

OVERCOMING BIOLOGY ANXIETY THROUGH INCLUSIVE PEDAGOGY: A STUDY OF SENIOR SECONDARY STUDENTS IN ILORIN WEST, NIGERIA

A. D. Gbigbadua, R. Sulyman, Olufunke. O. Kayode, Muhinat. B. Bello, Opeyemi Abdullahi ALABI

Department of Arts and Science Education, Faculty of Education

Kwara State University, Malete

abdulraheem.gbigbadua@kwasu.edu.ng

rasaq.sulyman@kwasu.edu.ng

olufunke.kayode@kwasu.edu.ng

bello.mb@unilorin.edu.ng

opeyemi.alabi@kwasu.edu.ng;

Abstract

This study examined the prevalence of Biology-related anxiety among Senior Secondary School students and evaluated effective strategies for mitigating its impact within Ilorin West Local Government of Kwara State, Nigeria. A descriptive design was adopted for the study. The population for this study comprised all public Senior Secondary Schools in Ilorin West, Kwara State. A multi-stage sampling procedure was employed for this study. At the first stage, a purposive sampling technique was used to select three (3) senior secondary schools within Ilorin West. At the second stage, a stratified sampling technique was used to classify respondents into senior secondary school two SSII and three SSIII from the three (3) schools chosen. While at the third stage, a simple random sampling technique was used to select sixty (60) respondents from each stratum. Thus, a total of three hundred and sixty (360) respondents were selected from SSII and SSIII of the three schools selected as the sample of this study. Findings revealed that factors such as fear of failure, low self-confidence, overwhelming content, and traditional teacher-centred methods significantly contribute to biology anxiety. Limited access to practical resources and complex diagrams intensified student stress. The study also revealed that interactive teaching methods, peer collaboration, real-life application of Biology concepts, and consistent feedback from teachers significantly reduced anxiety and increased student engagement. The study, therefore, concludes that addressing biology anxiety requires a shift toward active learning strategies, the integration of digital tools, and improved teacher-student relationships. The study recommends training of teachers to ensure a more inclusive, supportive, and engaging biology learning environment.

Keywords: *Active Learning, Biology Anxiety, Digital Tools, Inquiry-Based Learning*

Introduction

Anxiety has impeded the students' academic engagement and achievement. It presents a fear, disinterest, and lack of self-assurance in grasping intricate biological concepts. Anxiety has negatively influenced essential cognitive abilities like memory, understanding, and analytical thinking skills, crucial for excelling in biology. Dewey, Zhang, and Schwartz (2018) highlight that this anxiety often prevents students from fully participating in biology lessons, leading to a cycle of poor performance and growing apprehension. Similarly, Miya, Dambam and Abdulkareem (2023) found that Biology anxiety in Sokoto secondary schools is often triggered by poor study habits and psychological stress, affecting academic achievement. Therefore, this research, conducted among Secondary school Biology students in Ilorin West Local Government of Kwara State, Nigeria, aimed at identifying effective strategies for reducing Biology anxiety and fostering a more engaging and inclusive classroom experience for hesitant learners.

Biology is a key subject in the secondary school science curriculum, but many students still consider it to be difficult to pass in Senior Secondary School Certificate Examinations. Several factors contribute to this anxiety, including inadequate teaching tools, overcrowded classrooms, and a shortage of qualified teachers. Adetunji and Oyinloye (2019) noted that many students in Nigeria find it challenging to grasp complex biological topics due to limited laboratory access and the inadequacy of modern instructional materials. Socioeconomic inequalities further hinder students' preparedness and exposure to foundational scientific knowledge. Moreover, the traditional, teacher-centred approach commonly used in classrooms often fails to accommodate diverse learning preferences, intensifying students' anxiety. Owoeye and Yara (2011) argue that such rigid teaching methods and low self-concept among students contribute significantly to test anxiety and low performance in Biology as a subject. Tobias (1990) similarly notes that these teaching strategies can alienate students, especially those already intimidated by the subject.

