EMOTIONAL INTELLIGENCE, ACADEMIC SELF-CONCEPT, AND BIOLOGY ACHIEVEMENT OF SECONDARY SCHOOL STUDENTS IN OSUN STATE

Folake Beatrice YOADE
Obafemi Awolowo University;
E-mail: fbyoade@oauife.edu.ng

Oyedunni Adebunmi OBE
Adeyemi Federal University of Education, Ondo
E-mail: obeoa@aceondo.edu.ng

&

Taiwo John OLADEPO
Adeyemi Federal University of Education, Ondo
E-mail: Oladepotaiwo134@gmail.com

Abstract

The persevering problem of underperformance in Biology in Nigerian secondary schools National Exams shows that academic achievement requires more than a cognitive understanding approach. This study adopted a descriptive correlational design in investigating how students' Emotional Intelligence (EI) and their Self-Concept (SE) of academic performance affect their Biology learning outcomes while also considering the moderating effect of gender. The research involved 300 students from 15 co-educational public schools in Osun State. Data were collected using three main instruments, namely, Emotional Intelligence (EI) Inventory which included a 22-item tool modified from Schutte (1998) to measure essential EI aspects of self-awareness and self-regulation and empathy and social skills. Participants used a five-point Likert scale to rate their responses which included strongly Agree (5), Agree (A), Neutral (3), Disagree (D) and Strongly Disagree (SD) options. The instrument showed a Cronbach alpha result of 0.76. Academic Self-Concept (SC) Scale: The 20-item scale which Rastogi (1979)

developed measures students' confidence and perceived academic competence. The instrument used a Likert-scale format which included the response options of strongly Agree (5), Agree (A), Neutral (3), Disagree (D) and Strongly Disagree (SD). The instrument achieved high reliability through the split-half method which produced a reliability coefficient of 0.87. The students' standardized Biology examination scores which included their promotional examination scores served as the measurement tool for this assessment to guarantee both objectivity and validity. Data collected were analysed using standardized multiple linear regression methods. Results shows that EI and SC significantly predicted the academic achievement, both individually and jointly, while gender had no significant moderating effect. The findings suggest that classroom practices should focus on enhancing emotional intelligence and self-concept to boost academic outcomes in Biology

Keywords: *Emotional Intelligence, Academic Self-Concept, Student Performance, Biology Education, Learning Psychology*

Introduction

The current state of knowledge-based society establishes science education as the essential basis for national development and economic growth. As a matter of fact, the study of biology provides essential skills for students who want to become life scientists and work in healthcare, agriculture and biotechnology fields (Okebukola & Jegede, 2019). Nigerian students demonstrate severe underachievement in this subject despite its importance. The persistent problem has led teachers to search for new methods of teaching that extend beyond traditional approaches to understand the psychological aspects which affect students' learning process. contemporary educational research has begun to focus on how students' emotional intelligence and academic self-concept might hold keys to improving learning outcomes, particularly in demanding subjects like Biology. Biology continues to show persistent under performance through national examinations bodies in Nigeria which

includes the WASSCE examination (WAEC, 2022) because standard cognitive explanations that focus on intellectual ability and prior knowledge limitations do not account for this problem (Raiyegbemi et al., 2020). Researchers have studied non-cognitive factors because cognitive elements fail to explain the differences in students' academic performance.

The recognition of this phenomenon has produced a complete transformation in research which now investigates Emotional Intelligence (EI) and Academic Self-Concept (SC) as essential elements that determine academic performance. Science education requires students to develop their scientific knowledge while they also need to develop their emotional and psychological skills. Students use Emotional Intelligence (EI) which enables them to understand and control their emotions (Ubago-Jiménez et al., 2024) to manage their academic challenges and develop positive relationships with their classmates. A student uses Academic Self-Concept (SC) to assess their academic abilities which functions as an internal force that drives their academic participation and study persistence and future academic goals. The combination of these non-cognitive elements provides a complete view of the factors that lead to success in science education.

