



The Impact of Two Teaching Methods on Secondary School Biology Students' Performance in Zaria, Kaduna State-Nigeria

¹Abdurahaman Mahmud, ²Maryam Abdulkarim, ³Adamu Tairu Arome, ²Abdullahi Sani

¹Federal University of Education, Zaria, Nigeria

²Federal University of Education, Zaria, Nigeria,

³Kaduna State Ministry of Education, Zaria, Nigeria

ABSTRACT

This study compared the effects of lecture and demonstration teaching methods on Biology students' performance in Zaria, Kaduna State, Nigeria, using a quasi-experimental design with 161 purposively selected SS1 students from 15 secondary schools. The Biology Performance Test (BPT) instrument demonstrated high reliability ($r=0.849$) through Pearson correlation analysis. Results from pre-test/post-test assessments analyzed via descriptive statistics and independent t-test revealed that students taught with the demonstration method significantly outperformed their lecture-taught counterparts ($p<0.05$), showing better conceptual understanding and problem-solving skills, while the lecture method primarily emphasized theoretical report-writing. The study recommends adopting demonstration techniques and further investigation of other active learning strategies across different student age groups.

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INTRODUCTION

Developing students' interest in science and technology is the goal of scientific education. Biology is now a core science subject in secondary school curricula according to the updated national education policy. Teachers are expected to figure out how to get students interested in science and science-related fields so they can take science courses at higher educational levels. Calls for innovations and reforms to raise science education in Nigeria to international standards have been made repeatedly during the past 20 years. This implies that there are problems with Nigerian science education that require attention. In order to accomplish reform and innovation for progress, science education has included a number of current advances in the field of education.

Through observation, classification, experimentation, measurement, inference, data organisation, and other processes, science should influence students during the educational process. Science education, according to Dabah (2016), is the study of the relationship between science as a

field and the use of educational principles to understand scientific instruction and learning in the classroom. As a result, science classes introduce pupils to some fundamental concepts. One of the science courses taught in Nigerian senior secondary schools is biology, which is defined as the study of plants and animals (Michael, 2015). It is one of the scientific courses taken for the General Certificate in Education (GCE), Senior School Certificate Examination (SSCE), etc.

Many Nigerian secondary school pupils who enrolled in these science courses did not do well on external exams (Ikitde & Edet, 2013; Okoli & Azubuike, 2012). According to Okenze (2016), teaching is the act of transferring knowledge to a student. In order for students to be able to relate scientific ideas and theories to actual applications and practices in the world they live in, biology teachers must provide the appropriate accommodations for their active engagement in the learning process. A teacher can use a variety of techniques to impart knowledge, skills, and other skills to students during the teaching and

Corresponding author: Abdurahaman Mahmud

✉ dalhatmahmud384@gmail.com

Federal University of Education, Zaria, Nigeria.

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learning process. Better learning outcomes result from an enriched learning environment created by an effective instructional technique (Uche & Awujo, 2014). It is thought that when the interactive process is tailored to each student's unique learning preferences, learning occurs most effectively.

Every student has a unique learning style, and the role of the instructor is to determine these types and develop instructional tactics that correspond with the chosen learning styles to improve the teaching and learning process. A traditional lecture style frequently involves a face-to-face, teacher-centered manner. Berry's Capacity (2008). Achounye (2017) asserts that the demonstration approach is a useful teaching strategy. Teachers, trainers, and lecturers continue to use lecturing as one of the more common ways to spread knowledge and concepts. As audience members and students, we are well acquainted with the methodology.

Depending on the topic's fascinating nature, the presenter's style, and the message's clarity, lectures can be overwhelming, dull, or educational. The lecture approach typically only allows for one-way communication and little to no audience participation. In practice, it means that a lecturer is giving a talk to a crowd. With this teaching approach, a group of students participates in an oral presentation by the presenter or instructor. When using the demonstration method, the instructor will perform a show or display for the class to observe. Usually, it entails demonstrating a technique to pupils and demonstrating how to utilise scientific equipment correctly. The demonstration method is particularly helpful when it comes to attitudes and skills. Given the aforementioned, the purpose of this study was to investigate how biology is taught in the classroom using two different teaching modalities: lectures and demonstrations. The goal was to ascertain how each method affected the learning outcomes of senior secondary school students at Zaria, Kaduna State-Nigeria.

