020). This belief system, referred to as self-efficacy, reflects a future-oriented sense of competence and confidence, rather than serving as an actual measure of ability (Bhati and Sethy 2022). Bandura identified four primary sources of self-efficacy, that is, vicarious experiences, mastery experiences, verbal persuasion, and psychological and emotional states. Among these, mastery experiences are considered the most influential, as they involve direct personal experiences of success or failure while performing tasks (Juwita et al. 2023). Such experiences reinforce individuals' sense of efficacy, particularly when they result in successful task completion.

Vicarious experiences, another important source of self-efficacy, involve observing the performance of others who are perceived as similar to oneself. These observations foster self-efficacy by demonstrating that a particular task is achievable, thereby encouraging individuals to believe in their own capabilities (Bandura 1977). The most effective means of fostering self-efficacy through vicarious experiences is through modelling, where individuals observe and learn from others' behaviours and outcomes (Nikočević-Kurti 2021). Verbal persuasion, meanwhile, emphasises the role of encouragement and constructive feedback in enhancing individuals' confi-

dence in their abilities (Naidoo and Naidoo 2023). Reflective practices and feedback sessions are particularly critical in the context of teacher education, as they provide pre-service teachers with opportunities to evaluate and improve their teaching practices (Gale et al. 2021).

Lastly, psychological and emotional states, such as stress, anxiety and arousal, also influence individuals' judgments of their self-efficacy. These states can either bolster or undermine one's confidence in their ability to perform specific tasks (Bandura 1977). Recent research affirms that pre-service teachers' emotional states like anxiety during practicum or evaluation periods are significantly correlated with lower self-efficacy (Bach and Hagenauer 2022). An additional source of self-efficacy, not explicitly addressed by Bandura, pertains to the individual's level of content knowledge. High academic performance, as indicated by strong examination scores or subject-matter proficiency, has been positively correlated with higher levels of self-efficacy, especially in teacher education contexts (Xu and Jia 2022).

In the field of teacher education, self-efficacy holds particular significance. Teacher self-efficacy refers to educators' confidence in their capacity to design, coordinate, and carry out tasks essential for reaching intended learning objectives. Recent scholarship continues to affirm this definition, linking self-efficacy with teachers' confidence to face classroom challenges and engage students (Gordon et al. 2023). Woodcock et al. (2022) further define teacher self-efficacy in terms of its impact on learning outcomes. Teachers with high self-efficacy are more likely to adopt innovative teaching strategies, maintain a focus on academic achievement, and provide constructive feedback to their students, thereby fostering better learning environments (Vattøy 2020; Gan et al. 2021).

Teacher self-efficacy is closely associated with Bandura's concept of outcome expectancy, which refers to the degree to which individuals believe their actions will lead to desirable outcomes (Bandura 1989). High self-efficacy positively influences outcome expectancy and enhances motivation, as learners with strong self-beliefs are likely to engage in and persist with tasks despite challenges (Lauermann and ten Hagen 2021). For teachers, high outcome expect-

ancies translate into a belief that their efforts will lead to significant cognitive gains in their students. Consequently, teacher education programs must be intentionally designed to promote high levels of self-efficacy among pre-service teachers. By incorporating mastery experiences, opportunities for reflection, and feedback, these programs can prepare educators who are confident in their ability to create meaningful learning experiences and achieve desired educational outcomes (Naidoo and Naidoo 2023).

METHODOLOGY

Research Design

This study adopted a survey design utilising a quantitative survey to examine the self-efficacy levels of final-year pre-service science teachers. The design facilitated an investigation into the influence of academic performance, macro-teaching and micro-teaching on the self-efficacy of these pre-service teachers. Additionally, it assessed potential differences in self-efficacy levels between female and male pre-service teachers.