Academic achievement research focused on cognitive abilities research until 2023 according to scientific studies which recognized five fundamental cognitive abilities. The situation needs more evaluation because both elements have value on their own. Research shows that cognitive factors cannot explain all differences between students who achieve academic success and students who fail (Sultanova et al., 2024). The situation becomes evident through Nigeria's persistent Biology examination failures which demonstrate the need for cognitive explanation methods that go beyond established knowledge.

Research has demonstrated that Emotional Intelligence and Academic Self-Concept both relate to student success across all

academic disciplines. However, there is a dearth of literature on how these two factors together affect students' academic performance in Biology. Earlier studies in Nigeria have examined these factors separately for example, linking EI to general achievement (Ogundokun & Adeyemo, 2010) or connecting self-concept to performance (Nalah, 2013). Similarly, the relationship between gender and these relationships remains undefined at this time. Some studies suggest that emotional intelligence and self-concept may function differently for male and female students (Ezebube & Emeka, 2023), while others report no significant gender differences (Ali, 2016). The existing disagreement about whether gender affects student performance through psychological attributes in Biology requires resolution through research.

Thus, the study investigates how Emotional Intelligence and Academic Self-Concept both separately and together affect academic performance in Biology among secondary school students in Osun State, Nigeria. It also investigated whether gender differences affect these relationships.

Research Objectives

This specific objectives of the study are to:

1. examine the individual predictive influence of Emotional Intelligence (EI) on academic achievement in Biology among secondary school students.
2. asssess the individual predictive influence of Academic Self-Concept (SC) on academic achievement in Biology.
3. determine the joint predictive influence of Emotional Intelligence and Academic Self-Concept on students' academic achievement in Biology.
4. investigate the moderating effect of gender on the relationship between EI, SC, and academic achievement in Biology.

Research Hypotheses

The following hypotheses were tested in the study:

1. Emotional Intelligence will not significantly predict academic achievement in Biology among secondary School Students

2. Academic Self-Concept will not significantly predict academic achievement in Biology among secondary school students

3. Emotional Intelligence and Academic Self- Concept will not jointly significantly predict academic achievement in Biology

4. Gender will not significantly moderate the relationship between Emotional Intelligence, Self-Concept, and academic achievement in Biology.

Methodology

A predictive correlational research design was employed for the study. The population consisted of all co-educational public secondary school Biology students in Osun State. The study sample comprised 300 students selected from 15 co-educational public schools in Osun state. Multi-stage sampling procedure involving three steps was adopted for the study. The first step used purposive sampling to select only co-educational public schools for the study. Secondly, stratified random sampling was used to ensure students from each of SS1, SS2 and SS3 classes were represented in equal proportions and finally, the study adopted simple random sampling to choose 20 students from each school that participated in the study. Data were collected using three main instruments: Emotional Intelligence (EI) Inventory which included a 22-item tool modified from Schutte (1998) to measure essential EI aspects of self-awareness and self-regulation and empathy and social skills. Participants used a five-point Likert scale to rate their responses

which included strongly Agree (5), Agree (A), Neutral (3), Disagree (D) and Strongly Disagree (SD) options. The instrument showed a Cronbach alpha result of 0.76. Another instrument is Academic Self-Concept (SC) Scale consisting of 20-item scale which Rastogi (1979) developed to measure students' confidence and perceived academic competence. The instrument used a Likert-scale format which included the response options of strongly Agree (5), Agree (A), Neutral (3), Disagree (D) and Strongly Disagree (SD). The instrument achieved high reliability through the split-half method which produced a reliability coefficient of 0.87. The Biology Achievement Test (BAT) measured academic achievement as its main criterion variable. The students' standardized Biology examination scores which included their promotional examination scores served as the measurement tool for this assessment to guarantee both objectivity and validity. Data collected were subjected to analysis using SPSS.

