

STRATEGIES FOR INTEGRATING BIOLOGY AND SUSTAINABLE DEVELOPMENT INTO CLASSROOM PRACTICES IN SECONDARY SCHOOLS IN ILORIN METROPOLIS, KWARA STATE NIGERIA

BY

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Abstract

This descriptive survey, employing a quantitative research approach, explores strategies for integrating biology and sustainable development into classroom practices in Senior secondary schools within Ilorin Metropolis, Kwara State. The study specifically targeted 200 biology teachers from various senior secondary schools. The integration of biology with sustainable development is critical for imparting knowledge of environmental conservation, sustainable resource management, and social responsibility—key aspects of the global Sustainable Development Goals (SDGs). Structured questionnaires were used to collect data on current teaching practices, methodologies, and the extent to which sustainable development concepts are incorporated into biology instruction. The survey covered areas such as teacher preparedness, curriculum content, availability of instructional resources, and student involvement in sustainability projects. The data were analyzed using descriptive statistics, providing a quantitative understanding of the existing practices and the challenges biology teachers face in implementing sustainability concepts in their teaching. The results indicated that while a majority of biology teachers understand the importance of integrating sustainable development into their lessons, many lack the training and instructional materials necessary for full implementation. Additionally, effective strategies such as project-based learning, real-world case studies, and community-based sustainability initiatives were identified as beneficial in enhancing students' understanding of sustainability. However, challenges such as inadequate infrastructure, insufficient professional development, and limited funding emerged as major barriers. The study concludes that addressing these challenges through improved teacher training, curriculum development, and increased resource allocation is crucial for the successful integration of biology and sustainable development in public secondary schools. The recommendations emphasize investing in teacher capacity building and fostering partnerships with environmental organizations to support sustainability education.

Keywords: Biology integration, Sustainable development, Classroom practices, secondary schools, Teacher training, social responsibility and Environmental Conservation

Introduction

Education is fundamental in advancing sustainable development by providing students with the essential knowledge and skills to address pressing environmental, social, and economic issues. Biology, which focuses on the study of living organisms and their interactions with the environment, offers numerous benefits, it also presents several challenges. To balance academic achievement with sustainability education, teachers should be encouraged to adopt innovative teaching methods that promote critical thinking and problem-solving and valuable opportunities to promote sustainability awareness and practices. (Hogan & O'Flaherty 2021). Integrating biology with sustainability concepts in the classroom is essential for developing informed and responsible future citizens. According to UNESCO (2022), Education is a structured process where individuals acquire knowledge, skills, values, and competencies through teaching and learning in formal settings like schools. It also encompasses informal learning through life experiences. Education is essential for personal

development and plays a significant role in social, economic, and cultural progress. It is particularly important for reducing inequality, improving health, and fostering global peace and democracy.

Moreover, UNESCO (2022), refers to Sustainable development as meeting the needs of the present without compromising the ability of future generations to meet their own needs. It involves the integration of economic growth, social inclusion, and environmental protection. Education plays a key role in sustainable development, as it helps people understand and engage with challenges like climate change, biodiversity loss, and social inequality, fostering the knowledge and skills needed for a sustainable future. The major challenge is the limited availability of resources and teacher training in many schools. (Ferguson, et, al.2021). To address this, governments and educational institutions should invest in professional development programs and provide teachers with access to high-quality resources. The pressure to prepare students for standardized tests is another challenge

Nonetheless, the successful fusion of biology and sustainability education in classrooms demands careful planning, adequate resources, and comprehensive teacher training (OMOSEEB, 2021). Educators need to be well-prepared with the necessary expertise and materials to deliver engaging and relevant lessons that align with sustainability principles. Schools in Ilorin metropolis must also create an environment conducive to interdisciplinary learning, promoting collaboration between biology and other subjects like geography, economics, and social studies. Productive teaching strategies that integrate biology with sustainability education go beyond theoretical knowledge, promoting critical thinking, problem-solving, and practical involvement with real-world issues. For example, activities like school gardens, recycling initiatives, and field excursions to local natural habitats can engage students directly. Lessons on biotechnology and genetic advancements in agriculture can also provide insights into how scientific innovation can address global challenges such as food security and environmental conservation. (Adegbaju, et, al. 2024). These experiences enable students to contribute to sustainable practices within their schools and communities

In Ilorin metropolis, Kwara State, secondary schools play an important role in fostering sustainable development. Incorporating sustainability themes into the biology curriculum allows students to grasp the interconnectedness between natural systems and human actions. Topics such as ecosystems, biodiversity, climate change, and resource management can illustrate the environmental impact of human activities Biology education acts as an important channel for promoting environmental responsibility and sustainable lifestyles. This study examines various strategies for incorporating biology and sustainable development into classroom practices in secondary schools in Ilorin metropolis, Kwara State. It aims to identify practical methods for nurturing students who are well-equipped to address the sustainability challenges of the modern world. Therefore, the objectives of this study are:

1. Assess the current state of sustainable development education in secondary schools in Ilorin Metropolis.
2. Identify effective strategies for integrating sustainable development into classroom practices in secondary schools in Ilorin metropolis Kwara state
3. Explore the challenges and opportunities associated with implementing sustainable development education in secondary schools in Ilorin metropolis Kwara state.
4. Develop recommendations for policymakers, educators, and stakeholders to promote sustainable development education in Ilorin metropolis Kwara state.