The majority of teachers are unaware that different students process and comprehend material in the classroom in different ways. The ongoing low academic performance of students is

attributed to teachers' incapacity to recognise individual differences among students during the teaching-learning process. While many researchers have found that poor teaching strategies, lack of science textbooks, inadequate science teachers, and inadequate laboratory equipment are some of the factors that contribute to students' ongoing failure in schools (Ikite & Edet, 2013; Okoli & Azubuike, 2012), learning style is one of the factors that is often overlooked. Effective teaching techniques for science courses, such as guided inquiry, demonstration, and lectures, must be balanced with each student's unique learning preferences (Visual Nermal, Active/Reflective, Sensing/Intuitive, and Sequential/Global) in order to address these issues. It is thought that good teaching and learning would result from striking a balance such that every student is taught in a way that suits them. In light of this, the researchers aims to examine how instructional styles affect secondary school Biology students' academic performance in Zaria, Kaduna State – Nigeria.

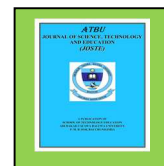
Objective of the Study

The specific objective of the study is to determine the mean difference in the performance of students taught Biology concepts using demonstration and lecture method.

LITERATURE REVIEW

The effectiveness of teaching methods significantly influences students' academic performance in biology. Research has shown that the demonstration method, which involves teachers actively showing processes and concepts, enhances students' understanding and retention of biological concepts. This method allows students to observe and engage directly with the material, leading to improved academic outcomes. For instance, a study found that students taught using demonstration methods performed better in biology assessments compared to those taught using traditional lecture methods (Renniza, 2023).

Conversely, the lecture method, characterized by teacher-centered instruction with minimal student interaction, has been associated



with lower student engagement and comprehension in biology. Students often struggle to retain information presented solely through lectures, leading to poorer academic performance. A study highlighted that reliance on lecture-based teaching resulted in lower achievement levels among biology students (Onasanya & Omosewo, 2011).

Furthermore, the availability and utilization of laboratory facilities play a crucial role in enhancing the effectiveness of teaching methods. Hands-on practical activities in well-equipped laboratories complement demonstration methods, leading to a deeper understanding of biological concepts. Research indicates that students with access to functional laboratory facilities exhibit better academic performance in biology (Nelson & Vincent, 2023). Incorporating visual instructional materials alongside demonstration methods has also been found to positively impact students' academic performance in biology. These materials cater to visual learners and help in simplifying complex biological processes, making them more comprehensible. A study demonstrated that the use of visual aids in teaching biology resulted in higher student achievement (Onasanya & Omosewo, 2011).

Moreover, the development and utilization of offline electronic modules have emerged as effective instructional strategies in biology education. These modules provide interactive and self-paced learning opportunities, enhancing students' understanding and retention of biological concepts. Research has shown that students using offline e-modules perform better in biology assessments (Rocky et al., 2022). E-modules, being one of the instructional materials utilized in the new normal, were characterized by Ghazali et al. (2020), Wijaya and Vidiarti (2020), Rini et al. (2020), Mulhayatiah et al. (2019), and Linda et al. (2020) as beneficial learning materials due to their multimedia and interactive elements.

Nevertheless, the instructional material's effectiveness, validity, and acceptability lie in its quality. In this regard, Chia et al. (2017), Kurt (2020), Tomlinson (1998, as cited in Marjanovikj-Apostolovski, 2019), and Hainsworth and Keyes (2016) all outlined essential

considerations in creating effective, valid, and acceptable e-modules. The concepts and ideas from these studies were taken into account in the development of an offline e-module, though this study differed in terms of mode (offline), subject matter (DISS), and context (new normal).

As education has increasingly embraced digital modalities, the role of teachers has also evolved. While the new normal does not necessarily require their physical presence, teachers remain integral to the learning process (Saxena, 2020; Patterson, 2020; Ferri et al., 2020). However, Mayol (2020), Plitnichenko (2020), and the Canadian Commission (2020) acknowledged that adapting to these new roles presents significant challenges for educators, particularly as digital education becomes more prevalent. This underscores the importance of equipping teachers with the knowledge and skills necessary for selecting and developing digital instructional materials that align with their instructional roles in the new normal.

In summary, adopting interactive and student-centered teaching methods, such as demonstrations complemented by visual aids and practical laboratory activities, significantly enhances secondary school students' performance in biology. Educators are encouraged to integrate these strategies to improve learning outcomes in biology education.

