

Managing Learning Styles and Academic Achievement among Senior Secondary II Biology Students in Calabar Municipality, Cross River State, Nigeria

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Abstract

It is disheartening to note that the poor academic achievement, in biology at public examinations in recent times has been explained as a major cause of decline in the general science course and standard of education in core science in Nigeria. The purpose of this study was to investigate whether learning styles relate with academic achievement of biology students in Calabar Education zone. A correlation design was the research design adopted by the researcher. In the course of conducting this study the simple random sampling techniques was employed in selecting 100 SSII students in the study area. Two instruments were used for data collection namely questionnaire named "Learning Style Questionnaire" (LSQ) and Biology Achievement Test (BAT) (adopted from Joy .M, Reid, 1987). The data collected was scored, coded and analyzed using Pearson Correlation and was tested at 0.05 level of significance. The results of the analysis revealed that the students' approach towards logical learning style correlates positively with academic achievement in biology. The result also showed that intrapersonal learning style correlates positively with the academic achievement in Biology among SSII students in Calabar Education zone. It was recommended among others that; for better academic achievement in Biology, teachers should identify the learning styles of their students and used teaching strategies that complement them.

Keywords: Learning styles, Biology, academic Achievement, students, teaching

Introduction

The word science is a derivative of the Latin word "*scientia*" meaning knowledge. Knowledge generally implies all the truth, facts, information, and principles learned throughout time (Ezeh, 2013). However, this does not suggest that all learned information, facts, truth, and principles are science. Science is a special type of discipline with peculiar characteristics, the prominent among them being the approach through which knowledge is pursued (Idiege, Nja, & Ugwu, 2017; Nja, Cornelius-Ukpepi, Edoho, & Orim, 2019; Nja, Idiege, & Obi, 2017). This approach is commonly known as the scientific method. The scientific method is a logical, rational, and systematic process by which knowledge in the discipline is pursued and conclusions about nature are derived. Science plays an important role in society because it relates to our daily life and career. Our daily activities and careers are the products of scientific knowledge and

thinking. Science helps construct further knowledge and understand phenomena, which has led to the tremendous development of technology (Ezeh, 2013; Uzoigwe, Zakka, & Anuforo, 2023).

Based on the numerous importance of science, the Nigerian government through the Federal Ministry of Education recommended the teaching of science subjects like Chemistry, Biology, Mathematics, and Physics in secondary schools in Nigeria. The study of life is the focus of the natural science discipline of Biology, involving all elements relevant to life (Ada, 2018). Biology is the branch of science that primarily deals with the structure, function, growth, evolution, and distribution of organisms. As a science, it is a methodological study of life and living things (Kumari & Saraladevi, 2014). Biology is one of the science subjects offered throughout senior secondary schools. It draws the most students who are interested in both the arts and sciences. Most students choose Biology because it is considered the easiest science subject when compared with Chemistry and Physics (Njoku, 2015; Inah & Uzoigwe, 2024). The primary science discipline of biology focuses on the study of both plants and animals. Botany and Zoology are the two main subfields of Biology.

The importance of Biology has been recognized in the development of drugs and vaccines for the prevention and treatment of diseases. Moreover, the knowledge of Biology helps in the improvement of new plant species and animal breeds (Crowle, 2018; Luke & Uzoigwe, 2022). Though Biology is fundamental to several professional courses like Medicine, Pharmacy, and Nursing, secondary school students in Nigeria have consistently performed poorly in Biology (Nwafor, 2014; Ihejimaizu, 2019; Ategwu, Kenn-Aklah, Fanan, & Uzoigwe, 2022). Furthermore, the West African Examinations Council (WAEC) annual publication (2020) reveals that candidates' academic achievements in Biology were not only worrisome but also indicate persistent concerns over low test scores. One of the primary causes of poor achievement in Biology is the negative learning styles students adopt. Biology is considered by many as too abstract to understand. Decanato (2008) observed that most students exhibit negative attitudes toward learning Biology, making the teacher's task more difficult indeed (Ojobe, Uzoigwe, & Bassey, 2024).

