



## **Impact Of Instructional Materials on Biology Achievement Among Senior Secondary School Students in Gumel, Jigawa State**

BY

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### **Abstract**

*Students' poor achievement in Biology has been widely associated with limited use of instructional materials. This study investigated the effects of instructional materials on the academic achievement of Biology students in Gumel, Jigawa State. Specifically, it examined whether instructional materials improve students' achievement in Biology and whether gender differences exist in achievement when such materials are used. A quasi-experimental design involving experimental and control groups was adopted. A total of 104 SS2 Biology students were randomly selected from a population of 3,255 students across 17 public secondary schools. The experimental group was taught using instructional materials, while the control group received instruction without them. Data were collected using the Biology Achievement Test (BPT), developed from past WAEC questions, validated by experts in Science Education, and found reliable with a coefficient of 0.88. Pre- and post-tests were administered, and independent t-tests were conducted at a 0.05 significance level. Findings revealed that students taught with instructional materials recorded significantly higher mean achievement scores than those taught without them. However, no significant difference was found between male and female students exposed to instructional materials. The study concluded that instructional materials significantly enhance comprehension and achievement in Biology, irrespective of gender, and recommended their consistent use in classroom teaching.*

**Keywords:** *Instructional Material, Achievement, Biology.*

## Introduction

Science is an organized body of knowledge derived from unbiased and empirical findings through observation and experimentation, serving as a problem-solving activity aimed at improving the living standard of humanity. Shuaib (2014) described science as a complex human activity that produces universal statements such as laws, theories, and hypotheses to explain observable behaviors of the universe and predict phenomena. Recognizing the importance of science, the Federal Government of Nigeria, through the Federal Ministry of Education, introduced science education into schools. Science education, according to Okeke (2007), is an integrated field that focuses not only on the subject matter in disciplines like Biology, Chemistry, and Physics but also on the processes of teaching and learning. In line with this, the Federal Ministry of Education (2013) made Biology a core subject at the Senior Secondary School (SSS) level. The Nigerian Educational Research and Development Council (NERDC, 2017) outlined objectives of the Biology curriculum to include equipping students with laboratory and field skills, providing relevant knowledge, fostering the application of biology to health and agriculture, and cultivating functional scientific attitudes. Biology, which is divided into Botany and Zoology and encompasses concepts such as evolution, genetics, nutrition, and ecology, is of great importance as it serves as a prerequisite for several applied sciences including Medicine, Nursing, Pharmacy, Biochemistry, Genetics, and Agricultural Science. Poor achievement of students in Biology have been attributed to different factors, by several researchers for instance, Lawal (2009), Atadoga and Lakpini (2013) found that the persistent low achievement in science education were attributed to teachers' instructional strategies and lack of using Instructional materials in teaching.

The effective teaching of biology requires the use of instructional materials. These are essential resources tools, devices, or aids that help teachers capture learners' attention, clarify abstract concepts, and simplify complex ideas to make learning more concrete, meaningful, and enjoyable. In the context of science education, particularly biology, instructional materials are indispensable in bridging the gap between theory and practice. Scholars have emphasized their significance: Jamilu (2002) observed that they enhance comprehension and support achievement in examinations, while Ogunlade (2005) noted that they range from simple locally sourced teaching aids to advanced technological devices, with their effectiveness depending largely on the teacher's competence in using them. Bell-Gam (2002) highlighted the usefulness of visual and audio-visual aids in achieving objectives. Similarly, Oluwagbohunmi and Abdurraheem (2014) pointed out that they make teaching more practical, learner-centered, and engaging. Beyond facilitating comprehension, instructional materials have a direct impact on students' academic achievement. James (2000), Sani (2017) explained that achievement, often measured through tests, reflects how much a student has learned. Proper use of instructional resources motivates students, sustains interest, enhances retention, and improves their problem-solving abilities.

Despite these benefits, the achievement of secondary school students in biology in Nigeria, and particularly in Gumel, has continued to decline. Many students find biological concepts difficult to grasp when taught without adequate instructional aids, which results in poor comprehension, low interest, and underachievement in examinations. Given biology's central role in preparing students for higher studies and careers in medicine, agriculture, and environmental sciences, this situation raises concern among educators, parents, and policymakers. It is against this background that this study investigates the effect of instructional materials on the achievement of biology students in Gumel, with the aim of determining how

effective use of instructional resources can enhance students' understanding, retention, and achievement in biology

### **Statement of the Problem**

One of the pressing challenges confronting secondary education in Nigeria today is the noticeable decline in students' academic achievement, particularly in the sciences. Gumel, like many other parts of the country, has not been spared from this trend. Despite the centrality of Biology to science education and its relevance to fields such as medicine, pharmacy, agriculture, and biotechnology, students' achievement in the subject has consistently remained unsatisfactory in both internal and external examinations.

