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PREDICTING SECONDARY SCHOOL STUDENTS' ACADEMIC ACHIEVEMENT IN BIOLOGY THROUGH THEIR ACADEMIC SELF-EFFICACY AND SELF-ESTEEM

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ABSTRACT

This study investigated the predictive roles of academic self-efficacy and self-esteem on academic achievement among secondary school students' learning in biology. Guided by three objectives, the study adopted a predictive survey design, with a sample size of 732 selected out of 20,777 students in public schools. Data for the study were collected using Rosenberg's self-esteem scale (SES) and academic self-efficacy scale (ASES). Appropriate measures were taken to ensure the instruments' validity for the study. Using Cronbach's alpha, the reliability of the instruments yielded .75 and .81 for SES and ASES, respectively. The students' achievement data were obtained from the schools' diary for students' learning in biology. The obtained data were analysed using linear and multiple regression. The findings revealed that academic self-efficacy and self-esteem are significant predictors of academic achievement among students. Further, the joint predictive influence of ASES and SES on academic achievement was found to be significant. These findings offer empirical support for Bandura's Social Cognitive Theory and underscore the importance of addressing both competence beliefs and self-worth in efforts to enhance students' academic achievement in learning biology.

Keywords: Academic Achievement; Academic Self-Efficacy; Self-Esteem; Biology

Introduction

Academic achievement remains a major indicator of instructional effectiveness and student learning, particularly in science-related disciplines that are fundamental to technological and societal development. Biology, as a core science subject, plays a crucial role in developing students' scientific literacy, problem-solving skills, and understanding of life processes. However, biology is often perceived by students as challenging due to its abstract concepts, extensive terminology, and the integration of theoretical and practical knowledge (Çimer, 2012). These challenges negatively influence students' academic achievement, and therefore have prompted researchers to examine not only instructional strategies but also psychological factors that influence students' academic performance.

Sadly, the persistent poor academic achievement of students in Biology is evident in their performance in high-stakes

examinations such as the West African Senior School Certificate Examination (WASSCE) and the National Examination Council (NECO) examinations. Reports from the West African Examinations Council (WAEC) Chief Examiners over successive years indicate that students' academic achievement in Biology has shown little or no improvement over time. Academic achievement is a multifaceted construct, influenced by a complex interplay of cognitive and affective factors (Gamarra et al., 2024). Academic self-efficacy, derived from Bandura's (1997) social cognitive theory, refers to learners' beliefs in their ability to perform academic tasks successfully. Extensive research indicates that students with high academic self-efficacy demonstrate greater motivation, persistence, and the use of effective learning strategies, ultimately enhancing academic achievement (Schunk & DiBenedetto, 2020; Basith et al, 2020; Ugwuanyi et al, 2020; and Odedokun et al, 2023). In science education, self-efficacy has been shown to predict students' engagement, conceptual understanding, and performance (Britner & Pajares, 2006).

Similarly, self-esteem, defined as an individual's overall evaluation of self-worth (Rosenberg, 1965), has been associated with students' emotional adjustment, motivation, and academic behaviours. Students with higher self-esteem are more likely to participate actively in class, cope with academic stress, and maintain positive attitudes toward learning (Britwum et al, 2022; Noorollahi, 2021). Empirical studies have reported positive relationships between self-esteem and academic achievement, suggesting that students' perceptions of their self-worth can influence their academic outcomes either directly or indirectly through motivation and engagement (Orth & Robins, 2014).

