Pre-Service Teachers' Perceptions on Biology Classroom Environment and their Attitudes towards the Subject in Ghana

Antwiwaa Opoku[1], George Brains Budu[2], Judith Kafui Kemetse[3], Kwaku Darko Amponsah[4,5*] & Phyllis Bernice Kwarteng Donkor[4]
[1]Department of Science, Accra College of Education, P. O. Box LG 221, Legon, Accra, Ghana
[2]Department of Science, E. P. College of Education, P. O. Box AM 12, Amedzofe, Ghana
[3]Department of Science, Peki College of Education, P. O. Box 14, Peki, Ghana
[*4,5]Department of Teacher Education, University of Ghana, Legon, Accra, Ghana & Department of Science and Technology Education, University of South Africa, Pretoria, South Africa
[*]Email: kdamponsah@ug.edu.gh

Abstract
The purpose of this study was to find out how pre-service teachers felt about their biology classroom environment and how they felt about biology. Two hundred and six (260) aspiring teachers from several Ghanaian science colleges of education took part in the study. The Attitude towards Biology Scale and the Biology Classroom Environment Scale were used to collect data. The study technique utilised to gather data is called a cross-sectional design. The data were analysed using means, independent samples t-tests, and one-way ANOVA across groups. The findings showed that pre-service teachers had a relatively good assessment of the environment in their biology classroom, with the categories of teacher support and involvement, cohesion, and research receiving the highest rankings. The pre-service teachers likewise had a mildly positive outlook on biology, scoring highest in the interest, significance, and enjoyment categories. Additionally, a strong positive association between pre-service teachers' attitudes toward biology and how they perceived their biology classroom setting was discovered. The results of this study indicate that fostering a good learning environment in biology classrooms may improve pre-service teachers' attitudes about biology.
Keywords: *Colleges of education; biology classroom environment; pre-service biology teachers; attitude toward biology*

1. Introduction

Students' ability to comprehend the natural world and make wise decisions about their health and surroundings is greatly aided by biology instruction. Students' opinions of the classroom environment can have an impact on their learning and engagement, and teachers play an essential part in influencing students' attitudes toward biology. According to earlier research (Chen *et al*., 2018; Mahmud *et al*., 2021), a supportive learning environment in the classroom is positively correlated with students' views toward biology. Additionally, pre-service teachers' views about biology may be influenced by things like prior experiences with the topic and ideas about how important biology education is (Adeniyi & Adesoji, 2020; Ma, 2019). However, to enhance biology education and teacher preparation programs, further study is required on pre-service teachers' attitudes about biology and how they perceive their biology classroom setting.

The physical, social, and psychological elements of the classroom that might affect students' learning experiences and outcomes are referred to as the "classroom environment." This includes elements like the classroom's physical arrangement, the teacher's demeanour and instructional style, the degree of student engagement and interaction, and the culture and atmosphere of the classroom. There is a considerable amount of research on classroom environments, which refers to the physical, social, and emotional characteristics of a classroom that influence learning and development. For instance, Johnson and Johnson (2021) assert that the classroom atmosphere has a big impact on

students' motivation, engagement, and academic success. Similar findings were made by Martin and Dowson (2009), who discovered that a supportive learning environment can raise students' self-efficacy, enthusiasm, and enjoyment of their studies. In Ryan's (2013) research, it was highlighted that learners form aspirations for their future and identify the skills they need to achieve those goals within the context of the learning environment. The study emphasized the significant influence of the learning environment on students' academic progress, underscoring the importance of understanding its impact on student achievement. This understanding becomes crucial for enhancing instructional efficacy (Ryan, 2013). The classroom setting has also been described in vivid detail by other studies. For instance, Bates (2014) proposed that the many physical settings, social circumstances, and cultural contexts in which students learn constitute the learning environment. In addition to Bates' perspective, the phrase encompasses various aspects of education, such as the dynamics of interpersonal interactions, classroom setup to foster learning, and the overall culture and characteristics of a school or class.

As Anderson (2020) highlights, the classroom environment has a profound impact on students' learning experiences and outcomes. This influence extends to students' motivation, engagement, and academic success, which can be significantly influenced by the physical, social, and emotional elements present in the classroom environment (Kim & Gopalan, 2021). For instance, a welcoming and encouraging classroom environment marked by peer interactions, teacher-student relationships, and a feeling of community might improve students' well-being and academic achievement (Wang *et al.,* 2022). Additionally, the setting in the classroom can be created to support learning styles, such as collaborative (Amponsah, *et al.,* 2021; Amponsah, 2020; Amponsah & Ochonogor, 2018; Amponsah, *et al.,* 2018)), inquiry-based (Mohammed, *et al.,* 2020; Mohammed & Amponsah, 2021a; Mohammed & Amponsah, 2021b), or project-based learning (Kirschner *et al.,* 2018). The sort of learning that occurs in a classroom can be influenced by a variety of elements, including the form and structure of the classroom, seating arrangements, the use of technology, and instructional tactics (Ertmer & Ottenbreit-Leftwich, 2020). In conclusion, the classroom setting is a comprehensive idea that includes a range of components that affects students' learning processes and results. By considering the physical, social, and emotional aspects of the classroom and coordinating them with the targeted learning outcomes, teachers can create a stimulating and encouraging learning environment that promotes students' motivation, engagement, and academic accomplishment.