It is obvious that for any student to be proficient in Biology concepts, a deep understanding is necessary, requiring hard work and dedication. Furthermore, the government has frequently failed to provide adequate funding and effective teaching and learning activities in schools. All these challenges seriously affect Biology education and contribute significantly to the poor results in the West African School Certificate Examinations, which qualifies candidates for matriculation into tertiary institutions in West Africa (Ogbeche & Uzoigwe, 2020). Government agencies, educational elites, stakeholders, and examination bodies like WAEC and NECO have acknowledged the poor achievements in Biology among students (Inah, Ekpang, & Uzoigwe, 2024).

With the current low performance in Biology, it is evident that many learners have not discovered their preferred learning styles or how to learn effectively. Likewise, many teachers fail to recognize learner diversity in their classrooms, continuing to employ traditional teaching methods in all contexts. As a result, students become bored and inattentive in class, perform poorly on tests, lose interest in the subject, the curriculum, and even in themselves—sometimes to the point of dropping out. Teachers, faced with poor results, unresponsive learners, or high dropout rates, may grow disillusioned, become overly critical of their students, or even begin to question their own career paths (Sunday, Afia, Essien, Inyang, Peters, & Uzoigwe, 2025; Opuwari & Uzoigwe, 2025).

It is therefore imperative to understand learning style preferences among learners and how they relate to academic achievement, so as to develop effective and successful learners. Cassidy (2004) stressed that learners should be motivated by the use of appropriate teaching strategies. In a similar vein, Ifeakor (2006) pointed out that biology is often taught using ineffective methods instead of a hands-on approach. Etuk (2011) emphasized that the continued use of such ineffective teaching methods reduces students' ability to grasp relevant concepts compared to lessons involving hands-on experiences. Appropriate teaching methods can help

students acquire scientific skills that may likely enhance achievement in science. This aligns with the argument by Opuwari and Uzoigwe (2025) that learner-centered pedagogies tailored to students' preferred learning styles are fundamental for fostering achievement in science-related subjects.

Learning styles refer to the characteristic cognitive, affective, social, and psychological behaviors that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment (MacKeracher, 2004). There are different types of learning styles, such as kinesthetic, visual, auditory, logical, and intrapersonal. However, for the purpose of this seminar, the researcher focuses mainly on logical and intrapersonal learning styles. According to Sunday et al. (2025), understanding individual learning profiles is essential in planning instructional strategies that maximize learners' potentials, especially in senior secondary education where subject mastery is critical.

A quasi-experimental research conducted by Obiefuna and Oruularito (2015) assessed the effect of students' learning styles on their achievement in biology among senior secondary school students in Imo State. The study, which used a purposive sampling technique to select 200 students, employed both descriptive and inferential statistics. The Mathematics Achievement Test (MAT) served as the instrument for both pre-test and post-test. Research questions were answered using percentages and means, while hypotheses were tested with ANCOVA at a 0.05 level of significance. Their findings showed that students performed better when teaching methods aligned with their preferred learning styles. Similarly, Uzoigwe, Zakka, and Anuforo (2023) reported that instructional alignment with cognitive learning preferences significantly predicts academic performance among Nigerian science students.

Further findings revealed significant differences in calculus achievement among students categorized by different learning modes, indicating that learning abilities such as abstract conceptualization and active experimentation play a role. These active learners preferred discovery-based inquiry, and computer-assisted instruction was deemed beneficial. Kinesthetic learners, who prefer learning by doing, benefited most from objective, hands-on teaching strategies (Adams & Uzoigwe, 2023). This is consistent with empirical findings by Ategwu, Kenn-Aklah, Fanan, and Uzoigwe (2022), who found that students taught through experiential methods demonstrated deeper retention and critical problem-solving abilities.

Riazi and Riasati (2007), in a study on Iranian EFL learners, found that students preferred active engagement and classroom interaction. Similarly, Kassaian (2007) investigated the effect of two teaching methods on students' retention of unfamiliar academic content and found that interactive methods improved learning outcomes. In the Nigerian context, studies by Chuktu and Uzoigwe (2019) and Ekpenyong, Uzoigwe, Onabe, and Onwochei (2020) supported the view that engagement-based learning strategies promote improved student outcomes, especially in subjects requiring conceptual understanding.

