

Home economics students' attitudes towards biology and how it impacts their academic performance

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ABSTRACT

In this contemporary dispensation, where advancement in science and technology are *sin qua none* of the societal development, research within the pedagogical spheres is centered on understanding students' attitudes toward academic subjects since they have been identified to be pivotal in predicting learning outcomes. This current study dives deeper into the attitudes of home economics students toward biology and examines their impact on academic performance in the subject. By adopting a survey design, the study investigates the attitudes of home economics students toward biology at St. Francis of Assisi Girls' Senior High School. From a simple random sampling technique, 197 participants were sampled from the year three students using Taro Yamane's formula. All 197 participants responded to the survey questionnaire and the responses were analyzed in collaboration with their end-of-semester exam scores in biology using both descriptive and inferential statistics. From the analysis, it was revealed that students' attitudes towards biology and their academic performance in the subject were significant and positively correlated. It was also evident that home economics students have a diverse spectrum of attitudes toward the subject, which ranges from positive to negative. Students who have positive attitudes toward biology and perceive the subject as being relevant to their program of study perform better than their counterparts. From these findings, the study emphasizes the adoption of tailored pedagogical approaches to cater for the individual needs of students and reviews the content of the biology syllabus that is presented to home economics students to align it to their program of study. These findings and recommendations would contribute valuable expertise to the ongoing discourse on attitudes and student success to pave the way for informed and customized pedagogical practices and curriculum development.

Keywords: attitudes, biology performance, home economics students

INTRODUCTION

In this time of unparalleled educational revolution and scientific advancement, the attitudes of students toward academic subjects have become a hotspot of educational research as they have been revealed to be predictors of learning outcomes (Darmawan, 2020; Mao et al., 2021). In retrospect, one area that has gained much attention is life science (biology) and how students perceive the subject. The multitude of students' perspectives as well as perceptions towards the subject do not only impact their motivation and participation but also affect their academic performance and career prospects (Chi et al., 2017; Telli et al., 2006). The multifaceted nature of the variable, 'attitude' and how it influences students' scholastic outcomes has been unveiled by recent research in several jurisdictions (Almasri et al., 2021; Bizimana et al., 2022). The findings from these studies are predicated on the universal relevance of beliefs, perceptions,

and emotions, which constitute attitudes and their incontrovertible impacts on academic success.

According to Ahmad et al. (2022), attitude is an intricate and distinct concept and is referred to as, the positive or negative cognitive, affective, and behavioral predispositions, conceptions, and preferences possessed by an individual towards a thing or an object. One's attitude towards something is a measure of the level of relevance with which he or she attaches to that object or a thing (Crano & Prislin, 2006).

Even though Ghana has incorporated and recognized science education as a key area of the educational curriculum to groom its citizenry to be adept in scientific literacy, the attitudes of students towards the learning of science, particularly biology have been identified among others to militate against this agenda (Acquah et al., 2013 as cited in Amoah et al., 2023; Ministry of Education [MOE], 2010).

Statement of the Problem

In the past few years, there has been growing societal concern and debate in various regions around the world (Cheng & Wan, 2016; Kennedy et al., 2014; Potvin & Hasni, 2014) regarding the diminishing positive inclination of students towards science and the declining enrolment in science-related studies.

The quest to provide answers to the fall in enrolment and interest in the sciences has led researchers to explore the complex interactions between students' attitudes toward subjects and their performance. This pivotal area of research has gained tectorial relevance as it serves as a bridge between theory and practice, providing insights into the determinants of students' academic achievements (Commeey-Mintah et al., 2023; Memon et al., 2023). Biology takes center stage in this scholarly discourse because of its fundamental role in the education of life sciences for the purposes of nurturing scientific literacy and the understanding of our natural world.