Evidence from empirical studies also suggests that classroom surroundings have an impact on how well students do in school. Compared to their parents at home, students spend more time with their teachers at school. Wang, Degol, Ye, Li, and Inzlicht (2022) contend that a supportive classroom environment can raise students' motivation levels and academic success. The term "classroom climate" refers to the social and emotional components of the learning environment, such as peer interactions, teacher-student connections, and a sense of community. Students who feel valued and respected can study in a setting that is safe and inclusive thanks to a supportive environment in the classroom (Kim & Gopalan, 2021). Additionally, the classroom's physical environment might have an impact on students' academic performance. According to Barrett, Zhang, Moffat, and Kobbacy (2013), factors such as seating arrangements, temperature, lighting, and classroom layout might affect students' engagement, performance, and attention. Additionally, according to Etmer and Ottenbreit-Leftwich (2020), incorporating technology and multimedia materials into the classroom can improve students' learning outcomes and experiences.

Since it has the potential to affect students' academic performance and career goals, the study of student attitudes toward science and biology has attracted a lot of attention in recent years. The definition of an attitude is a trained propensity to react favourably or unfavourably to a given thing, person, circumstance, or idea. In the context of science and biology education, attitudes refer to how students feel about scientific and biological ideas, how interested and motivated they are to learn about them, and how they see the value and significance of science and biology in their lives. According to research, students' perspectives on science and biology can affect their academic performance and decision to pursue a career in a scientific-related sector. Higher academic achievement, more perseverance in science courses, and a higher likelihood of pursuing jobs in the sciences have all been linked to positive views toward science and biology (Osborne & Dillon, 2008; Sjberg & Schreiner, 2010). On the other hand, unfavorable views of science and biology have been associated with lower academic performance, less enthusiasm and motivation in scientific education, and a lower likelihood of pursuing jobs in the sciences (Osborne & Dillon, 2008; Sjberg & Schreiner, 2010). Numerous research has concentrated on figuring out the variables that contribute to either good or negative attitudes among students because of the significance of their attitudes toward biology and science. These elements consist of gender, cultural background, curriculum design, student-teacher relationships, teaching methods, and

teacher quality (Sjberg & Schreiner, 2010; Wong & Fraser, 2014). Furthermore, studies have demonstrated that initiatives to change students' perspectives on science and biology might enhance academic performance and professional goals (Hidi & Renninger, 2006; Tai et al., 2006). Therefore, it is of utmost importance to conduct research on student attitudes toward science and biology, as these attitudes can significantly influence students' academic achievements and career aspirations. By comprehending the factors that shape individuals' feelings towards these subjects, educators can develop targeted interventions that positively influence students' academic performance and enhance their future prospects in science-related fields.

The What Is Happening In This Class (WIHIC) questionnaire, developed by Fraser et al. (1986), assesses students' perceptions of the classroom environment, including emotional ambiance, support, participation, task orientation, and investigation, rooted in social context and classroom climate theories. This questionnaire has been extensively employed to study the classroom environment's impact on students' attitudes, motivation, and academic achievement across various cultures, highlighting its cross-cultural validity (Aldridge & Fraser, 2000). Various studies have established significant connections between the WIHIC questionnaire and academic achievement, motivation, and attitudes. Fraser et al. (1995) found that positive classroom environments, as measured by WIHIC, correlated with better scientific academic achievement, with teacher support, investigation, and task orientation being strong predictors. These findings highlight the potential impact of pre-service teachers' WIHIC assessments on their professional development, emphasizing the importance of understanding motivators in the learning environment for teacher education programs.

Also, previous literature primarily focused on how junior high and senior high school students and in-service teachers perceived their science classroom settings. Similarly, there have been limited studies on students' perceptions of the learning environment in biology subjects, with more emphasis on instructors' or students' perspectives. Particularly in Ghanaian schools, there is a dearth of research on perceptions of classroom learning settings, especially in Colleges of Education (CoEs), where a unique biology curriculum was recently established due to the introduction of a 4-year B.Ed. (Basic Education) programme. In this context, little attention has been given to how potential biology teachers at Ghanaian educational institutions perceive their biology classroom setting. However, it is important to note that senior high schools recruit pre-service biology teachers from these institutions to teach biology to learners. In this research, these pre-service biology teachers are licensed to teach the biology aspect of integrated science in junior high schools in Ghana. Given this background, the current study aimed to investigate how pre-service teachers at Ghanaian colleges of education perceived their biology classroom environment and their attitudes toward biology.

