



School Environment and Self Efficacy as Predictors of Senior Secondary Schools Student's Academic Achievement in Biology in Nsukka Education Zone of Enugu State

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Abstract

This study examined the predictive power of school environment and self-efficacy on students' academic achievement in Biology in Nsukka Education Zone, Enugu State. Three research questions and three null hypotheses guided the study. A correlational survey design was adopted. The population comprised 1,529 Senior Secondary II (SS II) Biology students in public secondary schools, from which a sample of 317 students was selected using proportionate stratified and simple random sampling techniques. Data were collected using three instruments: the Biology Students' Self-Efficacy Questionnaire (BSSQ), Biology Student School Environment Questionnaire (BSSEQ), and Biology Achievement Test (BAT). The reliability coefficients were 0.90 for BSSQ, 0.88 for BSSEQ, and 0.73 for BAT, established using Cronbach's alpha and Kuder-Richardson Formula 20 (KR-20), respectively. Data were collected through face-to-face administration of the instruments. Research questions were answered using simple linear regression, while the null hypotheses were tested using analysis of variance (ANOVA) at the 0.05 significance level. The findings revealed that school environment and self-efficacy had low predictive power on students' academic achievement in Biology, both individually and jointly. The study recommended that government should provide conducive school environments and organize free training and seminars for teachers and students to improve school conditions and students' self-efficacy.

Keywords: Biology, school environment, self-efficacy, academic achievement

Introduction

Biology is one of the science subjects taught in secondary schools in Nigeria. It is described as the study of living things, how they grow, function, and interact with their environment. Natasa and Radovan (2023) defined Biology as a branch of science that studies living organisms and their interactions with each other and the environment, focusing on understanding the structure, function, growth, evolution, distribution, and taxonomy of life forms. The Natasa and Radovan (2023) also noted that the study of Biology as a subject at the secondary school level helps students in developing basic scientific skills, knowledge and attitude-based competencies required for problem solving in their environment. Biology is also seen as the scientific study of life and living organisms (Adebayo & Ajayi, 2023). It

encompasses a wide range of subfields that explore the structure, function, growth, evolution, distribution, and taxonomy of all forms of life. The fundamental principles of Biology provide insights into how living systems operate, from the smallest cellular components to the complex ecosystems on Earth. Biology therefore is, a diverse and dynamic field of study that continues to evolve with technological advancements, offering profound insights into the natural world and providing solutions to many of humanity's challenges.

Despite the importance of Biology, some students experience difficulties in understanding biological concepts and achieving satisfactory academic results. These difficulties may be associated with inadequate instructional materials, overcrowded classrooms, poor laboratory facilities,

ineffective teaching methods, lack of motivation, and students' negative beliefs about their ability to succeed in the subject. Okafor and Nwosu (2022) reported that teamwork enhances students' confidence and academic achievement in Enugu by promoting supportive and collaborative learning environments. Self-efficacy is equally important because students' beliefs about their abilities influence how they approach academic tasks (Bandura, 1997; Usman & Danjuma, 2022). The school environment and students' self-efficacy are therefore important factors to consider when examining academic achievement. Domike (2020), described school environment to include both the physical, psychological, and social environments, as well as the students' and teachers' mutual relationships. While, self-efficacy is a person's judgment about being able to perform a particular activity (Odiri, 2020). It is a student's "I can" or "I cannot" belief. The choice of the two variables is because very few or no research has been done in this area to investigate the predictive power of school environment and student's self efficacy on senior secondary school students academic achievement in Biology.

The learning environment and students' belief in their ability to succeed are important factors that may influence academic achievement. Kate, Okello and Kiu (2023) suggest that schools with better physical environments, including well-maintained buildings and classrooms, provide students with a more comfortable and focused learning experience, which ultimately leads to improved academic outcomes. On the other hand, Farmer, Hamm, Dawes, & Lambert. (2021) describe self-efficacy as individuals' beliefs about their capabilities within a specific domain, emphasizing its crucial role in motivating people to exert effort and persist in goal directed activities. (Abdullahi & Audu, 2023; Oyak, 2024) Stated that several other factors affects students' learning outcomes like poor laboratory facilities, ineffective teaching methods, lack of motivation. Hence, the researcher wants to examine how school environment and self-efficacy predict Biology achievement in senior secondary schools.