Research Question

1. How is sustainable development education currently incorporated into the curriculum of secondary schools in the Ilorin Metropolis?
2. What strategies have been successfully used to integrate sustainable development education into classroom practices in secondary schools in Ilorin Metropolis?
3. What are the key challenges and opportunities faced by secondary schools in Ilorin Metropolis in implementing sustainable development education?

4. What role can stakeholders such as government agencies, NGOs, and the private sector play in promoting sustainable development education?

Literature review

Integrating sustainable development into secondary school curricula is crucial for preparing students to address modern environmental, social, and economic challenges. (Zwolińska, et al., 2022) In the context of secondary schools in the Ilorin metropolis, Kwara State, biology serves as an excellent subject through which sustainability concepts can be effectively introduced. The biology curriculum can incorporate themes like ecosystems, biodiversity, and the impact of climate change, helping students understand how organisms interact with their environment and the consequences of human actions on natural systems. This approach highlights biology's relevance in teaching about sustainable development. Moreover, project-based learning enhances the practical application of biological concepts. (OCHIGBO, 2023). For example, students could engage in activities like establishing school gardens or conducting biodiversity studies within their school environment. These hands-on projects not only deepen students' understanding of biological processes but also foster a sense of responsibility for environmental conservation and sustainable resource management. The role of teachers in this integration is also vital. Professional development programs that focus on sustainable education equip biology teachers with the knowledge and skills necessary to introduce these concepts effectively. By attending workshops or training sessions, teachers can learn how to incorporate real-world environmental issues into their lessons, making biology more engaging and directly relevant to students' lives in Kwara State.

Integrating environmental conservation into biology education positively influences students' attitudes toward the environment. Students exposed to conservation education are more inclined to adopt sustainable behaviors, such as recycling, conserving water and energy, and promoting biodiversity (Turner & Delgado, 2021). Community involvement further strengthens the sustainability message (Abdulkadir, 2022). Biology projects can benefit from collaboration with local environmental organizations or agricultural experts, linking theoretical knowledge with practical, community-based applications. Additionally, incorporating information and communication technologies (ICT) into lessons allows students to access global resources and stay informed about worldwide sustainability efforts, making their learning experience more dynamic and applicable to contemporary environmental challenges. (Akintoye, et al., 2020). Biology offers a powerful framework for embedding sustainable development into secondary education, equipping students with both the knowledge and practical skills needed to address the interconnected environmental issues that will shape their futures.

Methodology

The study utilized a descriptive survey design and employed a quantitative research approach to examine the integration of biology and sustainable development into classroom practices in Senior Secondary Schools within Ilorin Metropolis, Kwara State. The target population for the study consisted of 200 biology teachers from various senior secondary schools. Data collection was conducted using structured questionnaires, which focused on gathering information about teaching practices, methodologies, and the extent to which sustainable development topics were incorporated into biology lessons. The survey specifically looked into areas such as teacher readiness, curriculum content, the availability of teaching resources, and student participation in sustainability-related projects. The collected data were then analyzed through descriptive statistics, providing a quantitative assessment of existing teaching practices and the challenges biology teachers face when incorporating sustainability concepts. This analysis helped identify the current level of integration and highlighted areas where improvements could be made.

Results

Research question one: How is sustainable development education currently incorporated into the curriculum of secondary schools in the Ilorin Metropolis

Table 1:
Incorporation of Sustainable Development Education into Curriculum

S/N	Item	Mean
1	Sustainable development education is explicitly included in our school's curriculum.	3.80
2	Social justice and human rights are integrated into our school's curriculum.	4.10
3	Our school's curriculum prepares students for sustainable development challenges.	4.10
4	Our school's curriculum adequately addresses environmental issues.	4.00
5	Students are given opportunities to engage in sustainable development projects as part of the curriculum.	4.10
6	Teachers in my school receive adequate training on incorporating sustainable development education into lessons.	3.50
Average mean		3.93

The table illustrates the incorporation of Sustainable Development Education (SDE) into the curriculum, with mean scores ranging from 3.50 to 4.10 across different items, leading to an overall average mean of **3.93**. This suggests that the respondents generally agree or strongly agree that elements of SDE are being incorporated into the curriculum, with a strong emphasis on certain items (such as 2, 3, and 5 with mean scores of 4.10).

Research question two: What strategies have been successfully used to integrate sustainable development education into classroom practices in secondary schools in Ilorin Metropolis?