Even within a nurturing environment, prospective biology instructors frequently encounter impediments to science learning that can impede their effectiveness, as documented by Amponsah (2014). Moreover, factors such as their classroom environment perceptions (Amponsah *et al.,* 2018), interactions with teachers, self-motivation, parental influence (2013), motivation levels (Amponsah, 2014), and overall perception (Amponsah & Mohammed, 2019) may also exert influence on their performance. The literature documents several factors contributing to these issues. According to Abdul-Mumuni (1995) and Lakpini (2007), some pre-service teachers find biology to be a challenging subject, influenced by their religious, social, and cultural backgrounds. Additionally, Mucherah (2008) highlights that some future instructors perceive biology as difficult due to the extensive reading involved. Soyinbo, Eke, and Ato again stressed that preservice teachers' attempts to understand the subject are hampered by misconceptions they have about some biological concepts, including genetics and evolution, as described in Shaibu and Olarewaju (2007). Because of their biases, some biology teachers utilize poor teaching strategies that hinder their students' progress in the subject (Mucherah, 2008). Furthermore, research has highlighted that the belief students should not be required to engage in insufficient laboratory-based biology practical work, hindering the integration of theory with practice, can significantly impact students' learning outcomes in the field (Anthony-Krueger, 2007).

Preservice instructors have also observed a significant correlation between large class sizes (Osai, *et al.*, 2021), the learning environments within such classes, and biology achievement (Myint & Goh, 2001; Chui-Seng, 2004; Mucherah, 2008). However, studies conducted by Mucherah (2008) and Myint & Goh (2001) indicate that classroom environments perceived as supportive by students foster positive attitudes toward the subject matter, resulting in improved achievement in biology. These factors have been documented as having an impact on students' biology achievement.

Most of the existing research on classroom environments has focused on industrialized nations like the United States of America (USA), Australia, New Zealand, and specific Asian countries such as Taiwan, Turkey, and Singapore. Regrettably, there is a notable lack of comprehensive information regarding the perspectives of African students on biology teaching environments, as highlighted by Mucherah (2008). Consequently, it becomes imperative to delve into the exploration of how pre-service teachers' perceptions of their biology classroom settings, where the subject is both taught and learned, exert influence over their attitudes toward biology. A deeper comprehension of this correlation has the potential to illuminate whether these perceptions and attitudes have a discernible impact on their approach to the subject matter and its subsequent outcomes.

It is against this backdrop that this study was undertaken, with the overarching goal of investigating three key facets pertaining to the discussed issues. First, we aimed to evaluate how pre-service teachers perceive their biology classroom environment. Second, we sought to assess the attitudes of pre-service teachers toward the field of biology. Finally, we endeavoured to explore the potential correlation between pre-service teachers' perceptions of their biology classroom environment and their attitudes toward biology. By delving into these aspects, we aim to contribute valuable insights to the field of biology education, shedding light on the intricate relationship between classroom environments and the attitudes of future educators. Through this research, we aspire to inform strategies for enhancing the educational experiences of pre-service teachers and, in turn, their ability to inspire the next generation of biology learners.

2. Research Methods

This study utilizes a cross-sectional survey to investigate the perceptions of pre-service biology teachers within their classroom environments. This approach efficiently captures their evaluations, making it suitable for large-scale data collection. The research involved final-year pre-service biology educators from six colleges of education across Central, Eastern, Oti, and Volta regions in Ghana, utilizing a census sampling approach to include all available participants, resulting in a total of 260 individuals. The data collection instrument, the Pre-Service Biology Teachers Classroom Environment Questionnaire (PBTCEQ), was adapted from Fraser et al.'s "What Is Happening in this Class (WIHIC)" assessment, customized to fit the context of Ghanaian Colleges of Education. Respondents rated positive statements on a five-point Likert scale ranging from 'Rarely (1)' to 'Very often (5).' Content validation was conducted by classroom specialists from the University of Cape Coast, and a pilot project involving pre-service biology instructors with similar educational backgrounds was carried out before the main study.

To establish a constructive rapport with colleges, the researchers-initiated contact and ensured confidentiality and anonymity during data collection, assuring participants that their data would be used solely for academic purposes. The instrument took an average of 35 minutes to complete. Data collection involved Level 100 and 200 pre-service teachers from selected colleges, with mean and standard deviation scores computed for each dimension of the PTBCEQ. Pre-service teachers' perceptions were analysed for differences among colleges using a one-way multivariate analysis of variance (MANOVA) and subsequent one-way analyses of variance (ANOVAs) for sub-scales. Additionally, the study employed the Pre-service Teachers' Attitude Towards Biology Questionnaire (PTATBQ) to compare pre-service teachers' attitudes toward biology across colleges. Mean and standard deviation scores were used to assess these attitudes, and Spearman's Rank Order Correlation was applied to explore potential associations between pre-service teachers' perceptions of their biology classroom environment and their attitudes toward biology. The study also utilised Spearman's Rank Order Correlation to examine relationships among sub-scales of the biology classroom environment as measured by the PTBCEQ.