In another study, Damavandi, Mahyuddin, Elias, Daud, and Shabani (2011) investigated the impact of learning styles on academic achievement among Iranian secondary school students. Using Kolb's Learning Style Inventory (2000), they measured students' performance in five subjects (English, Mathematics, Chemistry, and Geography) across eight public schools in Tehran. From a sample of 285 Grade 10 students, results from ANOVA showed statistically significant differences in achievement based on learning styles [$F(3, 285) = 9.52, p < .05$], with kinesthetic and visual learners achieving higher mean scores than other groups. In Nigeria, related studies by Inah and Uzoigwe (2024), Inah, Ekpong, and Uzoigwe (2024), and Luke and Uzoigwe (2022) also found that students' learning outcomes are strongly influenced by how well teaching strategies align with their preferred sensory and cognitive learning modalities.

Additionally, Mbon and Uzoigwe (2023) emphasized the importance of differentiated instruction in catering to the multiple intelligences present in senior secondary school classrooms. Nnaji and Uzoigwe (2021) also underscored the critical role of learner engagement and personalization in improving performance among low-achieving students. Ogbeche and Uzoigwe (2020) highlighted the need for pedagogical innovation in overcoming learning barriers in rural

and underserved schools. Ojobe, Uzoigwe, and Bassey (2024) concluded that the systematic integration of student learning styles into curriculum design is a catalyst for long-term academic success in Nigerian secondary education.

Learners, depending on the type of their personality, resort to different learning styles which affect their learning performance. The summary of the literature reviewed indicated that the authors revealed that learning styles have a significant relationship with academic achievement of the students in some areas like Agricultural Science, Biology, Mathematics, and other disciplines, although there was no consensus on which style is most effective across all subjects (Sunday et al., 2025; Opuwari & Uzoigwe, 2025). The preferred learning style effect varies across different content areas. It was observed that many of the reviewed studies were primarily conducted in Biology education within Calabar Municipality and Cross River State (Ekpenyong, Uzoigwe, Onabe, & Onwochei, 2020; Chuktu & Uzoigwe, 2019).

Logical-Mathematical Learning Style: People who are strong in logical-mathematical intelligence are good at reasoning, recognizing patterns, and logically analyzing problems. These individuals tend to think conceptually about numbers, relationships, and patterns. Individuals in this group are characterized by having excellent problem-solving skills, enjoying thinking about abstract ideas, conducting scientific experiments, and solving complex computations. Potential career choices include scientist, mathematician, computer programmer, engineer, and accountant. Recent studies support the link between logical learning styles and academic achievement in science and mathematics disciplines (Uzoigwe, Zakka, & Anuforo, 2023; Adams & Uzoigwe, 2023).

Intrapersonal Learning Style: On the other hand, individuals who are strong in intrapersonal learning styles are good at being aware of their own emotional states, feelings, and motivations. They tend to enjoy self-reflection and analysis, including daydreaming, exploring relationships with others, and assessing their personal strengths. People with this form of learning style are characterized by the ability to analyze their strengths and weaknesses, enjoy analyzing theories and ideas, have excellent self-awareness, and understand the basis for their own motivations and feelings. Potential career choices include philosopher, writer, and theorist. Research shows that students with dominant intrapersonal learning traits benefit from personalized and self-paced learning environments (Inah & Uzoigwe, 2024; Inah, Ekpang, & Uzoigwe, 2024; Luke & Uzoigwe, 2022).