The self-efficacy of pre-service science teachers was determined using their responses to a pre-service science teacher self-efficacy questionnaire, which demonstrated a reliability coefficient (Cronbach's alpha) of 0.703. The researchers developed and administered a 16-item questionnaire. Participants were asked to indicate their level of agreement or disagreement with each statement using a five-point Likert scale, ranging from strongly disagree to strongly agree. Frequencies and mean scores for individual items were computed. Additionally, the overall mean score of the responses across all items and participants was calculated. The computed mean score was placed on a continuum ranging from 1.0 to 5.0 and interpreted as indicating very low, low, neutral, high, or very high self-efficacy levels (see Table 1). An independent sample *t*-test was conducted to examine gender differences in self-efficacy. Additionally, the micro-teaching and macro-teaching scores, along with the cumulative grade point average (CGPA) of participants, were extracted from institutional databases to assess their influence on self-efficacy through multiple regression analysis.

Table 1: Interpretation of mean self-efficacy values

<i>Range of values</i>	<i>Interpretation</i>
1.0 to 1.9	Very low self-efficacy
2.0 to 2.9	Low self-efficacy
3.0	Neutral
3.1 to 3.9	High self-efficacy
4.0 to 4.9	Very high self-efficacy

Participants

The study was on self-efficacy of pre-service science teachers who have gone through four years of training, and hence the population comprised 63 Level 400 science major pre-service teachers. The study participants were of 63 final-year pre-service science teachers selected using purposive sampling. The sample included 44 males and 19 females, with ages ranging between 20 and 34 years. Consent was obtained from all participants prior to the administration of the questionnaire.

Research Setting

The study was conducted in a College of Education in the Central Region of Ghana, which admitted their first cohort of Bachelor of Education students in 2018. By the time of this study, these students had undergone four years of training and were preparing to write their fourth year end-of-second semester examinations.

During their training, the pre-service teachers completed micro-teaching in the second semester of their third year, macro-teaching in the first semester of their fourth year, and engaged in reflections on their macro-teaching experiences during the second semester of their fourth year. Both micro-teaching and macro-teaching activities focused on the participants' major subject areas, limiting their teaching experiences to their areas of specialisation. Macro-teaching sessions were observed and assessed by experienced college tutors, with scores serving as reliable indicators of participants' teaching competence in their respective major subject areas.

At the time of the study, the Grade Point Average (GPA) for the fourth year first semester was unavailable. Consequently, the cumulative grade point average (CGPA) as of the second semester of the third year was extracted from institutional records, with permission from the college, and used in the analysis. The GPA for

each semester is computed using the course credit hours and the grades obtained. The GPA for each semester is used to calculate the CGPA.

RESULTS

The pre-service teachers were asked to indicate their level of agreement with various statements on the pre-service science teachers' self-efficacy questionnaire. The frequency of their responses is summarised in Table 2.

The analysis of the responses indicates that the majority of pre-service teachers possess a high level of self-efficacy across various aspects of science teaching. Notably, most respondents expressed strong confidence in welcoming student questions during lessons, with 59 respondents either agreeing or strongly agreeing. This reflects their ability to foster interactive and inclusive classroom environments, which are critical for effective teaching and learning. Furthermore, 54 of the pre-service teachers disagreed or strongly disagreed with the notion that they lacked the skills necessary to teach science, suggesting that they generally perceive themselves as capable and skilled educators.

Confidence in addressing students' science-related questions was another area of strength, as 53 participants agreed or strongly agreed that they could handle such inquiries effectively. Similarly, 60 respondents reported feeling confident teaching a science concept after having taught it once, which reflects growing competence and familiarity with the subject matter through repeated practice. These findings align with the principles of mastery experiences in Bandura's theory of self-efficacy, which highlights the role of successful task performance in enhancing self-belief.

Despite these strengths, there were areas of variation and potential improvement. For example, while 50 out of the 63 respondents disagreed that they found science difficult to teach, the remaining participants were either undecided, agreed or strongly agreed. This indicates that a significant proportion of pre-service teachers still experience challenges with teaching science, which may stem from gaps in content knowledge or pedagogical skills. Similarly, 30 participants expressed a desire for a stronger understanding of science concepts, suggesting a need for additional training to deepen their knowledge base.