3. Analysis Result

3.1 Preservice Teachers' Perception of Their Biology Classroom Environment?

The primary objective of the first research question was to explore potential disparities in pre-service teachers' perceptions of their biology classroom environment across the six designated colleges. The study centred on the evaluation of five key facets of the biology classroom environment, namely student cohesiveness, teacher support, involvement, cooperation, and equity. To comprehensively analyse the participants' perspective on the biology classroom environment, mean and standard deviation scores were derived from their responses across these five sub-scales. Upon careful examination of the mean and standard deviation scores as presented in the table, a discernible pattern emerged. The findings indicated that pre-service teachers exhibited a tendency towards lower perceptions of their biology classroom environment. This assertion was underpinned by the observation that none of the mean scores

attained met or exceeded the average mean score of 3. To explore potential disparities in pre-service teachers' perceptions of their biology classroom environment across all six colleges, a One-way Multivariate Analysis of Variance (MANOVA) was executed.

Table 1: Mean (M) and Standard Deviation (SD) Scores for Preservice Teachers on their Biology Classroom Environment (BCE) Sub-scales

BCE Sub-scales	College A M (SD)	College B M (SD)	College C M (SD)	College D M (SD)	College E M (SD)	College F M (SD)
Student cohesiveness	2.0 (0.5)	2.0 (0.3)	1.7 (0.6)	1.7 (0.6)	2.0 (0.3)	2.0 (0.3)
Teacher Support	1.9 (0.6)	1.7 (0.5)	1.5 (0.3)	2.0 (0.3)	1.9 (0.2)	2.2 (0.4)
Involvement	2.1 (06)	1.9 (0.4)	1.8 (0.2)	2.6 (0.6)	1.8 (0.5)	1.8 (0.3)
Cooperation	2.0 (0.5)	2.0 (0.4)	1.6 (0.5)	2.1 (0.2)	1.7 (0.1)	2.0 (0.3)
Equity	1.9 (0.5)	1.9 (0.4)	1.7 (0.5)	1.5 (0.1)	1.6 (0.3)	1.7 (0.5)

College A = Jasikan CoE, College B = St. Francis CoE, College C= St. Theresa's CoE, College D = Kibi Presbyterian CoE, College E = Komenda CoE, College F = OLA CoE,

Prior to conducting the MANOVA, a preliminary assumption test was performed to evaluate normality, linearity, the presence of univariate and multivariate outliers, as well as homogeneity of variance-covariance matrices. The outcomes of this test indicated the absence of significant violations. The MANOVA outcomes unveiled a statistically significant distinction (Wilks' Lambda = 0.81, $F_{(25, 930)}$ = 2.216, p = 0.001, partial eta squared = 0.042) in the population mean scores for the five sub-scales of the biology classroom environment among pre-service teachers across the six selected colleges. This observation signifies that, noteworthy variations exist in how pre-service teachers perceive their biology classroom environment within these colleges. Consequently, a follow-up Analysis of Variance (ANOVA) was conducted individually for each of the five sub-scales that constitute the biology classroom environment. The ANOVA findings highlighted those two sub-scales displayed statistically significant differences at an alpha level of 0.05. Specifically, significant variations were noted in the dimensions of teacher support ($F_{(5, 254)}$ = 2.934, p = 0.014, partial eta squared = 0.055) and involvement ($F_{(5, 254)}$ = 3.022, p = 0.011, partial eta squared = 0.056).

Upon scrutinising the mean scores, it emerged that among the six selected colleges, pre-service teachers at College G exhibited the highest level of teacher support (M = 2.2, SD = 0.4), closely followed by their counterparts at College D (M = 2.0, SD = 0.3). Furthermore, both College F and College A demonstrated comparable levels of teacher support, as indicated by mean scores of (M = 1.9, SD = 0.6) and (M = 1.9, SD = 0.2), respectively. The fifth-highest level of teacher support was found among pre-service teachers at College B (M = 1.7, SD = 0.5), while those at College C reported the lowest level of teacher support (M = 1.5, SD = 0.3). A deeper examination of mean scores, as detailed in the provided table, reveals that pre-service teachers at College D exhibited the highest degree of involvement (M = 2.6, SD = 0.6) among all colleges. Notably, pre-service teachers at College A followed closely with the second-highest level of involvement (M = 2.1, SD = 0.6). Additionally, pre-service teachers at College B showcased the third-highest level of involvement (M = 1.9, SD = 0.4), while those at College E, College F, and College C demonstrated comparable levels of involvement (M = 1.8, SD = 0.5), (M = 1.8, SD = 0.3), and (M = 1.8, SD = 0.2), respectively.

Table 2 displays the outcomes of the subsequent one-way ANOVA, conducted as a supplementary analysis following the MANOVA, for the five distinct sub-scales encompassing the biology classroom environment.

Table 2: The ANOVA results, conducted as a follow-up to the One-way MANOVA, are displayed for the five sub-scales of the BCE

Classroom Environment Sub-scales	Df	Mean Squared	F	P-values	Partial Eta Squared
Student Cohesiveness	5	0.2	0.9	0.51	0.017
Teacher Support	5	0.9	2.9	0.014*	0.055

Involvement	5	1.1	3.0	0.011*	0.056
Cooperation	5	0.4	1.6	0.163	0.030
Equity	5	0.4	1.5	0.177	0.030

Significant using an alpha level of P< 0.05

The analysis of the initial hypothesis aimed to investigate potential disparities in the perception of the biology classroom environment among pre-service teachers across the six selected colleges. The study focused on five distinct sub-scales encompassing student cohesiveness, teacher support, involvement, cooperation, and equity. To gauge the pre-service teachers' perception of their biology classroom environment, mean and standard deviation scores were calculated across these sub-scales. Employing both a MANOVA and subsequent ANOVA, the study sought to elucidate any differences. Remarkably, despite the pre-service teachers across the six colleges exhibiting a generally modest perception of their biology classroom environment, the analytical results unveiled noteworthy variations in how they perceived this environment. These differences were particularly pronounced in the domains of teacher support and involvement.