Method of Data collection

The research team visited the school and intimate the school authority together with the teachers on the objectives of the study. Consent was also obtained from the students through a well -structured form to gather information on their readiness in participating in the study. Data were collected in the participants' classroom during the school hours. The emotional intelligence scale was first administered to the students, and after two weeks the Self-concept scale were subsequently administered. This is to avoid cumbersomeness of the instrument administration. Also. In ensuring, confidentiality and anonymity, the examination scores of the students were obtained from the school record with the help of the teachers without the knowledge of the student but with the consent of each school principals. Altogether, the collection of data lasted for about six weeks.

Results

Demographic Characteristics of the Participants

Table 1 provides a summary of the demographic characteristics that define the study participants.

Table 1: Demographic Characteristics of Participants (N=300)

Predictor Variable	R		Adj. R^2	B	SE B		t	p
(Constant)	0.463	0.214	0.211	31.724	2.985		10.628	< .001
Academic Self -Concept				0.652	0.074	0.463	8.811	< .001

Note: N = 300. Dependent Variable: Biology Achievement Score.

The analysis of Academic Self-Concept's relationship with Biology achievement yielded statistically significant results, as displayed in Table 3. The regression model demonstrated that Academic Self-Concept serves as a meaningful predictor of student performance in Biology, explaining approximately 21.4% of the variance in achievement scores ($R^2 = .214$). Students who maintain positive academic self-perceptions achieve better results in Biology according to the strong positive coefficient ($\beta = 0.463$, $t(298) = 8.811$, $p < .001$) which shows this relationship. The evidence collected from these findings proves that Academic Self-Concept functions as a significant predictor of academic success in Biology according to the hypothesis.

Hypothesis 3: Emotional Intelligence and Academic Self-Concept will not jointly significantly predict academic achievement in Biology.

The researchers examined their hypothesis through standard multiple linear regression analysis. The researchers used Emotional Intelligence EI and Academic Self-Concept SC as predictor variables while analyzing students' Academic performance through their Biology Achievement Test BAT scores as shown in the analysis in Table 4.

Table 4: Multiple Linear Regression Analysis of Emotional Intelligence and Self-Concept Jointly Predicting Biology Achievement

Predictor Variable	R	R^2	Adj. R^2	ΔR^2	B	SE B	β	t	p
(Constant)	0.521	0.271	0.266	0.271	22.117	3.451		6.408	< .001
Emotional Intelligence					0.402	0.080	0.283	5.025	< .001
Academic Self - Concept					0.501	0.077	0.356	6.506	< .001

Note: N = 300. Dependent Variable: Biology Achievement Score. $F(2, 297) = 55.18$, $p < .001$.

The result of the multiple linear regression analysis, as shown in Table 4, reveals that Emotional Intelligence and Academic Self-Concept together produce a statistically significant prediction of academic achievement in Biology. When examined together, Emotional Intelligence and Academic Self-Concept demonstrated substantial collective influence on Biology achievement. The combined regression model accounted for approximately 27.1% of the variance in student scores ($R^2 = .271$), revealing that these two factors jointly explain a meaningful portion of academic performance differences. The overall model proved statistically significant ($F(2, 297) = 55.18$, $p < .001$), confirming the substantial predictive power of these variables when considered together.

The two variables maintained their individual significance in the combined model. Emotional Intelligence showed a positive relationship with achievement ($\beta = 0.283$, $p < .001$), as did Academic Self-Concept ($\beta = 0.356$, $p < .001$). The beta weight for Academic Self-Concept shows a stronger value which indicates that both factors are essential but students' academic concept have a greater impact on their Biology performance. The evidence demonstrates that Emotional Intelligence and Academic Self-Concept both predict students' academic performance in Biology according to the hypothesis formulated.

Hypothesis 4: Gender will not significantly moderate the relationship between Emotional Intelligence, Self-Concept, and academic achievement in Biology.

To test this hypothesis, hierarchical multiple regression analysis was adopted. The analysis was conducted in two sequential steps to distinguish the main effects of the predictors from the moderating effect of gender. The model began with the main effects of Emotional Intelligence (EI) Academic Self-Concept (SC) and Gender being entered as the first step. The researchers added two-way interaction terms (EI x Gender and SC x Gender) to the model in Step 2 to evaluate their impact on explaining variance in Biology achievement. The results are displayed in Table 5.

