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Enhancing biology education in secondary schools through effective use instructional materials in Jemaa local government area of Kaduna State

Garba Linda Larai*, Dabo Jonathan, Simon Zachariah
Department of Biology, Kaduna state College of Education, Gidan Waya-Kaduna State, Nigeria
Corresponding Author: Garba Linda Larai

Abstract
This study investigated Enhancing Biology Education in Secondary schools Through Effective use Instructional Materials in Jemaa Local Government Area of Kaduna State. The study adopted the descriptive survey research design. Data were collected from Biology students using a structured questionnaire and analyzed using descriptive statistical methods. Biology involves some abstract concepts and practical processes that require concrete representation to facilitate meaningful learning. The findings revealed that the use of instructional materials such as charts, models, specimens, laboratory equipment, and audio-visual resources significantly enhances students' understanding of biological concepts, stimulates interest, and improves academic performance. The study also identified challenges affecting effective Biology instruction, including inadequate supply, poor maintenance, and limited utilization of available instructional materials in some schools. The results underscore the critical role of instructional materials in promoting active learning and improving instructional delivery in Biology classrooms. The study therefore recommends increased provision of instructional materials by relevant stakeholders, regular training of teachers on effective utilization, and improved funding for science education to enhance the teaching and learning of Biology in secondary schools in the area.

Keywords: Enhancing, biology education, Instructional materials, teaching, secondary schools

Introduction

Biology is a subject taught at the secondary school level to give students an in-depth understanding of biological concepts, principles, theories, and laws (Bello *et al*., 2020) [4]. Biology plays a fundamental role in secondary school education, providing students with a comprehensive understanding of biological concepts and their applications (Abidoye *et al*.,2023) [1]. Biology has a significant impact globally and plays vital roles in various fields, such as microbiology, biotechnology, genetics, botany, medicine, zoology, and bioinformatics.

The abstract nature of science subjects, including Biology, often poses challenges for educators, making instructional materials necessary to enhance students' comprehension and engagement (Neji & Ntibi, 2019) [9]. Instructional materials encompass visual resources that engage the sense of sight, audio materials that engage the sense of hearing, and audio-visual materials that integrate visual and auditory elements. While Abdullahhi (2010) viewed instructional materials as tools locally made or imported to help facilitate the teaching/learning process, Obanga (2005) viewed them as materials things which are used to composed ported that could make tremendous enhancement of intellectual use impact the instructional materials. Instructional materials play a crucial role in teaching and learning as they stimulate students' interests, help overcome physical limitations, and enhance the presentation of subject matter. This highlights the significance of instructional resources in facilitating effective teaching and learning experiences. Insufficient, unavailability and inadequate utilization of instructional materials have been identified as significant factors contributing to the ineffectiveness of the school system and poor student performance.

Digital resources, such as online simulations and educational videos, have emerged as valuable supplements to traditional materials, offering interactive and dynamic learning experiences. Despite their potential, the use of digital tools is often constrained by limited technological infrastructure and varying levels of teacher proficiency (Wahlberg & Gericke, 2018) [13]. Instructional materials serve as indispensable tools in education, particularly in subjects like biology, where complex concepts often necessitate visual aids and hands-on activities for effective comprehension and retention (Junco & Nabua, 2023) [8]. In the realm of biology education, instructional materials encompass an extensive array of resources, ranging from traditional textbooks to cutting-edge multimedia presentations, from laboratory equipment to intricate models, charts, and specimens (Amos *et al*., 2022) [2]. These materials are strategically employed to captivate students' interest, solidify foundational concepts, and foster dynamic, participatory learning environments. By leveraging instructional materials, educators can stimulate curiosity, encourage exploration, and facilitate deeper engagement with the subject matter (Abubakar *et al*., 2024) [3].

Many schools in underserved areas struggle to provide basic laboratory equipment and supplementary resources for biology classes, as revealed by Jacob *et al*. (2020) [7]. This shortage not only impedes teachers' ability to deliver quality instruction but also limits students' opportunities for hands-on learning experiences (Rapanta *et al*., 2020) [11]. Therefore, assessing the availability of instructional materials involves examining both the physical presence of resources and the accessibility of technology-enabled learning tools. The utilization of instructional materials in biology education is crucial for enhancing students' academic achievement. Research indicates that interactive and multisensory learning experiences facilitated by instructional materials can significantly improve student comprehension and retention of biological concepts (Idris *et al*., 2018) [6]. Moreover, instructional materials that cater to diverse learning styles and abilities promote inclusive

education practices and equitable learning outcomes (Bakare, 2024) [3].