On a global scale, extensive research has been carried out on the impact of attitudes on academic performance (Sen, 2013; Tasgin & Coskun, 2018). However, since attitudes are intrinsically impacted by socio-cultural practices in the various contexts in which they were developed (Eagly & Chaiken, 2007), it necessitates the reasons to contextualize investigations within specific regions of the globe. The educational tapestry of Ghana presents a context, where investigating attitudes of home economics students towards biology and how it affects their academic performance is paramount. Home economics students including others offering the pure science program in the senior high schools in Ghana are first introduced to biology via integrated science to furnish them with the needed prerequisite knowledge to study biology as an elective subject (Morgan et al., 2023). The subject biology and its concepts are therefore directly or indirectly part and parcel of the Ghanaian science curriculum, in both the first and second-cycle institutions. Despite the introductory mechanisms to make the study of the subject easy and its position in the science curriculum, it is reported that the interest of home economics students in the subject is debilitating and is presumed to have negative effects on their performance (Djudin, 2018). Furthermore, statistics from the chief examiners' report from 2015 to 2020 indicated that the performance of home economics students in biology across the country has continually been marginal (WAEC, 2015, 2020). The effect of attitudes on academic performance has been extensively studied in subjects including chemistry, mathematics, physics, and science (Asante, 2012; Lawer Egbenya & Kwesi Quayson, 2022; Mabee et al., 2021) with very little focus on biology as a subject. Considering these infinitesimal studies, the researcher embarked on a voyage of inquiry into unearthing the impacts of students' attitudes on their academic performance in biology (PIB) and their overall educational trajectory.

Therefore, the study seeks to investigate the attitudes of home economics students in St. Francis Girls' Senior High School towards biology and how it impacts their academic performance. This will provide empirical evidence of the antecedents of the menace and add a scholarly voice to the ongoing search for resolution.

Significance of the Study

1. The findings from this study would provide empirical data to the existing body of knowledge and suggest insights into the interconnections between the variables.
2. The findings from this study would also suggest the development and implementation of tailored pedagogical approaches that take into consideration the attitudes of students.
3. Investigating the perceived relevance of biology to home science programs would inform curriculum developers of the necessary adjustments to enhance students' appreciation of the subject matter and its incorporation into their selected fields of study.

Objectives

The objectives of the study are to

1. Examine the attitudes possessed by home economics students towards biology and group them into positive, neutral, and negative.
2. Assess how the perception of the relevance of biology (POROB) to the home economic program impacts students' academic performance in the subject.
3. Compare whether there is a significant difference in the performance of home economics students who exhibit positive attitudes (PATs) towards biology and those who show neutral or negative attitudes (NATs).
4. Investigate any potential correlation between the overall academic performance of home economics students and their attitudes toward biology.

Research Questions

1. What attitudes are possessed by home economics students toward biology?
2. Does POROB to home economics as a program affect the performance of students in the subject?

Hypotheses

1. **Null hypothesis 1:** There is no correlation between home economics students' attitudes toward biology and their overall academic performance in the subject.
2. **Null hypothesis 2:** There is no significant difference in terms of academic performance between home economics students who show PATs toward biology and those who exhibit neutral or NATs.

LITERATURE REVIEW

Attitudes

According to Page-Bucci (2013), as asserted in the words of Tordzro et al. (2021), the concept of attitude is complex and polysemous when mentioned within the pedagogical circles. The author added that several meanings and interpretations are articulated by various zones of learning such as social sciences and psychology.

As stated by Mazana et al. (2019), “attitude refers to a learned tendency of a person to respond positively or negatively towards an object, situation, concept or another person”. Attitude consists of three major aspects, which include behavioral, cognitive, and affective (Syeda, 2016). The affective component is made up of emotional states that are allied with an object or something, the behavioral aspect constitutes the overt or covert predispositions that determine how one acts in a way towards an object and the cognitive component is the mental, which is made up of perceptions and beliefs that a person has toward something. These three aspects of attitude are both interconnected and interrelated and must all be there to determine the existence of one’s attitude. Their interactions define one’s attitudes and can mostly be observed in the form of behavior toward attitude objects (Joseph, 2013). The interconnectedness and interrelation of these three attitude components, as emphasized by Joseph (2013), align well with the proposed study’s objective of exploring how these components work together in the context of home economics students’ attitudes toward biology. For instance, a student’s negative emotional response (affective) to biology might lead to avoidance behaviors (behavioral) and contribute to a belief that they cannot succeed in the subject (cognitive).