3.2 Preservice Teachers' Attitude Towards Biology
The second research question aimed to determine whether pre-service teachers' attitudes toward biology were positive, negative, or neutral. The study investigated whether the attitude toward biology was unidimensional. To analyse the pre-service teachers' attitude toward biology, mean and standard deviation scores of their responses were considered. The descriptive statistics for the Pre-Service Teachers' Attitude Towards Biology Questionnaire (PTATBQ) presented in Table 3 indicated an overall mean (M) of 2.1 and a standard deviation of 0.4. On the Likert scale, a score of 2 corresponded to "Agree." These results suggest that pre-service teachers in all six selected colleges hold a positive attitude toward biology.

Table 3: Mean and standard deviation of attitude towards biology by participants

	Number of participants	Mean	Standard deviation
Attitude	260	2.1	0.4
Valid N (listwise)	260		

3.3 Association between Perception of Biology Classroom Environment and Attitude toward Biology.
Research Question 3 was formulated to explore the link between pre-service teachers' perception of their biology classroom environment and their attitude towards biology. Spearman's rank-order correlation coefficient was employed to investigate this connection. Preceding this analysis, preliminary assessments were conducted to ascertain that the assumptions of normality, linearity, and homoscedasticity remained unviolated. The outcomes unveiled a positive correlation ($r = 0.19$, $n = 260$, $p < 0.001$) between the two variables. This finding underscores that a significant association exists between pre-service teachers' perceptions of their biology classroom environment and their attitude towards biology. The visual representation of this relationship is presented in Figure 1.
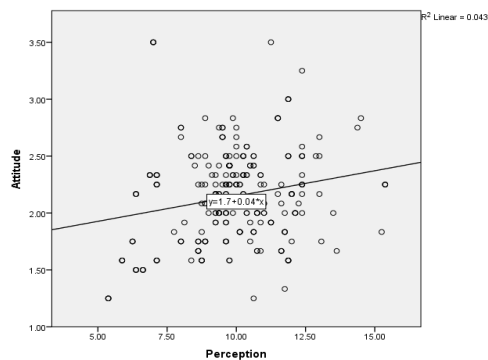

Figure 1: *A Scatter Plot Showing the Correlation between Students' Perceptions of their Biology Classroom Environment and their Attitude toward Biology in six selected colleges.*

4. Discussion

In general, according to the analyses done on the first research question, preservice teachers in the six colleges had a low opinion of the environment in their biology classrooms, although they revealed substantial disparities in those opinions. The assistance and involvement of teachers were the areas where there were variations. This current finding supports what Otami et al. (2011) discovered in their study of Ghanaian elective science students, which showed a negative assessment of their biology course across the board. Others include a study by Johnson and Watson (2011) that discovered that student academic engagement and success in biology were positively correlated with instructor assistance. Additionally, a study by Finson et al. (1995) found that teachers who were enthusiastic and supportive created a positive classroom environment that led to higher student achievement in science, and a study by Dorman and Fraser (2009) found that teacher involvement was positively related to students' cognitive and affective outcomes in science education. However, research by Edelson and Gordin (1998) discovered that student motivation and curiosity were other elements at play, and that teacher involvement was not always linked to students' science achievement. Furthermore, a study by Chiu et al. (2012) indicated that other factors, such as prior knowledge and the classroom environment, also played a part in predicting student progress in biology, and that teacher support was not a significant predictor of this.

It was discovered that preservice teachers at all six of the colleges chosen have a positive attitude toward biology. This research supports the outcomes of this investigation. Seçer and Sözbilir (2020), for example, discovered that "preservice teachers' attitudes toward biology were generally positive, and that there was a significant positive correlation between their attitudes and their achievement in biology" (p. 411). Additionally, preservice biology teachers in a study by Barreto *et al.* (2020) had favourable opinions toward biology and thought that biology was crucial to their future careers as instructors. Additionally, the study discovered a strong correlation between preservice teachers' academic achievement and their views toward biology (p. 14). Similarly, Dündar et al.'s study from 2021 discovered that preservice biology instructors had favourable opinions toward biology and thought it was crucial for their future careers. A substantial favourable association between preservice teachers' attitudes and their biology achievement was also discovered by the study (p. 9). However, other research suggested the opposite. For instance, preservice science teachers' views toward biology were not shown to be significantly connected with their academic achievement in the subject, according to a study by Akkuzu and Yaman (2020) (p. 79). According to a study by Chen et al. (2020), preservice teachers' attitudes toward science were favourably connected with their academic success in the subject, but the connection was shaky and distinct for each type of science (p. 13). Preservice biology instructors' attitudes toward biology were found to be favourably connected with their achievement in some areas of biology, but not in others, according to Erdemir and Ekmekci's study from 2021. For instance, in the field of ecology, there was a high positive association between attitudes and success, while there was no discernible correlation in the field of genetics (p. 60).