Academic achievement is the learning outcomes of students exposed to tests and examinations. Uchechukwu and Okigbo (2022) defined academic achievement as the level of understanding and knowledge of the students which is

commonly measured by continuous assessment, tests and examinations. Previous studies by Amuda, and Abdulrasaq (2021) found out that academic achievement is influenced by several factors, including students' cognitive styles, which determine how they perceive, process, and retain information.

Cognitive style refers to the characteristic ways individuals perceive, process, interpret, and respond to information in learning and problem-solving situations. Cognitive styles as opined by Hamann, Pilotti, and Wilson (2021) are the way people perceive stimuli and how they use this information to guide their behavior (that is, thinking, feeling, and actions). Several models have been proposed to examine cognitive style dimensions, including analytical intuitive, reflective impulsive, and holistic serialist. One of the most widely studied models is the field-dependence and field-independence model.

Field dependence (FD) shapes how students process complex information, often relying on structured settings like labs for clarity. Bao (2024) defines FD as a holistic cognitive style where learners depend on external contexts to interpret information. Field independence (FI) on the other hand empowers students to analyze Biology concepts independently, a key asset in lab-intensive classrooms. Nori et al. (2019) define FI as the ability to isolate details from their context, enabling autonomous problem-solving. While field dependence and independence influence how students engage with Biology, their interaction with the school environment and self-efficacy remains underexplored in Nigerian secondary education. This study bridges that gap by examining cognitive style as a moderating variable alongside school environment and self-efficacy as predictors of senior secondary students' academic achievement in Biology in Enugu State.

Purpose of the Study

The general purpose of this study is to determine the predictive power of school environment and self-efficacy on senior secondary school student's academic achievement in Biology in Nsukka Education zone of Enugu State. Specifically, the study determined the:

1. predictive power of school environment on senior secondary school students' achievement in Biology.

2. predictive power of self-efficacy on senior secondary school students' achievement in Biology.
3. joint predictive power of school environment and self-efficacy on senior secondary school students' achievement in Biology as moderated by cognitive styles.

Research Questions

The following research questions were posed to guide the study:

1. What is the predictive power of the school environment on senior secondary school students' achievement in Biology?
2. What is the predictive power of self-efficacy on senior secondary school students' achievement in Biology?
3. What is the joint predictive power of school environment and self-efficacy on senior secondary school students' achievement in Biology as moderated by cognitive styles?

Hypotheses

The following hypotheses were formulated for the study and will be tested at 0.05 level of significance.

H₀₁: The predictive power of school environment on senior secondary school students' achievement in Biology is not statistically significant

H₀₂: The predictive power of self-efficacy on senior secondary school students' achievement in Biology is not statistically significant

H₀₃: The joint predictive power of school environment and self-efficacy on senior secondary school students' achievement in Biology as moderated by cognitive styles is not statistically significant.

Method

The study adopted correlation research design. According to Nworgu (2015) correlation research design is a type of design that establishes relationship between two or more variables and indicates the direction and magnitude if the relationship between the variables. The population of the study comprised of all 1529 SSII Biology in the schools in Nsukka education zone. The sample size for this study is 317 Senior Secondary School II (SS2) Biology students selected from public

secondary schools in the Nsukka Education Zone of Enugu State, Nigeria. The sample size is considered appropriate for achieving the study objectives and was determined using Taro Yamane's formula. The study employed a multi-stage sampling procedure, carried out in three stages. Stage One: Selection of Local Government Areas (Stratified Sampling). Nsukka Education Zone comprises three Local Government Areas (LGAs): Nsukka, Igbo-Etiti, and Uzo-Uwani. All three LGAs were included in the study to ensure adequate representation of the zone. In stage two, simple random sampling technique was adopted to selected schools. From the three LGAs, nine public secondary schools offering Biology at the SS2 level were selected using the simple random sampling technique (balloting with replacement). The distribution of schools was as follows: four schools from Nsukka LGA, three from Igbo-Etiti LGA, and two from Uzo-Uwani LGA. This method was adopted to eliminate selection bias and to give each school an equal chance of being included, thereby enhancing the internal validity of the study.