According to Sen (2013), attitudes can also be termed as positive or negative depending on the reaction toward a particular stimuli or object. PATs are the state of mind, and behavioral dispositions that envisage positivity or favorable outcomes. They provide a better understanding and insights into the nature of students’ learnings and outputs. They also help students to embrace learned concepts with the highest alacrity and raise their expectancy levels thereby leading to higher productivity in terms of performance (Gungor & Un-Acikoz, 2006).

Conversely, NATs are those mindsets or behavioral orientations that do not produce constructive results. They introduce inferiority and diminish one’s zeal toward something thereby resulting in lower expectations (Sen, 2013). There is a higher propensity for home economics students to have one of the two forms of attitudes, which is a consequence of their behavioral orientations towards the subject of biology.

Attitudes & Academic Performance

One of the focal points of science education is the inculcation of PATs in students toward science subjects to create and tailor their interest in pursuing advanced scientific disciplines and to facilitate their understanding of concepts (Mao et al., 2021). Attitudes are vital indicators of students’ academic performance (Ahmad et al., 2022) as such, educators must emphasize their attainment by students of various disciplines. It is worth asserting that, for improved academic performance, a student should have a PAT for a particular subject. Various aspects of attitudes such as beliefs, and perceptions are known to significantly influence students’ performances in the sciences (Singh, 2011). For instance, according to Acar et al. (2015), student’s performance in the sciences is significantly and positively correlated with their attitudes toward individual science-related subjects.

However, some baffling findings were reported by studies conducted on the relationship between attitudes and academic performance in the sciences. For example, Salmi et al. (2016) reported that some aspects of attitudes such as interest were negatively associated with students’ science performance. This confirms the findings of other contradictory studies by (Brooks, (2011).

This and the irregularities in the findings of yesteryear’s studies necessitate the need to carry out a study to find out the interactive relationships between attitudes and the performance of home economics students in St. Francis Girls’ Senior High School, Jirapa in the Upper West Region of Ghana.

METHODOLOGY

Design

The study employed survey design. According to Creswell and Plano Clark (2014), the survey design is a design that offers the quantitative description of emanating patterns, views, and attitudes of a population and tests for the relationships existing between the variables of interest by focusing on just a fraction of the population. employing this design, provided an insightful as well as a vigorous methodological approach to exploring the levels of associations between students’ attitudes and their academic PIB. This approach is specifically compatible with the research topic as it proficiently gathers a wide range of data, explores attitudes in-depth, facilitates quantitative analysis, enables comparative assessments, provides longitudinal insights, and directly correlates attitudes with academic performance (Bryman, 2016; Dillman et al., 2014; Field, 2013).

Research Area

The study was conducted at St. Francis Girls’ Senior High School in Jirapa in the Jirapa Municipality, a district situated in the Upper West Region of Ghana. St. Francis of Assisi Girls’ Senior High School was the first and only girls’ boarding second-cycle school in the Northern part of Ghana. The school was established in 1959 by the Catholic Church in the Diocese of Wa in collaboration with the Franciscan Missionaries of Mary, an international religious women’s congregation. The school operates on biblical values but is assisted by the Government. It offers four programs of study; general science, home economics, business, and general art, one of which (home economics) is the focus of this study. The students in the home economics departments offer all core subjects (core mathematics, Integrated science, English language, and social studies) and four elective subjects, one of which is biology.