Additionally, scholars have provided various definitions of learning styles. From the above, learning style is described as a factor encompassing cognitive, affective, and psychomotor behaviors that serve as relatively stable indicators of how learners perceive, interact with, and respond to their learning environment (Bire, 2014). This holistic view is further supported by Mbon and Uzoigwe (2023), who argue for differentiated instruction, and Nnaji and Uzoigwe (2021), who emphasize the role of learning style awareness in fostering academic resilience. Furthermore, Ategwu, Kenn-Aklah, Fanan, and Uzoigwe (2022) stressed the need to align classroom practices with students' learning preferences to achieve meaningful learning outcomes. Similar recommendations were made by Ogbeche and Uzoigwe (2020) in their study of rural secondary schools. Ojobe, Uzoigwe, and Bassey (2024) also advocated for the institutionalization of learning-style-based pedagogies to enhance curriculum delivery. Barokah, Suseno, Say, and Mustadi (2021) opined that learning style is a student's consistent way of responding to or using stimuli in the context of learning. A learning style is also seen as a preferential mode through which a student prefers to master learning, solve problems, think, or react in a pedagogical situation (Zagoto, Yarni, & Dakhi, 2019). Moreover, cognitive style can be regarded as one significant component of learning style (Nja, Cornelius-Ukpepi, Edoho, & Orim, 2019).

Theoretical framework

The study therefore, sought to find out the learning styles and academic achievement of SSII Biology Student in Calabar Municipal. The following theories guided this work:

Stimulus response theory -1927

In 1927 Pavlov conducted perhaps one of the most famous psychological experiments when he showed that by paired a conditioned stimulus (a bell) with an unconditioned stimulus (food), a dog would begin to salivate (response) when the bell was ringing without presenting the food. This becomes known as classical conditioning or Stimulus Response Theory of Behavior. Stimulus response theory is a concept in psychology that refers to the belief that behavior manifest as a result of the interplay between stimulus and response. In particular, the belief is that a subject is presented with a stimulus, and then responds to that stimulus, producing "behavior" the object of psychology's study, as a field). In other words, behavior cannot exist without a stimulus of some sort at least from this perspective.

Stimulus response theory is linked with this study because it describes the process of basic and higher order of learning through the associations, we make experiencing a number of stimulus responses pairing in our lives. The use of learning styles helps to elicit stimuli (learning and the desired in behavior of a learner. As we develop, we encounter countless stimulus response pairings that result in learning outcomes. Various stimuli become generalized as we respond to similar type of stimuli in our environment, creating larger network of stimulus response pairing. These learning outcomes encoded in our brains and form the basis for understanding and adapting to the world around us.

Statement of the problem

The low achievement of biology students especially in the genetic concept is evident in Nigerian schools. It is public knowledge that the students' poor achievement in schools has diminished the mean achievement expectations. This has been the concern to various stakeholders in the educational industry, policy makers, and the ministry of education, teachers and even parents. Various steps had been taken by the government at all levels and educational planners in Nigeria, to solve the issue of students' poor retention in biology. For instance, the government has strengthened its policy on school supervision to make teachers more committed and dedicated to duty, encouraged science teachers through science teachers' allowances, rural teacher's allowances and sponsorship at seminars and grants of in-service courses. Also, there has been consistent increase in annual allocation to education as revealed by the Federal Government.

Furthermore, the government has failed most of the time to provide enough funds and learning and teaching activities in our schools. All these problems seriously affect the teaching and learning of Biology and contribute in no small measure to the poor results at West African School Certificate Examinations which is now known as examination that qualifies a candidate for matriculation in any tertiary institutions in West Africa. The government agencies, the public education elites, educational stakeholder and most importantly the examination bodies such as West African Examination Council (WAEC), National Examination Council (NECO), etc. have come to notice on the poor achievement in Biology students. It is therefore imperative to understand learning style preference among learners and how they relate to academic achievement so as to develop effective and successful learners.

Furthermore, the Cross River State government has renovated most schools across the state and equipped their laboratories. Also, there has been increase in teaching period for science subjects (Biology Inclusive) in all government schools from 3 periods to 5 periods a week (Oli, 2016). Despite Government efforts, poor achievement in biology concepts still persist and

constitute a serious problem in our educational system. It becomes obvious that the country may not impact its future manpower needs despite its huge population. It is in the light of this danger that it becomes necessary to explore the effectiveness of alternative method of redressing this problem. Hence, this study therefore seeks to find out the extent to which learning styles relates with academic achievement of biology students in Calabar Municipal.