Instructional materials play a very important role in the teaching and learning process. It enhances the memory level of the students. At this time that education has spread wide and entirely, oral teaching cannot be the key to successful pedagogy; therefore, the teacher has to use instructional materials to make teaching and learning process interesting (Raw2006). Research conducted in senior secondary schools in Osun State examined the correlation between the use of instructional materials and student's academic performance in Biology, revealing that students taught with instructional materials performed better than those taught without them.

The use of instructional materials can enhance the learning achievement. Cronbach (2009) states the important elements of behavior that provides the base for learning theory situation which consists of all the objects, persons and symbols in the learning environment

Orji (2000) asserts that teaching aid is "the guidance of learning activities" that "a teacher uses to motivate and arouse student's desire to learn"

Objectives

The objective of the study is:

1. To assess the relevance of instructional materials in the teaching of biology in Jemaa Local Government Area.
2. To evaluate the availability of instructional materials for teaching biology in Jemaa Local Government
3. To know the challenges encountered in the use of instructional materials while teaching Biology.

Research questions

The following research questions were formulated to guide the study:

1. What is the relevance of instructional materials in the teaching of biology in Jemaa Local Government?
2. What is the availability of instructional materials for teaching biology in Jemaa Local Government area?
3. What are the challenges encountered in the use of instructional materials in teaching Biology?

Methodology

The study adopted a descriptive survey research design. This design was considered appropriate because it enables the researcher to collect data from respondents and describe existing conditions regarding the availability, adequacy, utilization, and importance of instructional materials in the teaching of Biology in secondary schools.

The study was carried out in Jemaa Local Government of Kaduna State, Nigeria. The Local Government has a mix of urban, semi-urban, and rural secondary schools, making it suitable for examining variations in the availability and use of instructional materials in Biology teaching

The population of the study comprised secondary school students offering Biology in Jemaa Local Government. The target population included students from both public and private secondary schools

A sample size of 32 students was used for the study. The respondents were selected using a simple random sampling technique, ensuring that students from different school types, locations, class levels (SS1–SS3), and gender had equal chances of participation.

The instrument used for data collection was a structured questionnaire designed using Google Forms. The questionnaire consisted of both closed-ended and Likert-type items, arranged into sections covering:

Background information of respondents, Availability of instructional materials, Adequacy and utilization of instructional materials, Perceived importance of instructional materials, Challenges affecting their use

The questionnaire was subjected to face and content validity. Copies of the instrument were reviewed by experts in Biology education and research methodology, who assessed the clarity, relevance, and adequacy of the items. Corrections and suggestions made were incorporated before the final administration of the questionnaire.

The reliability of the instrument was ensured through a pilot test, after which the responses were analyzed to determine consistency. The instrument was found to be reliable and suitable for the study.

Data were collected through the online administration of the Google Form questionnaire. The questionnaire link was shared with selected respondents, and responses were automatically recorded. This method was cost-effective and allowed for easy data collation.

Data collected were analyzed using descriptive statistics, including frequency counts and percentages. The results were presented in tables for clarity and ease of interpretation, in line with the objectives of the study.

Ethical Considerations

Respondents were adequately informed about the purpose of the study, and participation

Results

Table 1: Table: A

Variable	Category	Frequency	Percentage (%)
School Type	Public	22	68.8
	Private	10	31.2
School Location	Semi-urban	15	46.9
	Rural	10	31.3
	Urban	7	21.8
Class Level	SS1	9	28.1
	SS2	17	53.1
	SS3	6	18.8
Gender	Male	16	50.0
	Female	16	50.0

The table shows that most respondents were from public secondary schools and were mainly in SS2. Both male and female students were equally represented, providing a balanced and reliable sample for the study.

Availability of Instructional Materials for Biology Teaching

Table 2: Availability of Instructional Materials in Schools

Instructional Materials	Available	Not Available
Biology textbooks	24 (75.0%)	8 (25.0%)
Charts/Posters	21 (65.6%)	11 (34.4%)
Models	17 (53.1%)	15 (46.9%)
Laboratory equipment	19 (59.4%)	13 (40.6%)
None available	6 (18.8%)	26 (81.2%)

The results indicate that while textbooks and charts are relatively available, other essential materials such as models and laboratory equipment are inadequate in many schools. A small but significant number of schools reported having none of the listed instructional materials, indicating inequality in resource distribution.