Population of the Study

The population of focus is made up of all enrolled students pursuing a home science program at the St. Francis Girls’ Senior High School at the time of this study. The total population is 1,247 and is made up of only girls. Out of this number, 409 are in form one, 448 are in form two, and 390 are in form three. The targeted population of interest will include all year three students in the 2023/2024 batch of candidates. The study focused on form three students because they are preparing for their final exams, where the impacts of their

attitudes may affect their academic PIB and other subjects. Also, these groups of students are on the verge of transcending into tertiary institutions to pursue higher degrees, consequently, their feelings, beliefs, perceptions, and experiences about the subject may impact their choice of programs and career prospects. Therefore, it is important to investigate the causes of poor performance in the subject so that probable interventions can be suggested for remediation.

Sample & Sampling Techniques

Purposive sampling was used in selecting home economics students to participate in the study because they exhibit traits of interest. However, simple random sampling was used to select participants from the targeted population (year three students). This offers every student within the targeted population equal chances of being selected for the study. Since the population size is less than 400, Taro Yamane's sample size calculation formula was used to sample 197 participants for the study. This formula helps obtain enough participants that would be representative of the entire population to ensure confident extrapolation.

Research Instruments

The research employed survey questionnaires and an end-of-second-semester examination scores in biology. The items of the test included both objectives and subjective questions covering all topics in the form one and two biology syllabus. The items were meticulously developed and selected to ensure content validity. They went through expert scrutiny by the head of the department for science, who is himself a biologist, and the assistant head for academics, who is an expert in test item development and serves as an external invigilator for both internal and external examinations. The items for the survey were reduced from 15 to 10 in number after they were reviewed by experts (lecturer). The items were presented on a five-point Likert scale format and were to assess the caliber of attitudes that students have.

Validity & Reliability

The instruments for measuring the attitudes of students toward biology were carefully constructed and validated by the researcher, colleagues, and lecturer. Colleague teachers of biology and graduate students pursuing science education programs independently examined the instruments and suggested their inputs, which were incorporated resulting in the final instruments. The reliability of the science achievement test items and the survey questionnaires were established using Cronbach's alpha coefficient. The reliability coefficients were, respectively, 0.75 and 0.81.

Data Collection & Analysis

The science achievement test results of participants were obtained from their terminal report cards. The survey questionnaires were administered during prep hours, invigilated, and collected by the researcher. The data was cleaned, sorted, and uploaded into the SPSS version-21 software for analysis. Various statistical tests including t-test, and Pearson correlation. ANOVA and measures of tendencies were used to analyze, compare, and interpret the results to answer the research questions.

Table 1. Correlation between students' attitudes towards biology & their performance

	Attitudes
Performance	r=0.678

DISCUSSION

Null hypothesis 1: There is no correlation between home economics students' attitudes toward biology and their overall academic performance in the subject.

From **Table 1**, a Pearson moment correlation coefficient was calculated to determine the nature of the relation that existed between home economics students' attitudes toward biology and their academic performance in the subject. A statistically strong positive correlation was obtained ($r[78]=0.678$, $p<0.05$), thereby indicating that, there is a linear association between these variables. Therefore, the researcher fails to accept the hypothesis, which asserted that there is no correlation between home economics students' attitudes toward biology and their overall academic performance in the subject. This relationship simply means that attitudes are functions of home economics students' PIB. The results align with the wide-ranging understanding that attitudes significantly impact academic performance in science. The significant positive association supports the idea that students who generally have PATs toward biology are inclined to perform better academically in the subject. This correlation is consistent with previous studies conducted on the relationship between attitudes and academic performance in various subjects, including science, mathematics, physics, and chemistry (Asante, 2012; Lawer Egbenya & Kwesi Quayson, 2022; Mabee et al., 2021; Sen, 2013; Tasgin & Coskun, 2018). It buttresses the idea that attitudes are undeniably integral aspects of students' learning experiences and can influence their academic outcomes significantly.

Null hypothesis 2: There is no significant difference in terms of academic PIB between home economics students who show PATs toward biology and those who exhibit NATs.