The attitudes of preservice science teachers toward biology and the variables influencing those attitudes were examined by Kocakaya and Yilmaz (2020). The perceptions and attitudes of preservice science teachers regarding biology were found to be significantly positively correlated in this study. To improve attitudes toward the discipline, the authors advise preservice teacher preparation programs to place a high priority on the formation of positive impressions of biology. Once more, Karatas and Dogan (2021) investigated how preservice science teachers' views of biology and attitudes toward teaching biology related to one another. Similar results were obtained in this study, which discovered a strong positive relationship between preservice science teachers' opinions of biology and their attitudes about teaching it. The authors contend that enhancing preservice teachers' views of biology may be a crucial element in encouraging favourable attitudes about teaching the subject. The attitudes of preservice science instructors toward biology were not shown to be significantly connected with their impressions of the subject in an Akkuzu and Yaman (2020) study (p. 79). Additionally, a study by Akn et al. (2020) revealed no significant correlation between preservice biology teachers' attitudes about biology and their comprehension of scientific inquiry or their views on the nature of science (p. 297). According to a study by Karahan and Alişkan (2018), preservice biology teachers' perceptions about their ability to teach biology were only weakly and favourably connected with their attitudes toward biology (p. 33). However, the correlation was not statistically significant. According to a study by Yalçin et al. (2021), there is a bad link between the attitudes of aspiring science instructors toward biology and how relevant they believe biology is to their daily lives (p. 30). The attitudes of preservice science teachers toward biology were found to be negatively connected with their self-efficacy beliefs in biology teaching in a study by Yaman and Akkuzu (2020) (p. 203).

According to a study by Karpudewan and Teo (2020), there is a link between preservice science teachers' views about biology and how difficult they think biology is (p. 27).

5. Conclusions

In conclusion, the research findings on preservice teachers' attitudes toward biology in the six colleges reveal both positive and negative aspects. While the overall opinion of the environment in their biology classrooms was low, there were significant disparities in their opinions, particularly concerning the areas of teacher assistance and involvement. These results align with previous studies that demonstrated negative assessments of biology courses among Ghanaian elective science students. Moreover, the research supports the notion that teacher involvement and support play vital roles in student academic engagement and success in biology. Enthusiastic and supportive teachers create a positive classroom environment that enhances student achievement in science education. However, it should be noted that other factors, such as student motivation, prior knowledge, and the classroom environment, also contribute to predicting student progress in biology, and teacher support may not always be the sole predictor of academic achievement. On the positive side, the research indicates that preservice teachers generally have a positive attitude toward biology. This finding aligns with previous studies showing a positive correlation between preservice teachers' attitudes and their achievement in biology. Preservice biology teachers often consider biology as crucial to their future careers as instructors. However, some studies have revealed mixed results, with some showing no significant correlation between attitudes and academic achievement in certain areas of biology. The research highlights the importance of fostering positive attitudes toward biology among preservice teachers. Studies recommend that preservice teacher preparation programs prioritize the formation of positive impressions of biology to improve attitudes toward the discipline and teaching of the subject. Enhancing preservice teachers' views of biology may play a critical role in encouraging favourable attitudes about teaching biology. While some studies have found significant positive correlations between preservice teachers' attitudes and certain factors, such as their attitudes toward teaching biology, their comprehension of scientific inquiry, and their self-efficacy beliefs in biology teaching, there were also instances where no significant connections were observed.

6. Recommendations

Future studies could look at the variables that affect preservice teachers' perceptions of their biology classroom environments and how these attitudes are affected by these perceptions. It would also be good to research efficient teaching methods that encourage a positive learning environment and positive attitudes toward biology among preservice teachers. Teacher training programs should emphasise tactics for building a healthy school atmosphere that encourages teacher support and participation. The classroom setting may influence preservice teachers' biological views. Therefore, they require the skills and expertise to establish a positive and supportive learning atmosphere that promotes good biological attitudes. Biology educators should promote active learning. Inquiry-based and collaborative learning can improve students' science attitudes. Preservice instructors can improve student engagement and biology attitudes by using these tactics.

7. References

Adeniyi, O. A., & Adesoji, F. A. (2020). Determinants of pre-service biology teachers' attitudes towards teaching profession in Nigeria. *Journal of Research in Science Teaching, 57*(1), 1-22. https://doi.org/10.1002/tea.21581

Akkuzu, N., & Yaman, S. (2020). Preservice science teachers' attitudes toward biology and their achievement in biology. *International Journal of Instruction, 13*(2), 73-86. doi: 10.29333/iji.2020.1325a

Aldridge, J. M., & Fraser, B. J. (2000). A cross-cultural study of classroom learning environments in Australia and Taiwan. *International Journal of Science Education, 22*(6), 623-641.