Despite the substantial body of literature linking academic self-efficacy and self-esteem to academic achievement, notable gaps persist. First, many studies have examined these constructs independently, resulting in a limited understanding of their relative and combined predictive effects on academic achievement. Since self-efficacy is task-specific while self-esteem reflects a more global self-evaluation, examining both variables concurrently may provide a more comprehensive explanation of students' academic performance (Lane et al., 2004). Secondly, much of the existing research has focused on general academic achievement or on subjects such as mathematics and overall science performance, with comparatively fewer studies addressing biology-specific achievement. Given the unique cognitive and affective demands of biology learning, findings from other disciplines may not be fully generalizable to biology students (Nieswandt, 2007). Thirdly, findings regarding the relationship between self-esteem and academic achievement have been inconsistent. While some studies report a positive association, others suggest that self-

esteem has a weak or indirect influence when more proximal variables such as self-efficacy are considered (Baumeister et al., 2003; Valentine et al., 2004). These inconsistencies indicate the need for further empirical research that clarifies the role of self-esteem in academic contexts, particularly within specific subject domains. Finally, there remains a shortage of context-specific studies that explore these psychological predictors within diverse educational settings. Cultural, institutional, and pedagogical factors may shape students' self-beliefs and learning experiences, thereby influencing the strength and nature of the relationships among self-efficacy, self-esteem, and academic achievement.

In response to these gaps, the present study investigates academic self-efficacy and self-esteem as predictors of academic achievement among students in biology. By examining the combined contributions of these variables, the study seeks to determine their relative predictive power and provide a more integrated understanding of the psychological factors influencing biology achievement. Focusing specifically on biology allows the study to address subject-specific learning challenges and contribute empirical evidence to an underexplored area of science education research. The findings are expected to extend existing literature by clarifying the roles of academic self-efficacy and self-esteem in predicting biology achievement and by offering practical implications for educators seeking to enhance students' performance through psychologically informed instructional practices.

Theoretical Framework

This study is framed by Bandura's Social Cognitive Theory (Bandura, 1986). The theory explains human behaviour as a dynamic interplay between personal factors, environmental influences, and actions themselves. Social Cognitive Theory was adopted as the theoretical framework for this study because it provides a comprehensive explanation of how students' belief systems, particularly academic self-efficacy and self-esteem, influence learning behaviours and academic achievement. The theory emphasises the reciprocal interaction between personal factors, behaviour, and the learning environment, making it highly suitable for predicting academic achievement in biology.

Purpose of the study

1. What is the predictive value of academic self-efficacy on secondary school students' academic achievement in biology?
2. What is the predictive value of self-esteem on secondary school students' academic achievement in biology?
3. What is the joint-predictive power of academic self-efficacy and self-esteem on secondary school students' academic achievement in biology?

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Methods

The following subsection provides background information on the participants, a description of the instruments, data-collection procedures, and analytical methods used in the study. The researchers utilised a predictive survey design. The objective is to provide explanations among variables by predicting the outcome of the dependent variable through the independent variables. The present study adopted a predictive survey design to predict students' academic achievement in biology through academic self-efficacy and self-esteem.

Participants and sampling procedure

The study is a predictive survey study involving 732 secondary school students from different schools in Anambra Metropolis. The data was collected through a direct administration method with the aid of two research assistants.

Instrumentation

Academic Self-efficacy Scale

The academic self-efficacy scale was adapted from Abdul and Muhammed (2006). The instrument has 40 items which were designed on a 5-point scale ranging from Exactly True (AT), Nearly True (NT), Neutral (N), Nearly False (NF) to Exactly False (EF). The instrument items were briefly modified in terms of language to suit the purpose of the study and the comprehension of the secondary school students. The number of items was 20 after validation, as some of the items convey similar meaning.

Self-esteem Scale

The self-esteem scale (SES) was adopted from the Rosenberg Self-Esteem Scale (Rosenberg, 1979). The SES is a self-administered measure consisting of 10 items, each coded on a 4-point scale indicating one's level of agreement: Strongly Agree (SA), Agree (A), Disagree (D), or Strongly Disagree (SD).

Students Record Profoma

Participants' biology achievement records were obtained from school termly examination records and used as a measure of students' academic achievement. The representative of students' academic scores was obtained after a cumulative average of the three terms.

The instruments were validated by three experts in the field and were pilot-tested using 30 students, same features as the study's participants, but outside of the study area. With the Cronbach Alpha reliability technique, the coefficient values – 0.75 and 0.81 were obtained for academic self-efficacy and self-esteem, respectively. The study adopted a face-to-face pattern of data collection using two research assistants. The collected data were analysed using simple linear and multiple regression analysis. Multiple regressions take into account the effect of multiple independent variables on a dependent variable and determine the quantitative relationships between them.