In **Table 2**, an independent sample t-test was conducted to compare students' PIB and their attitudes toward the subject. There were significant differences ($t[78]=2.543$, Sig. (2-tailed)=0.013) in the scores with those showing PATs toward biology having an average and standard deviation of 50.670 and 6.789 and those with NATs towards the subject having a mean and standard deviation of 45.130 and 3.675, respectively. Therefore, the researcher fails to accept the hypothesis that there is no significant difference in terms of academic PIB between home economics students who show PATs toward biology and those who exhibit NATs. This finding implies that home economics students who have PATs toward biology perform better in biology as compared to those having NATs toward the subject. From the literature review, PATs are seen to be essential for nurturing interest and understanding in the sciences. This correlation between attitudes and PIB has been reported in various studies (Ahmad et al., 2022; Mao et al., 2021). The findings from this study support the findings of yesteryear's studies specifically within the context of biology education for home economics students. However, the review

Table 2. Independent sample t-test between performance in biology & students' attitudes towards biology

Levene's test for equality of variances		t-test for equality of means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Standard error difference
PIB	PAT/NAT	0.620	2.543	0.159	195	0.013	5.542	3.423

Table 3. Attitudes possessed by home economics students toward biology

Item	SA	A	UD	D	SD
1. I enjoy biology.	5.0%	16.3%	33.8%	30.0%	15.0%
2. I think biology is relevant to my course of study.	10.0%	18.8%	27.5%	30.0%	13.8%
3. I am confident that I will pass biology in my final exams.	5.0%	12.5%	28.8%	38.8%	15.0%
4. I feel there is no relevance between biological concepts & home economics.	16.3%	31.3%	23.8%	21.3%	7.5%
5. I believe that biology is a hindrance rather than a help to our home economics program.	25.0%	37.5%	23.8%	8.8%	5.0%
6. I will pursue biology-related programs at tertiary.	5.0%	16.3%	26.3%	40.0%	12.5%
7. Biology is boring.	26.3%	38.8%	27.5%	5.0%	2.5%
8. Biology is too difficult.	26.3%	40.0%	21.3%	10.0%	2.5%
9. I am motivated to excel in biology.	17.5%	23.8%	23.8%	22.5%	12.5%
10. There are specific aspects of biology that I struggle with in relation to home economics.	13.8%	26.3%	31.3%	20.0%	8.8%

Note. SA: Strongly agree; A: Agree; UD: Undecided; D: Disagree; & SD: Strongly disagree

also stresses the complexities of the relationship between attitudes and academic PIB.

Some studies such as (Brooks, 2011; Salmi et al., 2016) conveyed contradictory findings suggesting that the relationship might not be homogenous across all contexts thereby desiderating the need to contextualize studies involving the variables.

In the pedagogical cycles, understanding students' attitudes toward a particular subject is crucial to enhancing learning experiences and outcomes. From **Table 3**, a section of students exhibits a PAT towards biology. For example, 5.0% of respondents strongly agree (SA) that they enjoy learning biology. Besides this, an additional, 10.0% SA that biology is relevant to their course of study. This means that there are students who find joy and purpose in learning biology as a subject. Moreover, 17.5% express their motivation to excel in the subject. However, a momentous portion of students appear to be on the fence. While 5.0% express confidence in passing biology exams, a substantial 38.8% remain undecided (UD). 26.3% of students remain UD about pursuing biology-related courses at the tertiary level. These uncertainties accentuate the need to provide clear career guidance, showcasing the multitudes of opportunities stemming from biology-related programs. Also, the neutrality in responses suggests a potential area of attention to provide tailored support and guidance to such students. Similarly, 13.8% admitted that they are struggling with specific aspects of biology with retrospection to their program of study. The suggested aspects are the diversity of living things, plant anatomy, and physiology.

The analysis equally reveals ubiquitous NATs. A whopping 26.3% find biology boring, while an equal percentage perceive it as exceedingly challenging. This shows a need for adopting diverse teaching methods, additional academic support systems, encouragement, and counseling to address these concerns effectively. Perhaps most fascinating is the fact that a significant segment of the sample of study has conflicting attitudes towards the subject.