Table 5: Hierarchical Regression Analysis Testing the Moderating Effect of Gender

Model and Predictor Variables	R	. .	Adj. R^2	. . .	B	SE B	β	t	p
Step 1: Main Effects	0.523	0.274	0.266	0.274					
(Constant)					22.505	3.528		6.380	< .001
Emotional Intelligence (EI)					0.398	0.080	0.281	4.975	< .001
Academic Self - Concept (SC)					0.499	0.077	0.355	6.482	< .001
Gender					0.891	0.721	0.055	1.236	0.218
Step 2: Interaction Effects	0.526	0.277	0.265	0.003					
(Constant)					22.814	3.665		6.224	< .001
Emotional Intelligence (EI)					0.419	0.112	0.295	3.741	< .001
Academic Self-Concept (SC)					0.536	0.110	0.381	4.872	< .001
Gender					0.707	1.143	0.044	0.619	0.537
EI x Gender					-0.031	0.152	-0.015	-0.204	0.839
SC x Gender					-0.054	0.148	-0.027	-0.365	0.715

The hierarchical regression analysis tested the moderating role of gender. As shown in Table 5, Model 1 (main effects) was significant,

$F(3, 296) = 37.25$, *p* < .001, confirming the joint prediction of EI and SC. The addition of the two interaction terms (EI x Gender and SC x Gender) in Model 2 did not lead to a significant increase in the variance explained in Biology achievement scores ($R^2 = .003$, $F(2, 294) = 0.585$, *p* = .558).

Furthermore, neither interaction term was statistically significant:

- **EI x Gender:** $\beta = -0.015$, *t*(294) = -0.204, *p* = .839
- **SC x Gender:** $\beta = -0.027$, *t*(294) = -0.365, *p* = .715

This indicates that the relationships between Emotional Intelligence and Biology achievement, and between Academic Self-Concept and Biology achievement, are not dependent on a student's gender. The predictive power of EI and SC on achievement is statistically similar for both male and female students.

Discussion

The research results provide essential information about the psychological elements which affect students' ability to succeed in Biology studies. The study results established that students' Emotional Intelligence levels served as an important factor which positively predicted their Biology academic performance. The research supports current educational theories which state that students who master emotional skills through detection and comprehension and emotional regulation will achieve better academic results (Ubago-Jiménez et al., 2024). The students who achieve these emotional management skills will develop better resilience when faced with challenging biological content and they will demonstrate more effective examination stress relief which enables them to perform better in their academic studies. Similarly, Academic Self-Concept emerged as a strong predictor of achievement, reinforcing established research on the motivational power of students' self-perceptions (Marsh & Craven, 2006). Students with positive academic self-concept likely approach Biology with greater confidence, demonstrate increased persistence when facing difficulties, and invest more effort in their studies,

viewing academic challenges as opportunities rather than threats.
The study proves that Emotional Intelligence and Academic Self-Concept together create a better understanding of academic success than their individual effects. The combination of both factors produced a greater predictive ability for Biology scores than the two factors showed when tested separately. This finding addresses a notable gap in the literature because researchers have studied these constructs in isolation (Ogundokun & Adeyemo, 2010; Nalah, 2013). The results show that students who have emotional skills and academic confidence experience benefits from a combined effect, which occurs because emotional intelligence helps them manage their learning emotional states and self-concept provides the motivation for their academic work.

Furthermore, the study helps to clarify how gender affects these relationships which researchers have debated. Our analysis found no significant moderating effect of gender which contradicts research that identified gender-specific pathways to achievement (Ezebube & Emeka, 2023). The consistent relationships between EI, SC, and Biology achievement across both male and female students aligns with other research in this area (Ali, 2016) and indicates that the benefits of developing these psychological resources are universal. The research provides practical guidance to educators because emotional intelligence and academic self-concept improvement programs can be applied to all students without needing gender-based modifications.