This study employs three researcher-developed instruments to collect data: the Biology Students' Self-Efficacy Questionnaire (BSSQ), the Biology Student School Environment Questionnaire (BSSEQ), and the Biology Achievement Test (BAT). The Biology Students' Self-Efficacy Questionnaire (BSSQ), developed by the researcher, measures students' confidence in mastering Biology tasks. The Biology Student School Environment Questionnaire (BSSEQ) developed by the researcher, evaluates the school environment's impact on Biology learning. The Biology Achievement Test (BAT) developed by the researcher, assesses students' academic performance in Biology. It has two sections. Section A collects personal bio-data, including age, gender, and cognitive styles (FD and FI). Section B contains 30 multiple-choice questions (MCQs) with four options (A–D), covering two core SSII Biology topics—Reproductive Systems in Vertebrates and Nervous Coordination—as outlined in the Nigerian Educational Research and Development Council (NERDC) curriculum.

The instrument were validated by three experts, two from Biology unit, and one from Measurement and Evaluation unit all from the Department of Science Education, Faculty of Education, University of Nigeria, Nsukka. The

internal consistency reliability index of BSSEQ and BSSQ were determined using the Cronbach alpha method and reliability coefficient of 0.88 and 0.90 respectively. The choice of Cronbach alpha method was because it is most suitable for instruments that are polytomously scored. Kuder-Richardson-20 method (KR-20) was used to determine the internal

consistency reliability index for BAT and a coefficient of 0.73 was obtained. The choice for KR-20 was because it is most recommendable for dichotomously scored instrument. Data collected for the study was analysed using the statistical package for the Social Sciences (SPSS).

Results

Table 1: ANOVA F-test for the significance of regression: school environment predicting senior secondary school students 'academic achievement in Biology

Model	Sum of Squares	Df	Mean Square	F	Sig.	Decision
Regression	3990.772	1	3990.772			
Residual	194495.512	315	617.446	6.463	0.011	H0
Total	198486..284	316				Rejected

Table 1 shows that an F-ratio of 6.463 with associated exact probability value of 0.011 was obtained. Since probability value of 0.011 is less than 0.05 level of significance set as bench mark for decision making on testing the hypothesis, the null hypothesis which stated that the predictive power of

school environment on senior secondary school students 'academic achievement in Biology was rejected. Therefore, inference drawn is that, there is a significant predictive power of school environment on senior secondary school students 'academic achievement in Biology.

Table 2: ANOVA F-test for the significance of regression: self-efficacy predicting senior secondary school students 'academic achievement in Biology

Model	Sum of Squares	df	Mean Square	F	Sig.	Decision
Regression	3302.163	1	3302.163			
Residual	195184.120	315	619.632	5.329	0.022	H0
Total	198486..284	316				Rejected

Table 2 shows that an F-ratio of 5.329 with associated exact probability value of 0.022 was obtained. Since probability value of 0.022 is less than 0.05 level of significance set as bench mark for decision making on testing the hypothesis, the null hypothesis which stated that there is no significant

predictive power of self efficacy on senior secondary school students 'academic achievement in Biology was rejected. Therefore, inference drawn is that, there is a significant predictive power of self efficacy on senior secondary school students 'academic achievement in Biology.

Table 3: Regression analysis of the joint predictive power of school environment and self-efficacy on senior secondary school students' achievement in Biology as moderated by cognitive style

Model	Interaction	N	R	R ²	SE	t	P
1	School Environment and Self efficacy X Cognitive style	317	.1759	.0309	2.910	-.0667	.9469

The result in table 3 shows the moderation analysis for the predictive power of joint combination of school environment and self efficacy on students' achievement in Biology as moderated by cognitive style. The result shows a correlation coefficient (R) of 0.17 which implies a low relationship between school environment, self efficacy and academic achievement of students in Biology. The coefficient of determination ($R^2 = 0.03$) means that 3% of the variation in students' academic achievement in Biology is attributed to school environment and self efficacy.