A significant 37.5% of respondents believe the subject (biology) hampers rather than aids the study of their home

Table 4. Correlation between POROB to home economics program & academic PIB

	POROB
PIB	r=0.751

economics program. Concomitantly, 31.3% disagree with the relevance of biological concepts to the home economics program. This conflict highlights a lacuna that exists among the subjects and emphasizes the need for annulling this gap by illustrating the practical application of biology within their field of study.

Research question 2: Does POROB to home economics as a program affect the performance of students in the subject?

A Pearson moment correlation was conducted to investigate the association between POROB and academic PIB (**Table 4**). The analysis discovered a strong and significant positive correlation between POROB and academic PIB, with Pearson's $r=0.751$. This implies that as students' POROB increases, their academic PIB also tends to increase. The relationship is statistically significant, suggesting that the correlation coefficient obtained is unlikely to have occurred by probability. The results also suggest that students who perceive the subject as highly relevant to their program of study are more likely to do well academically in the subject. The strength of Pearson's moment correlation coefficient ($r=0.751$) implies that variations in POROB are highly indicative of changes in PIB. The findings echo the concerns posited in previous studies regarding the diminishing interest in sciences (Cheng & Wan, 2016; Kennedy et al., 2014; Potvin & Hasni, 2014) and underscore the relevance of understanding students' attitudes, particularly in the context of biology education. The findings reinforce conception that students' attitudes are key indicators of their educational experiences and outcomes (Sen, 2013; Tasgin & Coskun, 2018).

CONCLUSIONS & RECOMMENDATIONS

In a nutshell, the study dived into the complex interplay between home economics students' attitudes towards biology

and their academic performance in the subject. Through rigorous analysis, it turns out to be evident that there is a significant correlation between the students' attitudes and their academic performance.

PATs possessed by students were strongly correlated with higher academic PIB, highlighting the fundamental role of a positive mindset in promoting academic success among students. Moreover, the research emphasized the diversity of attitudes within the participants, with a spectrum oscillating from positive to negative. This variation emphasizes the need for individualized pedagogical approaches that can cater for the varied needs of learners in the program to foster a more positive learning setting.

A remarkable revelation of this research was the students' POROB to their program of study. Students who recognized the subject's significance within the context of their program exhibited greater academic success. This suggests the need for aligning the curriculum with real-world applications, to create and direct students' interest, motivation, and engagement in the subject matter. From the findings the following recommendations are made; develop and implement tailored or individualized teaching strategies, curriculum developers and educators should review the content of the biology syllabus presented to the students and schools should organize career guidance to promote PATs in the students.

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Availability of data: All data generated or analyzed during this study are available for sharing upon request. Interested parties are encouraged to direct their inquiries to the corresponding author, who will facilitate the provision of the data in a timely and appropriate manner.