Table 2: Frequency distribution of responses to statements on science teaching self-efficacy

S.No.	Statement	SD	D	U	A	SA	Mean
1	I am open to student questions when teaching science.	3	0	1	17	42	4.5079
2	I lack the necessary skills to teach science effectively.	39	15	2	7	0	4.3651
3	I am confident in answering students' science-related questions.	0	1	10	36	17	4.0794
4	I would prefer not to have my supervisor evaluate my science teaching.	25	25	3	7	3	3.9841
5	I feel at ease improvising during science lab experiments.	2	8	7	28	18	3.8254
6	No matter how hard I try, I am not as effective at teaching science as I am with other subjects.	37	19	3	2	2	4.381
7	After teaching a science concept once, I feel confident teaching it again.	1	0	2	31	29	4.381
8	I find science to be a challenging subject to teach.	25	25	5	6	2	4.0317
9	I understand the steps required to teach science concepts effectively.	3	3	7	37	13	3.8571
10	I have difficulty explaining why science experiments work.	28	24	5	6	0	4.1746
11	I am constantly discovering better methods to teach science.	1	2	1	35	24	4.254
12	My teaching of science is generally ineffective.	32	18	3	5	5	4.0635
13	I have sufficient understanding of science concepts to teach them effectively.	0	2	5	37	19	4.1587
14	I know how to make science engaging for students.	0	1	2	31	29	4.3968
15	I feel nervous when teaching science content I am unfamiliar with.	12	25	10	10	6	3.4286
16	I wish I had a stronger grasp of the science concepts I teach.	8	11	6	28	10	2.6667
17	Mean Efficacy						4.0347

SD = Strongly Disagree (1), D = Disagree (2), U = Undecided (3), A = Agree (4), SA = Strongly Agree (5)

Pre-service teachers also demonstrated strong pedagogical self-efficacy, with 50 agreeing or strongly agreeing that they understood the steps required to teach science concepts effectively. Additionally, the majority felt confident in explaining why science experiments work (52) and continually discovering better teaching methods (56). These findings highlight their adaptability and commitment to professional growth, which are crucial attributes for effective educators. However, a small proportion of respondents (16) expressed nervousness about teaching unfamiliar content, with 37 agreeing or strongly agreeing with this sentiment, suggesting a need for targeted support in building confidence for novel teaching situations.

Another critical finding pertains to pre-service teachers' attitudes toward supervisor evaluations. While most participants disagreed or strongly disagreed with avoiding such evaluations (50), 10 would avoid being observed. This underscores the importance of fostering a culture where feedback and mentorship are viewed as opportunities for growth rather than criticism.

Finally, Table 2 suggests that pre-service teachers are highly confident in their ability to make science lessons engaging for students. The respondents who agreed or strongly agreed with this statement were 60 out of 63. This is a critical factor in fostering student interest and achievement in science. Additionally, 56 of respondents felt they understood science concepts well enough to teach effectively, further reinforcing their overall confidence as educators. However, the remaining respondents who expressed doubts in this area signal the need for continued emphasis on content mastery during teacher preparation programs.

The responses indicate that pre-service teachers exhibit high levels of self-efficacy in most areas of science teaching, particularly in engaging students, answering questions, and implementing effective teaching strategies. However, certain areas, such as teaching unfamiliar content and deepening science concept knowledge, require further attention. These findings highlight the importance of providing targeted support and training to address individual needs while leveraging existing strengths to enhance pre-service teachers' confidence and competence.

Table 2 reveals generally high levels of self-efficacy among pre-service science teachers, with notable strengths in several areas of their teaching practice. The highest-rated statement, "I am open to student questions when teaching science", with a mean score of 4.5079, indicates a strong sense of confidence in facilitating interactive and inclusive classroom discussions. This openness to student engagement is crucial for fostering critical thinking and active learning in science education. Similarly, the statement, "I know how to make science engaging for students" received a high mean score of 4.3968, reflecting the participants' ability to captivate students' interest and design engaging instructional activities. These findings underscore the pre-service teachers' confidence in their ability to create dynamic and stimulating learning environments, an essential attribute for effective science teaching.

Table 2 further highlights the pre-service teachers' growing confidence in mastering instructional content and delivery. The statement, "After teaching a science concept once, I feel confident teaching it again" achieved a mean score of 4.381, suggesting that participants feel increasingly self-assured with repeated exposure to teaching specific concepts. Additionally, the mean score of 4.254 for the statement, "I am constantly discovering better methods to teach science" reflects their commitment to professional growth and ongoing improvement in instructional practices. These responses suggest that pre-service teachers are not only confident in their current teaching capabilities but are also dedicated to refining their pedagogical approaches.