Table 2:
Strategies for Integrating Sustainable Development Education

S/N	Item	Mean
1	Sustainable development education is successfully integrated into existing lesson plans without disrupting other subjects.	3.60
2	Interactive discussions on sustainability help students understand the importance of sustainable practices.	4.30
3	Field trips related to environmental sustainability are regularly organized to enhance student learning.	4.10
4	Project-based learning is an effective strategy for teaching sustainable development	4.20
5	Technology is effectively used in teaching sustainable development concepts (e.g., videos, and online resources).	3.90
6	Hands-on activities like planting trees or recycling are integrated into classroom practices.	4.40
Average mean		4.08

The table provides an analysis of strategies for integrating Sustainable Development Education (SDE) into the curriculum. The mean scores range from **3.60** to **4.40**, leading to an overall average mean of **4.08**. This reflects a

strong agreement among respondents on the effectiveness of various strategies for incorporating sustainability into education.

Research three: Explore the challenges and opportunities associated with implementing sustainable development education in the Ilorin metropolis Kwara state secondary schools.

Table 3:
Challenges in Implementing Sustainable Development Education

S/N	Item	Mean
1	Lack of resources is a major challenge in implementing sustainable development education.	3.70
2	Teachers in my school face time constraints in covering sustainable development topics due to a packed curriculum.	4.70
3	Limited teacher training in sustainable development education is a barrier to effective implementation.	4.10
4	The school administration provides sufficient support for implementing sustainable development education.	4.00
5	Collaboration with external organizations could improve the teaching of sustainable development education.	4.00
6	There are ample opportunities for students to engage in sustainable development education through extracurricular activities.	4.60
Average mean		4.18

The table presents the analysis of **Challenges in Implementing Sustainable Development Education (SDE)** and shows an average mean score of **4.18**, indicating that respondents perceive significant challenges in integrating SDE into the curriculum. The highest scores, **item 2 (4.70)** and **item 6 (4.60)** suggest that barriers are major obstacles to the successful implementation of SDE. Moderate challenges are seen in **items 3 (4.10)**, **4 (4.00)**, and **5 (4.00)**, which reflect difficulties such as insufficient training for educators and the complexity of curriculum integration.

Research question four: What role can stakeholders such as government agencies, NGOs, and the private sector play in promoting sustainable development education

Table 4:
Stakeholder Roles in Promoting Sustainable Development Education

S/N	Item	Mean
1	Collaboration with stakeholders can help overcome the challenges schools face in implementing sustainable development education.	4.30
2	Government policies support the integration of sustainable development education in secondary schools.	4.20
3	Stakeholders regularly organize workshops and seminars to promote sustainable development education for teachers.	2.90
4	Partnerships with stakeholders (government, NGOs, private sector) have helped improve the quality of sustainable development education in schools.	4.20
5	NGOs have made significant contributions to sustainable development education by providing resources and training.	3.20
6	Government agencies provide adequate support for promoting sustainable development education in schools.	3.10
Average mean		3.65

The table provides an analysis of **Stakeholder Roles in Promoting Sustainable Development Education (SDE)** and presents an average mean of varying degrees of stakeholder involvement. The highest scores, **items 1 (4.30)** and **2 (4.20)** indicate that respondents believe certain stakeholders, such as educational institutions and government agencies, play significant roles in promoting SDE. These scores suggest a strong perception that policy-making and institutional leadership are crucial in fostering sustainability education. However, **items 3 (2.90)**, **5 (3.20)**, and **6 (3.10)** reflect lower levels of engagement from other stakeholders, potentially pointing to less involvement from the private sector, non-governmental organizations (NGOs), or community leaders.

Conclusion

The study finds that while biology teachers in Senior Secondary Schools within Ilorin Metropolis recognize the importance of integrating sustainable development into their lessons, several challenges prevent its full implementation. These obstacles include insufficient training, a lack of instructional materials, inadequate infrastructure, and limited financial resources. Despite these difficulties, effective approaches such as project-based learning, the use of real-world case studies, and community-driven sustainability initiatives were identified as valuable in improving students' understanding of sustainability concepts. To ensure the successful integration of sustainability into biology teaching, stronger support systems are needed, especially in the areas of teacher training, curriculum development, and resource provision.

Recommendations

- Continuous professional development programs should be implemented to provide biology teachers with the skills and knowledge needed to effectively integrate sustainable development concepts into their lessons. Training opportunities such as workshops, seminars, and in-service sessions will improve teacher preparedness and boost their confidence in delivering sustainability-focused education.
- The biology curriculum should be updated to incorporate detailed and clear content on sustainable development, aligned with the Sustainable Development Goals (SDGs). This will ensure that sustainability concepts become an essential component of biology teaching.
- Greater funding and investment are essential to ensure that schools have the necessary instructional materials and infrastructure to support sustainability education. Schools should be equipped with resources like textbooks, digital tools, and supplies for engaging in practical sustainability projects.
- Schools should form partnerships with environmental organizations to receive additional support for sustainability education. These collaborations can offer real-world experiences, involvement in community projects, and access to sustainability experts.
- Schools should adopt teaching methods like project-based learning, where students actively participate in sustainability projects. This hands-on approach will enhance their understanding of environmental conservation, resource management, and social responsibility.

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