REFERENCES

- Acar, O., Turkmen, L., & Bilgin, A. (2015). Examination of gender differences on cognitive and motivational factors that influence 8th graders' science achievement in Turkey. *EURASIA Journal of Mathematics, Science and Technology Education*, 11(5), 1027-1040. <https://doi.org/10.12973/eurasia.2015.1372a>
- Acquah, S., Adzifome, N. S., & Afful-Broni, A. (2013). Ensuring quality education in Ghana: Experiences of basic school mathematics and science teachers. *Journal of Education and Practice*, 4(25), 41-50.
- Ahmad, S., Sultana, N., & Jamil, S. (2022). Students' attitude towards biology and academic achievement in biology at secondary level, in Islamabad, Pakistan. *American Journal of Educational Research*, 10(5), 268-275.
- Almasri, F., Hewapathirana, G. I., Ghaddar, F., Lee, N., & Ibrahim, B. (2021). Measuring attitudes towards biology major and non-major: Effect of students' gender, group composition, and learning environment. *PLoS ONE*, 16(5), e0251453. <https://doi.org/10.1371/journal.pone.0251453>
- Amoah, J. E. M., Eminah, J. K., Ngman-Wara, E. I., & Azure, J. A. (2023). The status of biology teaching and learning materials in selected central regional schools, Ghana. *Cogent Education*, 10(1), 2198939. <https://doi.org/10.1080/2331186X.2023.2198939>
- Asante, K. O. (2012). Secondary students' attitudes towards mathematics. *IFE Psychologia: An International Journal*, 20(1), 121-133.
- Bizimana, E., Mutangana, D., & Mwesigye, A. (2022). Enhancing students' attitude towards biology using concept mapping and cooperative mastery learning instructional strategies: Implication on gender. *LUMAT: International Journal on Math, Science and Technology Education*, 10(1), 242-266. <https://doi.org/10.31129/LUMAT.10.1.1728>
- Brooks, T. (2011). *Effects of single-gender middle school classes on science achievement and attitude* [Unpublished doctoral dissertation]. Walden University.
- Bryman, A. (2016). *Social research methods*. Oxford University Press.
- Cheng, M. H. M., & Wan, Z. H. (2016). Unpacking the paradox of Chinese science learners: Insights from research into Asian Chinese school students' attitudes towards learning science, science learning strategies, and scientific epistemological views. *Studies in Science Education*, 52, 29-62. <https://doi.org/10.1080/03057267.2015.1112471>
- Chi, S., Wang, Z., Liu, X., & Zhu, L. (2017). Associations among attitudes, perceived difficulty of learning science, gender, parents' occupation, and students' scientific competencies. *International Journal of Science Education*, 39, 2171-2188. <https://doi.org/10.1080/09500693.2017.1366675>
- Commey-Mintah, P., Opoku, A., Kudjordji, S. K., & Awuah, F. (2023). Factors influencing students' academic performance: The case of pre-service teachers at Dambai College of Education in Ghana. *Education Quarterly Reviews*, 6(1). <https://doi.org/10.31014/aior.1993.06.01.691>
- Crano, W. D., & Prislin, R. (2006). Attitudes and persuasion. *Annual Review of Psychology*, 57, 345-374. <https://doi.org/10.1146/annurev.psych.57.102904.190034>
- Creswell, J. W., & Plano Clark, V. L. (2017). *Designing and conducting mixed methods research*. SAGE.
- Darmawan, I. G. N. (2020). The changes in attitudes of 15-year-old Australian students towards reading, mathematics and science and their impact on student performance. *Australian Journal of Education*, 64, 304-327. <https://doi.org/10.1177/0004944120947873>
- Dillman, D. A., Smyth, J. D., & Christian, L. M. (2014). *Internet, phone, mail, and mixed-mode surveys: The tailored design method*. Wiley. <https://doi.org/10.1002/9781394260645>