Hypothesis 3

The predictive power of school environment and self-efficacy on senior secondary school students' achievement in Biology as moderated by cognitive style is not statistically significant. From the analysis in table 3, the result indicates that a t-value of -0.0667 with a p-value of 0.9469 was obtained. The probability value of 0.9469 is greater than 0.05 level of significance. Therefore, the null hypothesis is not rejected. The inference drawn is that, the moderation of cognitive style on the amount of variation in students' academic achievement in Biology that can be attributed to school environment and self efficacy is not significant. Hence, it can be concluded that cognitive style does not significantly moderates the predictive power of school environment and self efficacy on students' academic achievement in Biology.

Discussion

The result showed that there is a low predictive power of school environment on senior secondary school students' academic achievement in Biology. The equivalent hypothesis stated that there is a significant predictive power of school environment on senior secondary school students' academic achievement in biology.. This finding indicates that school environment promotes active encouragement to go to school and could have accounted for the relationship between students' school environment and academic achievement in Biology, but the extent of its contribution is relatively small. The statistical significance suggests that school environment is a genuine predictor of academic achievement in Biology rather than a result of chance. However, the low predictive power implies that students' academic achievement in

Biology is influenced by several other factors beyond the school environment.

This finding agrees with the study of Talsma et al. (2018), who found that self-efficacy significantly predicted students' academic achievement but explained only a modest proportion of the differences in achievement because academic success is influenced by numerous cognitive and environmental factors. However, this finding contradicts the study of Bartimote-Aufflick et al. (2022), who reported that self-efficacy was a strong predictor of students' academic achievement and accounted for a substantial proportion of variation in learning outcomes across educational settings. These differences may be attributed to variations in sample characteristics, educational levels, subject areas, research designs, instruments used to measure self-efficacy, and differences in classroom and school contexts where the studies were conducted.

The finding further revealed that cognitive style does not significantly moderate the predictive power of the joint combination of school environment and self-efficacy on senior secondary school students' academic achievement in Biology. This finding indicates that although the joint combination of school environment and self-efficacy contributes to explaining variations in senior secondary school students' academic achievement in Biology, its contribution is relatively small. Furthermore, the non-significant moderating effect suggests that differences in students' cognitive style do not significantly influence the extent to which the joint combination of school environment and self-efficacy predicts academic achievement in Biology.

Conclusion

The study concludes that improving senior secondary school students' academic achievement in Biology requires a comprehensive approach that extends beyond providing a favourable school environment or fostering students' self-efficacy in isolation. Although both variables contribute to students' academic achievement in Biology, their individual and combined influences are relatively limited, suggesting that academic achievement is shaped by the interaction of multiple learner-related, instructional, and contextual factors.

Educational Implications

The results of this study have educational Implications for teachers, students, parents, school

administrators, and future researchers. The findings of this study places demand on teachers to consider organizing or decorating classroom in other to make it conducive for learning and also the methods of teaching that will enable students accomplishing a task in the classroom which will enhance their self efficacy leading to positive academic achievement.

The implication of the findings to parents is that self-efficacy is required to make students achieve academically. The inability of the parents to improve children's self-efficacy at home and also engage their children with activities like academic task that will bring them in contact with good self-efficacy to education will definitely affects children academic achievement. Also, parents' provision of their children with adequate leaning materials needed to complete academic task that will improve self-efficacy of the children is yet another implication of this study to the parents. Parental encouragement maybe in terms of paying tuition fee on time, providing all the learning materials and rewarding high academic achievement of the children.

The finding of this study means that the nature of learning environment created by the school administrators has to be welcoming and more positive and supportive towards the learner. Perhaps, improvement of the physical environment, training of the teachers on how to handle the students and employing the aid of a school counselor to help students with difficulties will contribute strongly in this regard.

Recommendations

In the light of the findings of this study, the following recommendations were made.

1. School administrators and government should ensure that schools provide a conducive learning environment through the provision of well-equipped laboratories, adequate classrooms, proper ventilation, sufficient instructional materials.
2. Biology teachers should adopt teaching strategies that build students' confidence in their ability to learn and perform academic tasks successfully. Such strategies may include encouraging classroom participation, providing constructive feedback, and assigning achievable tasks.
3. Since cognitive style did not significantly moderate the relationship examined in the study, teachers should avoid relying solely

on students' cognitive-style classifications when planning instruction. Instead, they should adopt flexible teaching strategies that accommodate different learning needs and provide equal opportunities for all students to succeed.

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