Scholars have linked this poor achievement in Biology to a variety of factors. Among these are the lack of adequate instructional materials and facilities for imparting knowledge Enohuan (2015), Sani (2017) inadequate and poorly equipped laboratories, and teachers' reluctance to effectively utilize or improvise instructional resources. Other factors include large class sizes that hinder effective management, insufficient time for practical activities, poor teaching strategies, and in some cases, unqualified or inexperienced teachers handling Biology classes. Poor achievement of students in Biology have been attributed to different factors, by several researchers for instance, Lawal (2009), Atadoga and Lakpini (2013) found that the persistent low achievement in science education were attributed to teachers' instructional strategies such as lecture method in which the learners remain passive while the teacher is always active. These challenges ultimately result in minimal exposure of students to practical experiences, which are crucial for meaningful learning and knowledge retention.

The analysis of recent WAEC results in Biology further underscores the seriousness of this problem, raising national concern about the future of science education in Nigeria. According to James and Pemida (2000), Biology education requires practical engagement through the use of readily available instructional materials, as mere specimen collection and traditional chalk-and-board teaching fail to develop students' scientific attitudes or problem-solving skills. UNESCO (1987–2006) also emphasizes that effective science learning requires interactive strategies that facilitate participatory learning, independent inquiry, and the ability to apply knowledge to real-life situations.

Unfortunately, evidence from both research and classroom practice suggests that Biology teaching in Nigeria, including Gumel, still relies heavily on conventional lecture methods with little or no emphasis on the use of instructional materials. This gap between instructional practice and pedagogical recommendations has contributed significantly to students' low achievement and lack of retention of key Biology concepts.

It is against this backdrop that this study seeks to investigate the effect of instructional materials on the academic achievement of secondary school Biology students in Gumel, with the aim of determining whether their use can improve achievement, retention, and interest in the subject.

## **Objectives of the Study**

The study has the following objectives, to:

1. Investigate effects of the use of instructional materials on the achievement of Biology student's in Gumel.
2. Examine the gender-related effect of instructional materials and achievement of biology students.

## **Research Questions**

1. What is the effect of the instructional material on the academic achievement in biology among students in Gumel Education Zone?
2. What is the effect of the instructional materials on the academic achievement of male and female among biology students?

## **Null Hypothesis**

HO<sub>1</sub>: There is no significant difference in the mean achievement scores of students taught Biology using instructional materials and those taught without instructional materials

HO<sub>2</sub>: There is no significant difference in the mean achievement scores of male and female students taught biology using instructional materials

## **Methodology**

The study adopted the quasi-experimental design, specifically the pre-test, post-test, quasi-experimental and control group design. Pre-test was administered before treatment to measure the students' academic achievement in Biology. The students in the experimental group were taught using Instructional material while those in the control group were taught without instructional material. Treatment lasted for six weeks each.

After the treatment post-test, was administered to both groups to measure their achievement ability of learnt concepts. One instrument were used for data collection, namely, Biology Achievement Test (BPT with a reliability coefficient of 0.88 and BPT is a 40-item multiple-choice test. One hundred and twenty four (104) SS2 Secondary school Biology students constituted the sample for this study and were derived from two (2) co-educational schools sampled from the seventeen (17) public senior secondary schools in Gumel Education Zone. The population of this study is made up of three thousand, four hundred and ninety-six (3255) SS2 Secondary school Biology students in the study area. The data collected were analyzed using Descriptive statistics of Means and Standard Deviations to answer the research questions as well as Independent Sample t-test the null hypotheses at  $p < 0.05$  level of significance. All analyses were done using the Statistical Package for Social Sciences (SPSS) IBM Version 26.

## Result and presentation

**Research Question 1:** What is the difference in the mean academic achievement of students taught biology using instructional materials and those taught using lecture method?

**Table 1: Mean, Standard Deviation Statistics Posttest BPT scores for Students in Experimental and Control Groups**

Group	N	Mean	STD	Mean difference
Experimental	61	15.18	3.75	2.85
Control	63	12.35	2.75	

Table 1: shows that the experimental group recorded a mean of 15.18 and standard deviation of 3.75 while the control group recorded a mean of 12.35 and standard deviation of 2.75. The mean difference of 2.85 shows that the students exposed to instructional materials performed better than those taught using conventional method.

**Research Question 2:** What is the difference in the mean academic achievement of male and female students taught biology using instructional materials?

**Table 2: Mean, Standard Deviation Statistics of Posttest BPT scores for Male and Female Students in Experimental Group**

Gender	N	Mean	STD	Mean difference
Male	34	15.40	3.60	0.40
Female	27	15.00	3.90	

Table 2 shows that the Mean Academic Achievement scores of Male Students in experimental group was 15.40 and standard deviation of 3.60 was observed. Female students in the experimental group also have a mean score of 15.00 with standard deviation of 3.90. The mean difference in achievement is 0.40, this shows that both male and female students have a very close mean achievement when taught Biology using Instructional material.

**H<sub>01</sub>:** There is no significant difference in academic achievement of students taught biology using instructional materials and those taught using lecture method.