- Djudin, T. (2018). The effect of teaching method and lecture program on students' satisfaction rates and academic achievement. *Journal of College Teaching and Learning*, 3(1), 121-128. <https://doi.org/10.26737/jetl.v3i1.322>
- Eagly, A. H., & Chaiken, S. (2007). The advantages of an inclusive definition of attitude. *Social Cognition*, 25(5), 582-602. <https://doi.org/10.1521/soco.2007.25.5.582>
- Field, A. (2013). *Discovering statistics using IBM SPSS statistics*. SAGE.
- Gungor, A., & Un-Acikgoz, K. (2006). Application of collaborative learning method and reading comprehension strategies and their effects on the attitude towards reading. *Educational Method in Theory and Practice*, 48, 481-50.
- Joseph, G. (2013). *A study on school factors influencing students' attitude towards learning mathematics in the community secondary schools in Tanzania: The case of Bukoba Municipal Council in Kagera Region* [Masters dissertation, The Open University of Tanzania].
- Kennedy, J., Lyons, J. T., & Quinn, F. (2014). The continuing decline of science and mathematics enrolments in Australian high schools. *Teaching Science*, 60(2), 34-46.
- Lawer Egbenya, D., & Kwesi Quayson, E. (2022). Attitude of junior high school students towards the study of science in Ghanaian schools: The case of first-year students in the Cape Coast metropolis. *International Journal of Science Education*, 44(16), 2442-2464. <https://doi.org/10.1080/09500693.2022.2126954>
- Mabee, M. K. A., Haruna, T. Z., & Salifu, A. (2021). Attitude of students towards the study of physics: A case of Tamale College of Education, Ghana. *Journal of Education and Learning Technology*, 2(1), 10-16. <https://doi.org/10.38159/jelt.2021212>
- Mao, P., Cai, Z., He, J., Chen, X., & Fan, X. (2021). The relationship between attitude toward science and academic achievement in science: A three-level meta-analysis. *Frontiers in Psychology*, 12, 784068. <https://doi.org/10.3389/fpsyg.2021.784068>
- Mazana, Y. M., Suero Montero, C., & Olifage, C. R. (2019). Investigating students' attitude towards learning mathematics. *International Electronic Journal of Mathematics Education*, 14(1), 207-231. <https://doi.org/10.29333/iejme/3997>
- Memon, N. A., Shah, S., & Almani, A. S. (2023). The determinants of students' academic performance: An empirical analysis of secondary schools in Sindh, Pakistan. *Journal of Entrepreneurship, Management, and Innovation*, 5(1), 20-37.
- MOE. (2010). *Teaching syllabus for biology: Senior high school*. Curriculum Research and Development Division of Ministry of Education.
- Morgan, M. A., Doku, B. C., Asare, E. S., Dansoah, J., Nartey, J. K., & Manteaw, N. (2023). Improving home economics students' interest in biology: The influence of certain effective teachers' classroom management practices. *International Journal of Scientific Research and Management*, 11(03), 2708-2726. <https://doi.org/10.18535/ijstrm/v11i03.e1>
- Page-Bucci, H. (2013). *The value of Likert scales in measuring attitudes of online learners*. <https://www.scribd.com/document/88333640/ATTITUDE>
- Potvin, P., & Hasni, A. (2014). Analysis of the decline in interest towards school science and technology from grades 5 through 11. *Journal of Science Education and Technology*, 23, 784-802. <https://doi.org/10.1007/s10956-014-9512-x>
- Salmi, H., Thuneberg, H., & Vainikainen, M. P. (2016). How do engineering attitudes vary by gender and motivation? Attractiveness of outreach science exhibitions in four countries. *European Journal of Engineering Education*, 41(16), 638-659. <https://doi.org/10.1080/03043797.2015.1121466>
- Sen, H. S. (2013). The attitudes of university students towards learning. *Procedia-Social and Behavioral Sciences*, 83, 947-953. <https://doi.org/10.1016/j.sbspro.2013.06.177>
- Singh, Y. G. (2011). Academic achievement and study habits of higher secondary students. *International Referred Research Journal*, 3(27), 2.
- Syyeda, F. (2016). Understanding attitudes towards mathematics (ATM) using a multimodal modal model: An exploratory case study with secondary school children in England. *Cambridge Open-Review Educational Research e-Journal*, 3, 32-62.
- Tasgin, A., & Coskun, G. (2018). The relationship between academic motivations and university students' attitudes towards learning. *International Journal of Instruction*, 11(4), 935-950. <https://doi.org/10.12973/iji.2018.11459a>
- Telli, S., Cakiroglu, J., & Brok, P. D. (2006). Turkish secondary education students' perceptions of their classroom learning environment and their attitude towards biology. In D. L. Fisher & M. S. Khine (Eds.), *Contemporary approaches to research on learning environments: Worldviews* (pp. 517-542). World Scientific. https://doi.org/10.1142/9789812774651_0022
- Tordzro, G., Asamoah, E., & Ofori, K. N. (2021). Biology education in perspective: An inquiry into Ghanaian senior high school students' attitude towards biology practical lessons. *Asian Research Journal of Arts & Social Sciences*, 15(4), 82-94. <https://doi.org/10.9734/arjass/2021/v15i430270>
- WAEC. (2015). *Chief examiner report*. WAEC Press.
- WAEC. (2020). *Chief examiner report*. WAEC Press.