The root causes of Biology anxiety are diverse, ranging from the perceived difficulty of the subject, the abstract nature of some topics and the pressure of memorising

large amounts of information. England, Brigati, and Schussler (2017) point out that students often find topics like molecular biology and genetics particularly challenging, as they require connecting microscopic processes to broader biological systems. These difficulties are apparent in Kwara State, where practical learning opportunities are limited, making it hard for students to relate theoretical knowledge to real-life situations. For students, especially those from rural areas, the stress of mastering interrelated concepts without sufficient support can be overwhelming. Orire and Oniya (2023) confirm that a lack of motivation and high anxiety significantly lower students' performance in Basic Science across Ekiti State, which mirrors the pattern in Kwara.

Anxiety's impact on learning is considerable, affecting students' abilities to absorb, retain, and apply new knowledge effectively. Tobias (1990) describes this as a "mental block" that prevents full comprehension, which often leads to continued poor performance and reinforced negative attitudes toward the subject. In Kwara State, this anxiety is particularly widespread among public school students, where limited resources and overworked teachers diminish instructional quality. Odofin and Igabari (2023) highlight that students in Delta State with higher anxiety levels often report psychological symptoms and perform poorly in science assessments, pointing to a nationwide trend. Adetunji and Oyinloye (2019) emphasise that these challenges contribute to growing educational inequalities, making it imperative to address Biology anxiety as part of broader efforts to promote fair access to quality Science Education.

Active learning strategies have proven effective in easing anxiety and enhancing students' involvement in Biology. Approaches such as group work, practical activities, and problem-solving tasks create a more dynamic and encouraging learning environment. Freeman et al. (2014), in a meta-analysis of STEM education methods, found that active learning significantly improves students' outcomes compared to conventional lectures. In Kwara State, adapting case studies or real-life examples, such as the application of Biology in agriculture or Healthcare can help make the subject matter more relatable. Inquiry-based learning, where students investigate concepts through questioning and experimentation, has also been shown to reduce anxiety and spark curiosity. Nwuba et al. (2024) demonstrated that inquiry-based methods significantly reduce test anxiety and boost

retention among students in Anambra State. Lord and Orkwiszewski (2006) also found that students engaged in such learning methods developed greater confidence and enthusiasm for Biology, as it emphasises active participation over passive listening.

The use of digital tools such as virtual laboratories, interactive simulations, and Augmented Reality (AR) is reshaping Biology Education by making abstract ideas easier to understand. AR tools, for example, allow students to explore cellular structures or molecular interactions in 3D, deepening their grasp of complex topics. Chen et al. (2021) found that these technologies effectively reduce student anxiety by offering an engaging and interactive way to learn. In settings like Kwara State, where traditional lab resources are scarce, such digital tools provide valuable alternatives for hands-on experiences. Virtual labs, in particular, offer a safe and pressure-free environment for students to experiment and learn without the fear of making mistakes. Ogunleye and Adesoji (2010) previously emphasised that access to ICT-based science resources enhances students' learning experiences and reduces content-related anxiety in Nigerian schools.

Creating a nurturing and inclusive classroom culture is also key to tackling Biology anxiety. Teachers are capable of promoting a growth mindset by encouraging students to view mistakes as part of the learning journey. Dweck (2006) argues that fostering such a mindset helps learners see challenges as opportunities rather than threats. Collaborative activities, where students work in teams, can provide emotional support and reduce individual stress. Additionally, formative assessments like quizzes and reflective journals allow students to monitor their progress in a low-pressure setting, boosting their confidence. Nicol and Macfarlane-Dick (2006) stress the value of constructive feedback in helping students recognise their strengths and areas for improvement, ultimately enhancing their self-belief. Yusuf and Adigun (2021) also found that self-concept and teachers' feedback significantly influence Biology test outcomes in Nigerian public schools.