Purpose of the study

The purpose of this study is to determine whether learning styles relate with academic achievement of Biology students in Calabar Municipality of Cross River State. Nigeria. Specifically, the research sought to find out the:

1. Relationship between Logical learning styles And Academic Achievement of SSII Biology Students in Calabar Municipality
2. Relationship between intrapersonal learning Style and academic achievement of Biology students in Calabar Municipality

Research questions

The study sought to answer the following research question

1. How does logical learning styles relate with the academic achievement of SSII biology student in Calabar Municipality of Cross River State.
2. How does intrapersonal learning styles relate with the academic achievement of SSII biology students in Calabar Municipality of Cross River State.

Hypotheses

The following null hypotheses are formulated or guide the study and will be tested at 0.05 alpha level:

1. There is no significant relationship between Logical learning style and academic achievement of SSII Biology students in Calabar Municipality of Cross River State
2. There is no significant relationship between intrapersonal learning styles and academic achievement of SS II biology student in Calabar Municipal of Cross River State.

Methodology

A correlation survey was the research design adopted by the researcher in the course of conducting this study. This was because the intention of this study is to investigate the relationship between learning styles and academic achievement of SSII biology students. And a correlation study determines whether or not two variables are correlated or not. This means of study whether an increase or decrease in the other variable. More so, that, the relationship between two variables is usually obtained by a correlation coefficient “r” hence this methodology is most preferable to any other design. A total of one hundred students SS II students from the sample of this study. The sample was randomly selected from 2 schools in Calabar Municipality. Two instruments were used for data collection; questionnaire named “Learning Style Questionnaire” (LSQ) and Biology Achievement Test (BAT). (adopted from Joy .M,Reid, 1987). LSQ was made up of two sections. Section A and B. Section A required students to respond to demographics variables while section B had 12 items the first 6 items illicit responses for logical learning style and the other 6 items was for intrapersonal learning style. The questionnaire was based on the modified Likert scale of strongly (4) agreed (3), disagreed (2) and strongly disagreed (1). BAT was made up of 25 multiple choice objective tests in biology. It had a correct response and 3 distracters. LSQ had a Cronbach reliability coefficient ranging from 0.71 to 0.75 and .BAT had a kuder Richardson reliability coefficient of 0.73 respectively.

Results

The summary of the result as presented in Table 1 indicated that the r-ratio obtained in establishing the relationship between logical learning style and academic achievement of biology students was .645 ($p < .05$). This was seen to be significant since the obtained p-value, (.000) is less than 0.05 level of significance in this study. With this result, the null hypothesis which stated that logical learning style does not relate significantly to the academic achievement of biology students was rejected. This means that logical learning style significantly relates to academic achievement of biology students.

Table 1: Mean, standard deviation and Pearson correlation analysis of the relationship between logical learning style and academic achievement of SS11biology students (Using SPSS 26)

	Mean	Std. Deviation	N
Biology achievement test	14.6200	2.88479	50
Logical learning Style	15.4600	2.74947	50

Correlations

		Biology achievement test	Logical intelligence
Biology achievement test	Pearson Correlation	1	.645**
	Sig. (2-tailed)		.000
	N	50	50
Logical learning Style	Pearson Correlation	.645**	1
	Sig. (2-tailed)	.000	
	N	50	50

*($p < .05$)

Table 2 indicated that the r-ratio obtained in establishing the relationship between intrapersonal learning style and academic achievement of biology students was .518 ($p < .05$). This was seen to be significant since the obtained p-value, (.000) is less than 0.05 level of significance in this study. With this result, the null hypothesis which stated that Intrapersonal learning style does not relate significantly to the academic achievement of biology students was rejected. This means that Intrapersonal learning style significantly relates to academic achievement of biology students.

Table 2: Mean, standard deviation and Pearson correlation analysis of the relationship between intrapersonal learning style and academic achievement of SS11biology students (Using SPSS 26)

	Mean	Std. Deviation	N
Biology achievement test	14.6200	2.88479	50
Intrapersonal learning style	15.8000	2.88557	50

Correlations

		Biology achievement test	Intrapersonal learning style
Biology achievement test	Pearson Correlation	1	.518**
	Sig. (2-tailed)		.000
	N	50	50
Intrapersonal learning style	Pearson Correlation	.518**	1
	Sig. (2-tailed)	.000	
	N	50	50

*($p < .05$).