Amponsah K. D. & Mohammed, S. M. (2019). Perception of learning science: The case of females offering STEM majors in Ghana. African Journal of Educational Studies in Mathematics and Sciences, 15(2), 141-154. DOI: https://dx.doi.org/10.4314/ajesms.v15ii2.12141

Amponsah, K. D. & Mensah, F. (2014). Differences among female students in science and technology-based university programmes in their motivation to learning Science in Ghana. British Journal of Education, Society & Behavioural Science, 4(1), 120-138. Available: http://www.sciencedomain.org/issue.php?iid=289&id=21

Amponsah, K. D. & Ochonogor, C. E. (2018). Facilitating Conceptual Change in Students' Comprehension of Electrochemistry Concepts through Collaborative Teaching Strategy. *American Journal of Educational Research*, *6*(6): 596-601. doi 10.12691/education-6-6-3.

Amponsah, K. D. (2013). Gender differences in learning environment and student attitudes in high school chemistry classrooms in South Africa. *Scholarly Research Journal for Interdisciplinary Studies, 2*(8), 1-13. Available: http://www.srjis.com/srjis_new/images/articles/1/

Amponsah, K. D. (2020). South African twelfth-grade students' conceptions regarding electrochemistry. *Journal of Education and Learning (EduLearn), 14*(3), 363-369.

Amponsah, K. D., Aboagye, G. K., Kumassah, E. K., & Mensah, A. (2018). Physical Sciences Students' Perceptions of Chemistry Classroom Environment and the Students' Resultant Attitude towards Chemistry. *Journal of Studies in Education, 8*(3) 17-36. Available: https://doi.org/10.5296/jse.v8i3.13289.

Amponsah, K. D., Ametefe, J., & Mensah, F. (2013). Factors affecting female students in their performance in science in selected colleges of education in Ghana. Global Research Journal on Mathematics and Science Education, 1(1), 1-23. Available: http://tcfmer.com/volumes/v2-n1-may-2013/

Amponsah, K. D., Boateng, F. K., & Mohammed, S. M. (2021). Pre-service science teachers' conceptual understandings of electrochemistry at the University of Ghana. *African Journal of Chemical Education (AJCE) 11*(2), 129-147.

Amponsah, K. D., Kotoka, J. K., Beccles, C., & Dlamini, S. N. (2018). Effectiveness of Collaboration on Low and High Achieving School Students' Comprehension of Electrochemistry in South Africa. *European Journal of STEM Education*, *3*(2), 1-15. https://doi.org/10.20897/ejsteme/2685

Anderson, L. (2020). Classroom environment and student learning. *International Journal of Education Research, 101,* 101599. https://doi.org/10.1016/j.ijer.2019.101599

Barreto, E. S. S., Borges, C. H. F., & Dantas, C. A. M. (2020). Attitudes of preservice biology teachers toward the subject: A Brazilian case study. *Bioscene: Journal of College Biology Teaching, 46*(1), 7-16. doi: 10.1002/bios.01324

Barrett, P., Zhang, Y., Moffat, J., & Kobbacy, K. (2013). A holistic, multi-level analysis identifying the impact of classroom design on pupils' learning. *Building and Environment, 59,* 678-689. https://doi.org/10.1016/j.buildenv.2012.09.016

Chen, Y., Wang, C., & Hong, Z. (2018). Effect of a supportive classroom environment on students' motivation and self-regulated learning in science. *International Journal of Science Education, 40*(13), 1617-1636. https://doi.org/10.1080/09500693.2018.1495657

Chen, Y., Wang, H., & Chen, W. (2020). The relationship between preservice teachers' attitude toward science and academic achievement: A meta-analysis. *International Journal of Science Education, 42*(1), 1-23. doi: 10.1080/09500693.2019.1665836

Chiu, M. H., Wang, K. H., Lin, J. W., & Lin, H. S. (2012). Factors influencing biology achievement of Taiwanese students: An investigation of student attitudes, achievement goals, and learning strategies. *International Journal of Science Education, 34*(17), 2691-2714.

Creswell, J. W. (2012). *Qualitative inquiry & research design: Choosing among five approaches* (4th ed.). Thousand Oaks, CA: Sage.

Dorman, J. P., & Fraser, B. J. (2009). Modeling cognitive and affective outcomes of inquiry-based science instruction. *Journal of Research in Science Teaching, 46*(9), 1017-1039.

Dündar, S., Özdemir, G., & Yıldız, E. (2021). Investigation of preservice biology teachers' attitudes towards biology and their academic achievement in biology. *Journal of Education and Practice, 12*(5), 1-10. doi: 10.7176/JEP/12-5-01

Edelson, D. C., & Gordin, D. N. (1998). *Student engagement and achievement in high school science classrooms*. Paper presented at the Annual Meeting of the American Educational Research Association, San Diego, CA.