Collectively, The study proves that a complete system of evaluation discovers better academic achievement patterns for Biology students in Nigeria. Our research shows that students learn better when they use emotional management skills and self-belief to control their learning process. The solution to Biology (WAEC 2022) under performance requires two essential improvements which include better content delivery and the development of psychological resources.

Conclusion

This study concludes that that educational improvement in science particularly Biology requires attention to students' psychological development alongside traditional academic instruction as the findings shows a significant correlation between Emotional Intelligence, Self-Concept and Academic Performance. However, the relationships between Emotional Intelligence and Biology achievement, and between Academic Self-Concept and Biology achievement, are not dependent on student's gender.

Recommendations

Based on the findings of this study, the following recommendations are proposed:

1. The Osun State Ministry of Education must implement Social-Emotional Learning into secondary school education to help students develop emotional intelligence through structured learning.
2. School administrators should focus on teaching methods which help students develop their academic self-confidence in science subjects especially Biology.
3. The State Government should provide funding for teacher training programs which to help students develop their emotional and academic self-awareness skills.
4. There is need for Schools to strengthen their guidance and counseling departments in providing consistent, structured support for students' emotional and psychological well-being.

References

Ali, M. A. K. (2016). The relationship between emotional intelligence and academic achievements in males and females in Egyptian context. *Psychology Research*, *6*(10), 567–578. https://doi.org/10.17265/2159-5542/2016.10.002

Ezebube, N. C., & Emeka, I. D. (2023). Emotional intelligence, self-esteem and gender as correlate of secondary school students' academic achievement in Anambra State, Nigeria. *Integrity*

Journal of Education and Training, *7*(5), 114–119. https://doi.org/10.31248/IJET2021.125

Marsh, H. W., & Craven, R. G. (2006). Reciprocal effects of self-concept and performance from a multidimensional perspective: Beyond seductive pleasure and unidimensional perspectives. *Perspectives on Psychological Science, 1*(2), 133–163. https://doi.org/10.1111/j.1745-6916.2006.00010.x

Nalah, A. B. (2013). Self-concept and students' academic performances in College of Education, Akwanga, Nasarawa State, Nigeria. *World Journal of Young Researchers, 3*(2), 31–37.

Ogundokun, M. O., & Adeyemo, D. A. (2010). Emotional intelligence and academic achievement: The moderating influence of age, intrinsic and extrinsic motivation. *The African Symposium, 10*(2), 127–141.

Okebukola, P. A., & Jegede, O. J. (2019). Enhancing science education in Africa: The role of curriculum andassessment reforms. African Journal of Science and Technology, 22(1), 78–89.

Peng, P., & Kievit, R. A. (2020). The development of academic achievement and cognitive abilities: A bidirectional perspective. *Child Development Perspectives, 14*(1), 15–20. https://doi.org/10.1111/cdep.12352

Raiyegbemi, S. S., Osokoya, M. M., Taiwo, O. A., Adu, O. O., Nsofor, A. U., Adeniran, A. O., & Ajani, R. (2020). Factors that affect the performance of students in Senior Secondary School Biology Examination: A case-study in Abeokuta South Local Government Area of Ogun State. *Anchor University Journal of Science and Technology*, *1*(1), 110–115.

Sultanova, G., Shilibekova, A., Rakhymbayeva, Z., Rakhim, A., & Shora, N. (2024). Exploring the influence of non-cognitive skills on academic achievement in STEM education: The case of Kazakhstan. *Frontiers in Education*, *9*. https://doi.org/10.3389/feduc.2024.1339625

Ubago-Jiménez, J. L., Zurita-Ortega, F., Ortega-Martín, J. L., & Melguizo-Ibañez, E. (2024). Impact of emotional intelligence

and academic self-concept on the academic performance of educational sciences undergraduates. *Heliyon, 10*(8), e29476. https://doi.org/10.1016/j.heliyon.2024.e29476

West African Examinations Council (WAEC). (2022). Chief Examiners' Report: May/June West African Senior School Certificate Examination. Yaba, Lagos: WAEC Headquarters.