Despite these areas of strength, Table 2 identifies certain challenges that require attention. The lowest-rated statement, "I wish I had a stronger grasp of the science concepts I teach", with a mean score of 2.6667, indicates that many participants feel inadequately equipped with content knowledge. This finding highlights a critical gap in pre-service teacher training programs and suggests the need for enhanced focus on building subject matter expertise. Similarly, the statement, "I feel nervous when teaching science content I am unfamiliar with", received a moderate mean score of 3.4286, reflecting that some pre-service teachers experience anxiety when handling unfamiliar topics. These findings

indicate the importance of providing pre-service teachers with robust opportunities to deepen their knowledge base and develop confidence in teaching a broader range of scientific content.

The analysis also highlights specific areas of teaching practice where participants experience moderate levels of self-efficacy. The statement, "I feel at ease improvising during science lab experiments" received a mean score of 3.8254, suggesting that while many pre-service teachers are comfortable handling practical scenarios, there is room to improve their ability to adapt to unexpected situations during laboratory activities. Furthermore, the statement, "I have difficulty explaining why science experiments work" had a mean score of 4.1746, indicating that while participants generally feel confident, some face challenges in articulating the underlying scientific principles of experiments. Addressing these areas could enhance their ability to facilitate inquiry-based learning and develop students' understanding of scientific concepts.

Table 2 also suggests that some pre-service teachers harbour reservations about external evaluations of their teaching practice. The statement, "I would prefer not to have my supervisor evaluate my science teaching" received a mean score of 3.9841, reflecting a mixed response. While many participants may feel confident in their abilities, others might experience apprehension regarding supervisory feedback. This find-

ing underscores the need to foster a supportive environment for mentorship and constructive evaluation, which can further enhance their self-efficacy.

While the pre-service science teachers in this study demonstrate strong overall self-efficacy, there are areas for targeted improvement. Strengthening content knowledge, reducing anxiety around unfamiliar topics, and enhancing practical teaching skills are critical areas for intervention. Teacher education programs should also emphasise the importance of reflective practice and provide robust support systems to address individual challenges, thereby preparing pre-service teachers for the complexities of science teaching.

The regression analysis in Table 3 shows that CGPA before macro-teaching was a significant predictor of self-efficacy. The total variance explained by the regression model was 0.122, which in terms of percentage is 12.2 percent ($R^2 = 0.122$, $F(2.497, 54)$; $p > 0.05$). The results showed that micro-teaching ($\beta = -.212$, $p > 0.05$) and macro-teaching ($\beta = -.114$, $p > 0.05$) did not significantly predict self-efficacy. CGPA before macro-teaching ($\beta = 0.307$, $p < 0.05$), however, had a significantly small positive impact on self-efficacy. The results suggest that on average, a point increase in CGPA before macro-teaching increased self-efficacy by 0.288. An increase in the micro-teaching and macro-teaching scores

Table 3: Multiple regression showing the influence of micro-teaching, macro-teaching and CGPA on self-efficacy

Model summary						
Model	R	R square	Adjusted R Square	Std. error of the estimate		
1	.349 ^a	.122 (12.2%)	.073	.40906		
a. Predictors: (Constant), CGPA before Macro Teaching, Micro Teaching Score, Macro Teaching						
Coefficients ^a						
Model	Unstandardised coefficients			tandardised coefficients	T	Sig.
	B	Std. error	Beta			
1	(Constant)	6.086	2.421		2.514	.015
	Micro Teaching Score	-.014	.009	-.212	-1.564	.124
	Macro Teaching	-.021	.026	-.114	-.825	.413
	CGPA before Macro Teaching	.288	.123	.307	2.352	.022

a. Dependent Variable: Mean Efficacy

decreased self-efficacy by 0.014 and 0.021 points, respectively. The results suggest that the impact of micro- and macro-teaching is small and insignificant.