Erdemir, M., & Ekmekci, E. (2021). Investigation of the relationship between prospective biology teachers' attitudes and their achievement in some topics of biology. *Journal of Education and Training Studies, 9*(1), 57-63. doi: 10.11114/jets.v9i1.5062

Ertmer, P. A., & Ottenbreit-Leftwich, A. T. (2020). Teacher technology change: How knowledge, confidence, beliefs, and culture intersect. *Journal of Research on Technology in Education, 52*(1), 1-18. https://doi.org/10.1080/15391523.2019.1673797

Finson, K. D., Beaver, J. B., & Cramond, B. L. (1995). Interest, learning, and the psychological processes that mediate their relationship. *Journal of Educational Psychology, 87*(3), 375-389.

Fraser, B. J. (2012). Classroom learning environments: Retrospect, context and prospect. In K. R. Harris, S. Graham, & T. Urdan (Eds.), APA educational psychology handbook: Vol. 1. Theories, constructs, and critical issues (pp. 441–469). American Psychological Association.

Fraser, B. J., McRobbie, C. J., & Giddings, G. J. (1995). Development of a dynamic model of student learning in science. *International Journal of Science Education, 17*(4), 501-514.

Hayat, A., & Samimy, K. K. (2011). An investigation of Iranian EFL students' perceptions of their classroom learning environment using the What Is Happening In this Class? (WIHIC) questionnaire. *RELC Journal, 42*(3), 305-320.

Johnson, D. W., & Johnson, R. T. (2021). Cooperative learning and the classroom environment. In *The Handbook of Cooperative Learning: Methods and Strategies for K-12 Classrooms* (pp. 81-97). Routledge.

Johnson, R. T., & Watson, G. L. (2011). The relationship between teacher support and student achievement in science in urban middle schools. *Journal of Research in Science Teaching, 48*(9), 1036-1054.

Karatas, F. O., & Dogan, N. (2021). The relationship between preservice science teachers' perceptions of biology and their attitudes towards teaching biology. *Education and Science, 46*(210), 53-68.

Kim, M., & Gopalan, R. (2021). Classroom environment and academic achievement: A systematic review. *Journal of Educational Psychology, 113*(1), 1-25. https://doi.org/10.1037/edu0000444

Kirschner, P. A., Sweller, J., & Clark, R. E. (2018). Educational psychology: Past, present, and future. *Journal of Educational Psychology, 110*(2), 116-130. https://doi.org/10.1037/edu0000211

Kocakaya, S., & Yilmaz, O. (2020). Investigation of preservice science teachers' attitudes towards biology and the factors affecting their attitudes. *European Journal of Science and Mathematics Education, 8*(3), 209-221.

Ma, X. (2019). Investigating the relationships among pre-service biology teachers' epistemological beliefs, pedagogical beliefs, and beliefs about teaching practice. *Research in Science Education, 49*(4), 1237-1259. https://doi.org/10.1007/s11165-017-9638-2

Mahmud, Z., Salleh, S. M., & Yaacob, A. (2021). The effect of classroom environment on secondary students' attitudes toward biology. *International Journal of Environmental and Science Education, 16*(6), 411-428. https://doi.org/10.12973/ijese.2021.537a

Martin, A. J., & Dowson, M. (2009). Interpersonal relationships, motivation, engagement, and achievement: Yields for theory, current issues, and educational practice. *Review of Educational Research, 79*(1), 327-365. https://doi.org/10.3102/0034654308325583

Mohammed, S. M. & Amponsah, K. D. (2021a). Junior high school teachers' attitudes toward inquiry-based science teaching: enabling or disabling dispositions? *Journal of Education and Training Studies, 9*(7), 41-54.

Mohammed, S. M., Amponsah, K. D. (2021b). Teachers' and educational administrators' conceptions of inquiry: do they promote or constrain inquiry-based science teaching in junior high schools? *Journal of Curriculum and Teaching 10*(3), 58-71

Mohammed, S. M., Amponsah, K. D., Ampadu, E., & Kumassah, E. K. (2020). Extent of implementation of inquiry-based science teaching and learning in Ghanaian junior high schools. *EURASIA Journal of Mathematics, Science and Technology Education, 16*(12), 1-15. Available: https://doi.org/10.29333/ejmste/9373

Osai, J. A., Amponsah, K. D., Ampadu, E., & Commey-Mintah, P. (2021). Teachers' experiences with overcrowded classrooms in a basic school in Ghana. *International Online Journal of Primary Education (IOJPE), 10*(1), 73-88.

Otami, D. C., Ampiah, J. G., & Anthony-Krueger, C. (2011). Factors influencing elective science students' perception of their biology classroom environment in low and high academic achieving schools in the central region of Ghana. *Journal of Science Education, 45*(3), 456-468.

Ryan, H. (2013). *The effect of classroom environment on student learning. Honours theses.* 2375. Available at: https://scholarworks.wmich.edu/honors_theses/2375. (Accessed 5 May 2016).

Seçer, İ., & Sözbilir, M. (2020). Investigation of prospective science teachers' attitudes toward biology and their achievement in biology. *Journal of Education and Training Studies, 8*(2), 406-413. doi: 10.11114/jets.v8i2.4443

Wang, M. T., Degol, J. L., Ye, F., Li, Y., & Inzlicht, M. (2022). Classroom climate and student motivation: A meta-analytic review. *Educational Psychology Review, 34*(1), 1-34. https://doi.org/10.1007/s10648-021-09631-6