Adequacy and Utilization of Instructional Materials

Table 3: Adequacy of Available Instructional Materials

Response	Frequency	Percentage (%)
Very adequate	6	18.8
Fairly adequate	15	46.9
Inadequate	11	34.3
Total	32	100

The table reveals that although most respondents considered instructional materials fairly adequate, a considerable proportion viewed them as inadequate, suggesting insufficient resources for effective teaching.

Table 4: Frequency of Use of Instructional Materials

Frequency of Use	Frequency	Percentage (%)
Always	7	21.9
Sometimes	18	56.2
Rarely	7	21.9
Never	0	0.0
Total	32	100

The findings show that instructional materials are mostly used occasionally, with limited regular use. This irregular utilization may reduce students' exposure to practical learning experiences.

4.5 Perceived Importance of Instructional Materials

Table 5: Students' Perception of the Importance of Instructional Materials

Statement	Agree (%)	Disagree (%)
Makes Biology easier to understand	87.5	12.5
Increases interest in Biology	90.6	9.4
Improves academic performance	84.4	15.6
Links theory with practice	93.8	6.2

The results indicate strong agreement among respondents on the positive role of instructional materials in enhancing understanding, interest, and academic performance in Biology.

Challenges Affecting the Use of Instructional Materials

Table 6: Challenges Limiting the Use of Instructional Materials

Challenge	Frequency	Frequency (%)
Lack of instructional materials	20	62.5
Inadequate laboratory facilities	18	56.3
Large class size	15	46.9
Insufficient funding	22	68.8

Insufficient funding and lack of instructional materials emerged as the most significant challenges, highlighting structural and financial constraints faced by secondary schools.

Suggested Strategies for Improvement

Table 7: Suggested Strategies to Improve Instructional Materials

Suggested Strategy	Frequency	Percentage (%)
Provision of standard laboratories	24	75.0
Increased government funding	26	81.3
Stakeholder support	19	59.4
Regular supply and maintenance	21	65.6

Respondents strongly recommended increased funding and provision of standard laboratories as key solutions to improve Biology teaching and learning.

Discussion of Findings

The use of tables in presenting the findings clearly shows that instructional materials play a critical role in effective Biology teaching. Despite high awareness of their importance, availability and utilization remain inadequate. These findings align with existing studies which emphasize that insufficient resources and funding constraints negatively affect science education.

Summary of Findings

In summary, the results show that instructional materials are widely recognized as essential for effective Biology teaching among secondary schools in Jemaa Local Government. However, their availability, adequacy, and utilization are inconsistent. Addressing funding challenges, improving laboratory facilities, and ensuring regular use of instructional materials will significantly enhance students' understanding and academic performance in Biology.

Summary

The study investigated the importance of instructional materials in the teaching of Biology among secondary schools in Jemaa Local Government of Kaduna State. A descriptive survey design was adopted, and data were collected using a structured Google Form questionnaire administered to 32 secondary school students. The study examined the availability, adequacy, utilization, perceived importance, challenges, and possible strategies for improving instructional materials in Biology teaching.

The findings revealed that although some instructional materials such as textbooks and charts are available in many schools, essential resources like laboratory equipment and models are insufficient. Instructional materials were mostly rated as fairly adequate, but their utilization was irregular. Students strongly perceived instructional materials as vital for enhancing understanding, interest, and academic performance in Biology. Major challenges identified included insufficient funding, lack of instructional materials, inadequate laboratory facilities, and large class sizes.

Conclusion

Based on the findings of the study, it can be concluded that instructional materials are indispensable tools for effective teaching and learning of Biology in secondary schools. While students clearly recognize their importance in linking theory with practice and improving academic performance, their availability and consistent use remain inadequate in many schools across Jemaa Local Government. Financial constraints and poor infrastructure significantly limit the effective integration of instructional materials into Biology lessons.

Recommendations

The study recommends that adequate instructional materials should be provided to senior secondary school students for motivation I their learning of Biology.

Digital audio visuals should be provided

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