An independent sample t-test was conducted to determine whether there was a significant difference in the self-efficacy of male and female pre-service science teachers (see Table 5). The results showed no significant difference in male pre-service teachers' science efficacy ($M=4.0881$, $SD=0.35924$) and female pre-service teachers' science efficacy ($M=3.9112$, $SD=0.53209$; $t=1.542$, $p=0.129$). This result indicates that male and female pre-service science teachers' self-efficacy was statistically the same. It also reveals that high self-efficacy was not largely contributed to by only one gender.

DISCUSSION

The findings of this study reveal that pre-service science teachers exhibit a high level of self-efficacy in teaching science, with their overall self-efficacy being positively influenced by their Cumulative Grade Point Average (CGPA), a measure of academic achievement. However, the study indicates that micro-teaching and macro-

teaching scores did not significantly contribute to the participants' high self-efficacy. Pre-service teachers demonstrated strong self-efficacy in areas related to pedagogical content knowledge, subject matter knowledge, engaging students, providing feedback, and delivering instructional practices. These findings are consistent with those reported in previous research. For instance, Mishra (2024) found that pre-service teachers demonstrated high self-efficacy across, student engagement, classroom management, and instructional strategies. Similarly, Bamidele and Akanmu (2023) reported very high self-efficacy among pre-service science and mathematics teachers, with strong links to academic performance and CGPA, a trend also corroborated by the study of Brantuo et al. (2024).

The importance of assessing pre-service teachers' self-efficacy before graduation cannot be overstated, as it provides a critical measure of the effectiveness of teacher education programs. Recent research emphasises that evaluating self-efficacy offers valuable insights into the quality of training received and helps identify strengths and gaps in teacher preparation programs (Molefe et al. 2024). In this study, the results suggest that pre-service science teach-

Table 4: Independent sample t-test showing the effect of gender on teaching self-efficacy

Group statistics											
Gender		N	Mean		Std. deviation		Std. error mean				
Mean Efficacy	Male	44	4.0881		.35924		.05416				
	Female	19	3.9112		.53209		.12207				
Independent Samples Test											
		Levene's test for equality of variances		T-test for equality of means							
		F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference	95% confidence interval of the difference		
										Lower	Upper
Mean Efficacy	Equal variances assumed	5.009	.029	1.542	61	.128	.17688	.11468	-.05243	.40620	
	Equal variances not assumed			1.325	25.372	.197	.17688	.13355	-.09795	.45172	

ers possess a solid understanding of Junior High School science concepts, indicating that the curriculum of the Bachelor of Education program was well-aligned with the demands of teaching science at this level. This finding aligns with Lee et al. (2025), who reported that integrated science content courses significantly improved pre-service teachers' self-efficacy and content knowledge, both of which are critical for engaging students and responding effectively to classroom questions. Consequently, the pre-service teachers' confidence in welcoming student questions and comfortably teaching scientific concepts can be attributed to their strong conceptual understanding and the content knowledge acquired during their training.

Contrary to these findings, Gizaw et al. (2024) reported lower levels of self-efficacy among pre-service science teachers. They attributed the low level of self-efficacy to inconsistencies in conceptual understanding of the nature of science. In the current study, however, the high self-efficacy levels may also be attributed to the supported teaching-in-schools component of the program, which provided pre-service teachers with practical teaching experiences. This finding suggests that the four-year Bachelor of Education program effectively equipped pre-service teachers with both pedagogical and content knowledge through a combination of enactive experiences (direct practice), vicarious learning (observing others), verbal feedback, and emotional support. As Canlas et al. (2024) demonstrated, pre-service teachers' confidence in responding to scientific queries and managing classroom challenges increases significantly when strong conceptual foundations are reinforced through well-structured instructional support. Likewise, Kyriazis et al. (2024) found that engaging pre-service teachers in inquiry-based science instruction enhanced both their understanding of scientific concepts and their science teaching self-efficacy. These components are critical in shaping confident and effective science educators.