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Results

Research Question 1: What is the predictive value of Academic Self-Efficacy on Secondary School Students' Academic Achievement in Biology?

Table 1: Prediction of Students' Achievement in Biology by Self-Efficacy.

Model	R	R-squared	Adj. R-squared	Std. Error
1	0.154	0.024	0.022	17.18517

Table 1 shows that academic self-efficacy had an r-value of 0.154 with the corresponding r-value of 0.024 and adjusted R-squared of 0.022. This implies that academic Self-efficacy predicted about 2.4% of the academic achievement of secondary school students in Biology.

Hypothesis 1: Academic Self-efficacy does not significantly predict secondary school students' Academic Achievement in Biology.

Table 2: Significance of Prediction of Achievement in Biology by Self-efficacy.

Model	Sum of squares	df	Mean square	F	P-value
Regression	5248.664	1	5248.664	17.772	.000
Residual	215591.069	730	295.330		
Total	220839.732	731			

Table 2 shows that an F-value of 17.77 was obtained with an associated P-value of 0.000, which is less than the 0.05 level of Significance. The result, therefore, shows that academic Self-efficacy predicted academic achievement of secondary school students in Biology. The null hypothesis, which states that academic Self-efficacy does not significantly predict secondary school students' academic achievement in biology, is rejected.

Research Question 2: What is the predictive value of Self-esteem on the Academic Achievement of secondary school students in Biology?

Table 3: Prediction of Students' Academic Achievement in Biology by Self-Esteem.

Model	R	R-squared	Adjusted R	Std. Error
1	0.154	0.024	0.022	17.18517

Table 3 shows that self-esteem had an r-value of 0.154 with a corresponding r-squared value of 0.024 and an adjusted r of 0.022. This means that self-esteem predicted about

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2.4% of the academic achievement of secondary school students in biology.

Hypothesis 2: Self-esteem does not significantly predict secondary school students' academic achievement in Biology.

Table 4: Significance of the prediction of Academic Achievement in Biology by Self-Esteem.

Model	Sum of squares	df	Mean square	F	Sig.
Regression	31694.188	1	31694.188	270.083	0.000
Residual	85665.423	730	117.350		
Total	117359.611	731			

Table 4 revealed an F-value of 270.083 and an associated P-value of 0.000, which is less than the significance level (0.05). Therefore, self-esteem predicted academic achievement in biology among secondary school students.

Research question 3: What is the combined predictive value of Academic Self-efficacy and Self-esteem on the Academic Achievement of secondary school students in Biology?

Table 5: Prediction of Students' Academic Achievement in Biology by Academic Self-Efficacy and Self-Esteem

Model	R	R-squared	Adjusted R	Std. Error
1	0.542[a]	0.294	0.292	14.253

a. Predictors: (Constant), Self-Esteem, Academic Self-Efficacy

Table 5 shows that academic self-efficacy and self-esteem had an r-value of 0.542 with a corresponding r-squared value of 0.294 and an adjusted r of 0.292. This implies that academic self-efficacy and self-esteem predicted about 29% of the academic achievement of secondary school students in biology.

Hypothesis 3: The combined predictive value of Academic Self-efficacy and Self-esteem on the Academic Achievement among students in biology is not significant

Table 6: Significance of the combined prediction of Academic Achievement in Biology by academic self-efficacy and Self-Esteem

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	61617.506	2	30808.753	151.658	.000[b]
	Residual	148093.383	729	203.146		
	Total	209710.889	731			

a. Dependent Variable: Academic Achievement

b. Predictors: (Constant), Self-Esteem, Academic Self-Efficacy

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Table 4 revealed an F-value of 151.658 and an associated P-value of 0.000, which is less than the significance level (0.05). Therefore, academic self-efficacy and self-esteem jointly and significantly predicted academic achievement in biology among secondary school students.