**Table 3: t-test analysis of difference in the academic achievement of experimental and control groups.**

Group	N	Mean	S.D	D.F	T - value	P-value	Remark
Experimental	61	15.18	3.75	122	3.51	0.001	Rejected
Control	63	12.35	2.51				

Table 3 shows a p-value of 0.001, observed at degree of freedom of 122. This p-value is less than the 0.05 level of significance, indicating that there is significant difference between the mean achievement scores of Secondary school Biology students taught using Instructional material and their counterparts taught same concept using lecture method.

**H<sub>02</sub>:** There is no significant difference in the academic achievement of male and female students taught biology using instructional materials.

**Table 4: t-test analysis of achievement between male and female students in Experimental group**

Group	N	Mean	S.D	DF	T - value	P-value	Remark
Male	34	15.40	3.60	59	0.41	0.67	Accepted
Female	27	15.00	3.90				

Table 4: shows that the male students recorded a means score of 15.40 with a standard deviation of 3.60 while the female students scores a means of 15.00 with a standard deviation of 3.90. The mean difference is 0.40. The calculated t-value is 0.41 with a p-value of 0.67 indicates that there is no significant difference in the academic achievement of male and female students taught using instructional materials.

### Discussion of Findings

The findings from Tables 1 and 3 revealed that there was a significant difference in the academic achievement of students taught Biology using instructional materials compared to those taught through the conventional lecture method. This shows that instructional materials had a remarkable positive effect on students' achievement. The result agrees with the findings of Munir (2021), Enohuan (2015), and Jafar (2025), who all reported that students exposed to instructional materials performed significantly better than those taught without them. Likewise, Adebule and Ayoola (2015), Ogunmola (2008), and Apondi (2015) found that instructional materials enhance comprehension, simplify difficult concepts, and promote higher achievement.

One major reason for this improvement can be attributed to multisensory engagement. Instructional materials stimulate multiple senses—visual, auditory, and tactile—allowing learners to see, hear, and manipulate objects, which strengthens memory and understanding. This multisensory experience facilitates better cognitive processing and makes learning more meaningful. Furthermore, from a constructivist learning perspective, students actively construct their own understanding by linking new information with prior knowledge through interaction with learning materials. Such hands-on and minds-on activities foster deeper conceptual understanding, encourage curiosity, and sustain learners' motivation. By turning abstract biological ideas into concrete experiences, instructional materials make learning more interactive, enjoyable, and effective.

The study also revealed from Tables 2 and 4 that there was no significant difference in the academic achievement of male and female students taught using instructional materials. This suggests that both genders benefited equally from the use of instructional resources. The finding is consistent with the works of Enohuan (2015), Nwuba and Osuafor (2021), and Jafar (2025), who established that gender has no significant influence on achievement when instructional materials are integrated into teaching. This indicates that the positive impact of instructional materials cuts across gender boundaries, promoting inclusiveness and equity in learning outcomes.

The implications of these findings are far-reaching. First, teacher training programs should incorporate modules that build teachers' competence in designing, selecting, and effectively

using instructional materials. Teachers need both pedagogical and technological skills to integrate these resources meaningfully into their lessons. Second, adequate resource allocation by education stakeholders is essential to ensure that schools are equipped with quality and context-appropriate instructional materials for effective teaching and learning. Third, at the policy level, education authorities should formulate and enforce policies that encourage and standardize the use of instructional materials in classroom practice. Such policies should emphasize innovation, inclusivity, and evidence-based teaching to foster improved educational outcomes nationwide.

Despite these promising results, the study is not without limitations. The treatment period was relatively short, which might not fully capture the long-term effects of instructional materials on student performance. Additionally, the study involved a limited sample size, restricting the generalizability of the findings to other populations or subjects beyond Biology. Future research should therefore explore longer intervention periods, larger and more diverse samples, and other subject areas to provide a broader understanding of the role of instructional materials in improving students' learning experiences.

In conclusion, this study reaffirms that instructional materials significantly enhance students' academic achievement compared to traditional lecture methods, and that gender does not influence achievement when such materials are used. The findings highlight the importance of multisensory and constructivist approaches in classroom instruction and underscore the need for well-trained teachers, adequate resources, and supportive policies to promote effective, equitable, and engaging science education.

### **Conclusions and Recommendations**

The study established that the use of instructional materials in teaching Biology at the Senior Secondary School level significantly enhances students' academic achievement and retention. Students taught with instructional materials consistently performed better than those taught through the lecture method alone, while gender was found not to have any significant effect on achievement when instructional resources were used. This indicates that instructional materials are beneficial to all learners, regardless of gender, and contribute to making abstract concepts clearer, more engaging, and easier to retain.

In view of these findings, it is recommended that the Ministry of Education and school authorities ensure the adequate provision of instructional materials in secondary schools to support effective teaching and learning. Teachers should also be trained and encouraged to integrate these materials into their instructional practices, including improvisation where necessary, as this learner-centered approach has the potential to improve students' interest, participation, and overall achievement in Biology and other science subjects. Furthermore, professional development workshops should be organized to equip teachers with skills in material improvisation and digital instructional tools. Future research should adopt larger samples, extend the duration of intervention, and incorporate modern digital instructional resources to provide deeper insights into the long-term impact of instructional materials on science education.

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