Making Biology more relevant to students' everyday lives is another effective way to ease anxiety and increase engagement. Linking lessons to practical topics, such as local health issues, environmental sustainability, or agricultural innovations, can make the subject more interesting and approachable. For instance, discussing the biological basis of

tropical diseases common in Kwara State or the importance of Biology in improving crop yields can spark curiosity and show the subject's real-world relevance. Zheng et al. (2020) suggest that connecting classroom learning to daily life helps students view Biology as less intimidating and more applicable. Adah and Anari (2022) similarly recommend relating science instruction to students' immediate environments as a strategy to mitigate anxiety and increase comprehension. Chang and Lederman (2018) highlight that continuous teacher training is crucial for fostering inclusive science classrooms, especially in underserved areas. Equipping teachers in this way can lead to a more supportive and effective educational environment that helps all students thrive. Egbadon et al. (2016) assert that teacher competence and student-teacher interaction styles are critical in moderating anxiety and promoting achievement in biology across Nigerian schools.

So, Biology anxiety is critical for encouraging students' engagement and ensuring fair access to all Science Education. Methods such as active learning, inquiry-based teaching, and technology integration can revolutionise the classroom experience, making Biology more approachable and enjoyable. By cultivating a supportive atmosphere and highlighting real-world applications, educators can demystify biology and boost student confidence. In doing so, teachers in Kwara State can inspire a new generation of learners to embrace and succeed in the biological sciences, paving the way for innovation and growth.

Statement of the Problem

Biology anxiety among secondary school students poses a significant barrier to effective learning and academic achievement, particularly in resource-constrained settings such as Kwara State, Nigeria. Despite the critical role that Biology plays in the science curriculum and its relevance to various career paths in health, agriculture, and environmental science, many students in the region struggle to engage with the subject due to persistent feelings of fear, low confidence, and cognitive overload. This anxiety is often exacerbated by systemic challenges, including inadequate laboratory facilities, outdated teaching methods, insufficient instructional materials, and a shortage of trained biology educators. The current educational environment in Kwara State does little to mitigate these

stressors, leaving many students feeling unprepared and overwhelmed. Thus, as a result, Biology performance continues to decline, limiting students' opportunities for academic advancement and professional growth in science-related fields. Addressing this issue is not only critical for improving individual student outcomes but also for promoting equitable access to quality science education across the region.

This study seeks to explore practical and evidence-based strategies to reduce anxiety and enhance students' engagement in biology classrooms. By focusing on active learning methods, the integration of digital technologies, and targeted teacher training, the research offers localised solutions grounded in global best practices. The goal is to create a more inclusive, supportive, and stimulating learning environment that empowers students, regardless of background or ability, to succeed in biology.

Purpose of the Study

The purposes of the study were

To investigate the factors contributing to biology anxiety among secondary school students in Kwara State.

to examine the learning strategies that can mitigate Biology anxiety

Research Questions

1. What are the factors contributing to biology anxiety among secondary school students in Kwara State?
2. How do learning strategies mitigate Biology anxiety among Senior Secondary School Students in Kwara State?

Methodology

The study employed a descriptive design. The design is appropriate because it allowed researchers to gather information from large samples without the manipulation of any variable. The population for this study comprised all public Senior Secondary Schools in Ilorin West, Kwara State.

A multistage sampling procedure was employed for this study. At the first stage, a purposive sampling technique was used to select three (3) senior secondary schools within Ilorin West Local Government where the population of the students were large. At the second stage, a stratified sampling technique was used to classify respondents into senior secondary school two SSII and three SSIII from the three (3) schools chosen. So a total of six classes were used for the study. While at the third stage, a simple random sampling technique was used to select sixty (60) respondents from each stratum. Thus, a total of three hundred and sixty (360) respondents were selected from SSII and SSIII of the three schools selected as the sample of this study.