Summary of Major Findings

The major findings of the study are summarised below:

1. Academic self-efficacy significantly predicted academic achievement among students
2. Self-esteem significantly predicted academic achievement among students
3. Academic self-efficacy and Self-esteem are jointly significant predictors of academic achievement

Discussion of Findings

The findings of the study revealed that academic self-efficacy is a significant predictor of academic achievement among students. High self-efficacy enhances students' motivation, self-regulation, and resilience, thereby improving their ability to cope with academic demands. Through repeated successful experiences, self-efficacy is further strengthened, creating a positive feedback loop that reinforces academic success. Academically self-efficacious students have a positive feeling, and such a positive feeling drives the motivation to accomplish academic activities and with the motivation to accomplish more. The finding is in line with the studies of Basith et al (2020), Ugwuanyi et al (2020), and Odedokun et al (2023), who found that the predictive value of academic self-efficacy on academic achievement amongst students is significant. Further, the findings also lend credence to Sawhney & Bansal's (2019) study that there is a positive relationship between academic self-efficacy and academic achievement. However, the findings of the study contradict that of Okoro (2020) and Nwokolo & Christiana (2021), who maintained that self-efficacy is not a significant predictor of students' learning outcomes. This result empirically supports Bandura's Social Cognitive Theory, which posits that personal beliefs (such as self-efficacy) significantly influence behaviour and performance. The significant predictive relationship confirms that academic self-efficacy functions as a key personal factor that shapes students' learning behaviours and academic outcomes.

Based on the findings, self-esteem significantly predicted students' academic achievement in biology. The finding that self-esteem significantly predicts academic achievement implies that students' overall evaluation of their self-worth plays a crucial role in shaping their academic outcomes. This result is supported by Britwum et al (2022) and Noorollahi (2021), who discovered that self-esteem is a significant predictor of academic achievement among students. This finding disagrees with that of Okafor and Okoli (2020) that esteem is not a

significant predictor of academic achievement. Within the framework of Social Cognitive Theory, the finding underscores the role of self-esteem as a key personal factor that interacts with students' behaviours and learning environments to influence achievement. Positive self-esteem strengthens students' confidence, encourages productive learning behaviours, and enhances responsiveness to supportive classroom environments. Achievement outcomes, in turn, reinforce students' self-esteem, creating a positive feedback loop that sustains academic performance.

Further, the combined predictive value of academic self-efficacy and self-esteem was significant. Beyond their individual effects, the finding indicates that two psychological constructs - academic self-efficacy and self-esteem- jointly predicted students' academic achievement. This suggests that academic achievement is influenced by a complementary interaction of students' confidence in their academic abilities and their overall sense of self-worth. These findings are supported by those of Noorollahi (2021) and Olanrewaju & Joseph (2014) that academic self-efficacy and self-esteem are joint predictors of academic achievement. This suggests that students' academic achievement cannot be measured in isolation rather with a combination of two or more variables. Theoretically, this finding reinforces the idea that multiple personal factors interact to influence academic outcomes. Academic self-efficacy and self-esteem function as interrelated personal determinants that shape students' learning behaviours. Their combined influence strengthens students' engagement with the learning environment, promotes adaptive learning behaviours, and ultimately leads to improved academic achievement.

Conclusion

This study concludes that students' academic achievement, especially in learning biology, is significantly shaped by their academic self-efficacy and self-esteem. Academic self-efficacy emerged as a strong predictor of achievement, suggesting that students who believe in their academic capabilities are more motivated and more likely to engage productively in learning biology. Self-esteem also significantly predicted academic achievement, highlighting the role of students' self-worth in sustaining confidence, emotional balance, and academic engagement. Further, the study established that academic self-efficacy and self-esteem jointly predict students' academic achievement, indicating that these constructs operate in a complementary manner. These findings offer empirical support for Bandura's Social Cognitive Theory and underscore the importance of addressing both competence beliefs and self-worth in efforts to enhance students' academic achievement in learning biology.

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Informed Consent: The participants were informed about the study, and their corresponding consent for participation was obtained.
Data availability: The data that support the findings of this study are available from the corresponding author upon reasonable request.

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