Discussion of findings

The result of hypothesis one indicated that, there was a significant relationship between logical learning style and students' academic achievement. The results were significant maybe because, individuals with logical learning style are good at reasoning, recognizing patterns, and logically analyzing problems. These individuals tend to think conceptually about numbers, relationships, and patterns. Peoples in this group are characterized by having excellent problem-solving skills, enjoy thinking about abstract ideas, like conducting scientific experiments, can solve complex computations.

This study collaborated earlier studies by Obiefuna and Oruularito (2015), who reported a significant relationship of learning styles with academic achievement. In the same vein, Damauaudiet al., (2011) study showed that there was a statistically significant differences in the academic achievement of the Iranian students that correspond to the four learning styles.

The result of hypothesis two indicated that, there was a significant relationship between intrapersonal learning style and students' academic achievement. The result Was Significant may be because individuals with intrapersonal learning Styles are good at being aware of their own emotional states, feelings, and motivations. They tend to enjoy self-reflection and analysis, including daydreaming, exploring relationships with others, and assessing their personal strengths. People with this form of learning style are characterized with the ability to; Analyze their strengths and weaknesses well, enjoy analyzing theories and ideas, have excellent self-awareness, Understand the basis for his or her own motivations and feelings. Potential Career Choices includes; Philosopher, Writer, Theorist and Scientist.

This study agrees with the earlier studies by (Bire, J. (2014)). Barokah, S. M., Suseno, L. C., Say, Y. K. D., & Mustadi, A. (2021) who reported a significant relationship of learning styles with academic achievement. In the same vein, Damauaudiet al., (2011) study showed that there was a statistically significant differences in the academic achievement of the Iranian students that correspond to the four learning styles.

Conclusion

It was concluded that the logical learning style correlates positively with academic achievement in biology among Senior Secondary School two (SSII) Student in Calabar Municipal. It was also concluded that intrapersonal learning style also correlates positively with academic achievement on Senior Secondary School two (SSII) biology Student in Calabar Municipality. This study was designed to determine Learning style as it relate with academic achievement of Senior Secondary two (SSII) Students in Calabar Municipality, Cross River State, Nigeria. The finding showed that:

1. The result shows the Logical learning style correlates positively with academic achievement in Biology among Senior Secondary School two (SSII) Students in Calabar Municipal.
2. The result also shows intrapersonal learning style correlates positively with academic achievement on Senior Secondary School two (SSII) biology Student in Calabar Municipality.

Recommendations

Based on the finding of the study, it was recommended that for better academic achievement in biology, teachers should identify the best learning style that will be more effective for their students and use teaching strategies that complement them. The use of logical learning Style and intrapersonal learning Style will greatly enhance the process of teaching and learning and make it effective and rewarding. The findings have implications on the teaching and learning of Biology on the senior secondary schools.

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LSQ

A learning styles questionnaire base on the key components provided, this forms questions that asses the observable character of each learning modality: logical learning style and intrapersonal learning style. The questions are designed to reflect the traits associated with each learning style, allowing individuals to identify which modality best suit them. Below is a learning styles questionnaire that aligns with the three learning styles provided above (adopted from Reid, 1987)

The questions are spliced into two sections (logical and intrapersonal intelligence). For each question, select the responses that most accurately describes your preferences.

S/N	ITEMS	SA	A	D	SD
	Logical learning style				
1.	I like solving complex problems				
2.	I understand complex principle				
3.	I am good in conducting experiment				
4.	I am good in analyzing mathematical problems				
5.	I love thinking of abstract problems				
6.	I like solving complex computations				
.	Intrapersonal learning style				
7.	I know my strength				
8.	I understand my thought and feelings				
9.	I have good self-regulation and I am able to make inform decision				
10.	I enjoy spending time alone				
11.	I enjoy learning				
12.	I am good in helping others understand themselves				