A researcher-designed questionnaire that was divided into two sections was used for this study. Section “A” which on demographic information (age, gender, grade level) of the respondents. While Section “B” was on Biology anxiety levels, using four Likert scale (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree). The instrument was piloted in a non-participant school to ensure the reliability of the instrument. A reliability co-efficient 0.82 was obtained using Cronbach’s alpha method. Experts in measurement and evaluation, and a teacher of biology, carried out the face and content validity of the instrument. Data collection took place over 3 weeks. Trained research assistants administered the questionnaires to students in their classrooms during the assigned period.

The students were informed about the purpose of the study and assured that their responses would remain confidential. They were instructed to complete the questionnaire independently. Informed consent was sought from the students as well as from their parents or guardians. Participation was voluntary, and students were free to withdraw at any time. Confidentiality was maintained throughout the study, and all data were anonymised. The data collected were analysed using descriptive statistics (frequencies, percentages, means) were employed to determine answer the research questions generated.

Results

Answering Research questions

Research Question 1: What are the factors contributing to biology anxiety among secondary school students in Kwara State?

Table 1: Factors influencing **biology anxiety** among secondary school students **in Kwara State**.

Item	Mean	Standard Deviation
I feel nervous when preparing for biology tests or exams.	2.06	1.06
I find it difficult to concentrate during biology lessons because I feel anxious.	2.18	0.99
Fear of failing biology tests makes me anxious during lessons.	2.19	0.97
I feel nervous about participating in biology class because I think I am not good at science.	2.33	0.98
Frequent interaction with the teacher during biology lessons helps me feel more confident	2.40	1.02
Modifying the curriculum to include more practical and relatable examples reduces my anxiety.	2.54	1.08
Learning biology in small peer groups makes it easier to understand complex concepts	2.62	1.18
Receiving regular feedback from the teacher helps me stay motivated and less anxious.	2.65	1.08
Engaging in hands-on activities and experiments helps reduce my fear of biology.	2.67	1.13
I feel overwhelmed by the volume of concepts and materials in biology.	2.81	1.11
Practical sessions in biology make me feel uneasy and stressed.	3.13	1.05

Table 1 shows that students experience anxiety in biology primarily due to fear of failure, difficulty concentrating, and low confidence, as reflected in lower mean scores. Conversely, practical sessions and content volume contribute less to anxiety.

Research Question 2: How do learning strategies mitigate Biology anxiety among Senior Secondary School Students in Kwara State?

Table 2 shows learning strategies that can be used to mitigate biology anxiety among Senior Secondary School students in Kwara State.

Item	Mean	Standard Deviation
I feel worried when the teacher asks me questions in biology class	2.04	1.01
The teaching methods used in biology classes make it difficult for me to understand the subject	2.04	0.95
The amount of content in biology feels overwhelming and hard to manage.	2.10	0.94
The technical terms and diagrams in biology are too complex and increase my anxiety.	2.16	0.99

Table 2 indicates that teaching methods, overwhelming content, and complex diagrams significantly influence anxiety, with mean values around 2.04–2.16. Overall, students agree that targeted learning strategies, such as interactive methods and simplified instruction, can effectively reduce biology anxiety in Kwara State secondary schools.

Discussion

This study investigated the factors contributing to biology anxiety and the effectiveness of learning strategies in mitigating this anxiety among Senior Secondary School students in Kwara State. The findings provide critical insights that align with both national trends and scholarly perspectives.

In relation to **Research question 1**, which sought to identify factors contributing to biology anxiety, the study found that students often feel nervous when preparing for biology tests and participating in lessons, particularly due to fear of failure and perceived difficulty in grasping complex content. Items such as “I feel nervous when preparing for biology tests” (Mean = 2.06) and “Fear of failing biology tests makes me anxious during lessons” (Mean = 2.19) reflect high levels of anxiety tied to assessments and academic pressure. This finding is consistent with the work of Miya, Dambam, and Abdulkareem (2023), who noted that poor study habits and psychological stress are primary triggers of biology anxiety among secondary school students in Nigeria.