Interestingly, the regression analysis indicated that the practical components of the program, such as micro-teaching and macro-teaching, were not major contributors to the participants' high self-efficacy. Together, CGPA, micro-teaching, and macro-teaching accounted for

only 12 percent of the variation in self-efficacy, leaving 88 percent unexplained by these factors. Among these, CGPA emerged as the only positive predictor of self-efficacy, reinforcing the role of academic achievement in fostering pre-service teachers' confidence in their teaching abilities (Brantuo et al. 2024). While micro-teaching and macro-teaching contributed to overall academic achievement, their individual scores were found to have a slight negative association with self-efficacy. Although this negative association is small, it warrants attention as it suggests that these components, if not well-implemented, could undermine pre-service teachers' confidence (Lekhu 2023).

Given the potential impact of micro-teaching and macro-teaching on self-efficacy, science teacher educators must take steps to strengthen these components of the program. Enhancing the design and delivery of micro-teaching and macro-teaching sessions can ensure that they contribute positively to pre-service teachers' development, enabling them to attain or maintain very high levels of self-efficacy. Enhancing these aspects enables teacher education programs to more effectively equip pre-service teachers for the demands of science instruction, leading to better outcomes for both educators and their students (Baabdullah et al. 2024).

CONCLUSION

This study examined the self-efficacy of pre-service science teachers in Ghanaian Colleges of Education, focusing on the influence of academic performance, micro-teaching, and macro-teaching on their self-efficacy levels. The findings demonstrate that pre-service science teachers possess high levels of self-efficacy, particularly in areas related to subject matter knowledge, pedagogical competence, student engagement, and instructional practices. These findings affirm the effectiveness of the reformed Bachelor of Education program in equipping pre-service teachers with the skills and confidence necessary to teach science effectively.

The study also identified that Cumulative Grade Point Average (CGPA) had a small but significant positive influence on self-efficacy, highlighting the importance of academic achievement in building confidence among pre-service

teachers. However, micro-teaching and macro-teaching were not significant predictors of self-efficacy, and their slight negative association with self-efficacy suggests areas for improvement in the design and implementation of these practical components. Strengthening these components through enhanced supervision, constructive feedback, and alignment with real-world teaching scenarios could mitigate their negative impact and further enhance teacher preparation.

Additionally, while pre-service teachers exhibited high self-efficacy overall, areas for targeted support were identified. A considerable number of participants expressed the need for a stronger understanding of science concepts and reported anxiety when teaching unfamiliar content. These findings emphasise the importance of prioritising content mastery and confidence-building in teacher education programs.

Importantly, the findings also revealed no significant differences in self-efficacy between male and female pre-service teachers, indicating that both genders are equally confident in their teaching abilities. This suggests that the program is equitable in fostering self-efficacy across gender lines, a positive outcome for teacher education in Ghana.

RECOMMENDATIONS

Based on the discussion and conclusion of the study, several recommendations emerge to enhance the quality and impact of science teacher education programs, particularly within the context of Ghana's 4-year Bachelor of Education program. First, the consistently high self-efficacy levels exhibited by pre-service science teachers underscore the importance of integrating academic achievement as a central component of teacher preparation. Since CGPA was identified as a significant positive predictor of self-efficacy, efforts should be made to reinforce the academic rigour of the program and support students in achieving strong academic outcomes. This implies that coursework must continue to prioritise both content mastery and pedagogical development. Furthermore, the relatively weak or even negative association between micro-teaching and macro-teaching scores and self-efficacy suggests that these practical com-

ponents require careful re-examination. While practical teaching experiences remain crucial, their design and delivery must be reviewed to ensure they are meaningful, reflective, and confidence-building rather than anxiety-inducing or mechanical. Science teacher educators should revise and strengthen the micro-teaching and macro-teaching modules by embedding more structured feedback, increased mentorship, and enhanced opportunities for reflection and peer collaboration. Additionally, the study highlights the value of assessing pre-service teachers' self-efficacy prior to graduation, especially as a tool for evaluating the effectiveness of the teacher education program. Such assessments can help institutions identify gaps in training, adjust instructional strategies, and tailor support to meet the specific needs of pre-service teachers. Ultimately, refining these program components will help sustain or elevate the already high self-efficacy levels, better preparing pre-service science teachers for the demands of the classroom and improving the overall quality of science education at the basic level.

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