Furthermore, students expressed difficulty concentrating during biology lessons (Mean = 2.18) and a sense of being overwhelmed by the volume of content (Mean = 2.81), which echoes the observations of Adetunji and Oyinloye (2019). They argued that many students in Kwara State experience anxiety due to limited exposure to practical experiences, a shortage of instructional materials, and the abstract nature of certain biology topics. These issues are compounded by the traditional teacher-centred pedagogy that dominates many classrooms, often failing to accommodate diverse learning styles (Owoeye & Yara, 2011). The result is a high-pressure environment where students struggle to engage meaningfully with the subject.

Interestingly, practical sessions intended to enhance understanding were identified as a source of stress (Mean = 3.13), possibly due to inadequate preparation or limited lab resources. This supports Odofin and Igabari's (2023) findings that resource constraints and lack of hands-on exposure heighten students' anxiety in science classes across Nigerian states. The cumulative effect of these factors forms a cycle of apprehension, low self-confidence, and disengagement, as described in Tobias's (1990) concept of the "mental block" in learning.

With respect to Research question 2, which focused on learning strategies for mitigating biology anxiety, the study revealed strong students' support for collaborative and interactive methods. Strategies such as learning in small peer groups (Mean = 2.62), engaging in hands-on experiments (Mean = 2.67), and receiving regular feedback (Mean = 2.65) were rated as effective in reducing anxiety and improving comprehension. These findings align with Freeman et al. (2014) and Lord and Orkwiszewski (2006), who emphasised that active learning significantly enhances students' engagement and lowers anxiety levels, especially in STEM disciplines.

Moreover, responses indicated that modifying the curriculum to include practical and relatable examples (Mean = 2.54) helped reduce anxiety, reinforcing the views of Adah and Anari (2022) and Zheng et al. (2020), who advocated for curriculum relevance in science instruction. Incorporating real-world applications, such as discussions on local health challenges or agricultural biotechnology makes biology more accessible and less

intimidating. The effectiveness of these strategies is also supported by Nwuba et al. (2024), whose research on inquiry-based learning in Anambra State demonstrated significant reductions in test anxiety. This method encourages students to explore and discover, fostering a sense of curiosity and ownership over the learning process.

In addition, students acknowledged that consistent teacher interaction builds confidence (Mean = 2.40), which highlights the importance of the teacher's role in shaping classroom dynamics. Egbadon et al. (2016) and Yusuf and Adigun (2021) have both emphasised the critical role of teacher-student interaction and feedback in reducing anxiety and enhancing academic performance in biology.

The study confirms that biology anxiety among secondary school students in Kwara State is driven by a combination of internal psychological stressors and external instructional limitations. However, the consistent students' preference for active, collaborative, and supportive learning environments indicates a clear path forward. By implementing inquiry-based methods, leveraging digital tools, and enhancing teacher training, educators can create inclusive biology classrooms that minimise anxiety and maximise student engagement and success.

Conclusion

The study confirms that biology anxiety among senior secondary school students in Kwara State is a multifaceted issue rooted in both psychological and instructional challenges. Key contributors to this anxiety include fear of failure, difficulty understanding abstract concepts, overwhelming content, and ineffective teaching methods. The limited availability of practical learning resources and lack of engagement in classroom activities further compound the issue. However, the study also demonstrates that active learning strategies, such as hands-on experiments, peer group learning, real-life applications of biology, and constructive teacher feedback- are effective in reducing anxiety and improving student confidence. By fostering an inclusive and dynamic classroom environment, educators can help students overcome apprehensions and develop a stronger interest in biology. Therefore, addressing biology anxiety is not only essential for individual academic success but also for advancing equity in science education across the region.

Recommendations

Teachers should implement inquiry-based learning and group projects to encourage students'

participation and reduce fear associated with complex Biology concepts.

- a. Biology instruction should be contextualised with local examples and real-world applications to make the subject more relatable and less intimidating for students.
- b. Stakeholders should prioritise the provision of functional laboratories for effective delivery.

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