METHODOLOGY

This study adopted a quasi-experimental research design to compare the effectiveness of the demonstration and lecture methods in teaching Biology. Two groups were randomly assigned: one was taught using the demonstration method, while the other received instruction through the lecture method. At the end of the instructional period, both groups were tested on the same topics, and their results were analyzed to determine the relative effectiveness of the two teaching methods. According to Tuchman (1975), this design is useful for comparing the scores and means of two groups in pre-test and post-test conditions, ensuring that differences in performance can be attributed to the teaching methods. The experimental group (EG) received

the treatment (demonstration method), while the control group (CG) was taught using the lecture method. The research design can be summarized as follows:

Group 1 (EG): 01 → X1 → 02

Group 2 (CG): 01 → X2 → 02

Where:

01 = Pre-test measurement, 02 = Post-test measurement, X1 = Demonstration method, X2 = Lecture method.

The study population comprised 18,245 SS1 Biology students from 16 senior secondary schools in Zaria during the 2018/2019 academic session. These students, aged 14-16, were familiar with the school environment, laboratories, and instructors. From this population, a sample of 161 students was selected through a simple random sampling technique. Two schools were chosen: Government Girls Secondary School, Pada, with an intact class of 90 female students, and Barewa College, Zaria, with an intact class of 71 male students. A multiple-choice objective test, the Biology Performance Test (BPT), was used as the research instrument. The BPT consisted of 30 multiple-choice questions drawn from the first-term SS1 Biology curriculum, covering topics such as characteristics of living things and sensory receptors. Questions were adapted from past WAEC and NECO examinations (2009-2015). To ensure validity, the test items and lesson plans were reviewed by experts in the Department of Biology, Federal University of Education, Zaria.

Data collection lasted five weeks, during which a pre-test was administered to both groups before instruction. The experimental group was taught using the demonstration method, while the control group received instruction through the lecture method. Teaching lasted ten weeks, with both groups receiving an equal number of lessons from experienced Biology teachers trained by the researcher. A post-test was conducted at the end of the treatment period, and the results were analyzed to compare the performance of students in both groups. Research assistants aided in data collection, ensuring the reliability of the process.

RESULTS AND DISCUSSION

The paper contains the result and analysis of data collected and were used to answer the research questions and test the null hypothesis for the study. The data were collected from both pre and posttest group for both demonstration and lecture method. Accordingly, four instruments were used for the collection of data. Statistical Package for Social Sciences (SPSS version 16.0) was used to analyze the data at two different levels, viz: descriptive and inferential levels. Mean and standard deviation were used for descriptive analysis and t-test for inferential analysis. All the analysis for inferences were done based on alpha (α) value of 0.05. Findings and discussion of the result were also discussed.

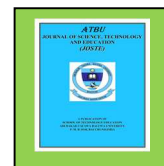
Table 1: Age of Respondents

Option	Frequency	Percentages
less than 13 years	42	26.09
13 years	52	32.30
14 years	30	18.63
15 years	18	11.18
More than 15 years	19	11.80
Total	161	100.00

Source: Field Work, 2019

Table 1 reveals the age of the respondents, the result shows that forty-two

respondents representing 26.09% of the respondents age is less than 19 years, fifty two respondents out of our total sample representing



32.30% have 19 years. Thirty respondents out of our total sample representing 18.63% have 14 years. Eighteen respondents out of our total sample representing 11.18% have 15 years.

However, nineteen respondents of our total sample size representing 11.80% of the respondents have more than 15 years.

Table 2: School of Participants

Option	Frequency	Percentages
GGSS Pada, Zaria Barewa College, Zaria	90	55.90
Barewa College, Zaria	71	44.10
Total	161	100.00

Source: Field Work, 2019

Table 2 reveals the study mode of participants, the result shows that ninety respondents representing 55.90% of the respondents are from GGSS Pada Zaria while seventy one participants out of our total sample representing 44.10% are from Barewa College, Zaria.

Answer to the Research Questions

This section presented the answers to the research question on below. In answering research questions, mean score performance of

students in both experimental and control groups were used to answer research questions. T-test statistical tool using pair-sample mean was adopted to test the significant effect of the two approaches.

Research Question One: What is the mean difference in the performance of students taught Biology concepts using demonstration method and those taught using¹ lecture method? This question was answered by the descriptive statistic presented in table 3 below:

Table 3: Descriptive statistics for pre- test result on difference in the performance of students with difference learning taught Biology concepts using demonstration method and those taught using lecture method.

Group	N	Mean	Sd	Mean diff
Pre-Demonstration Method	71	23.41	12.12	1.11
Pre-Lecture Method	90	24.52	15.95	

In Table 4 the result revealed calculated mean scores and standard deviation of the pre demonstration and lecture method respectively. The result revealed that students in the demonstration group have mean performance of 23.41 and standard deviation of 12.12 while the pre lecture method students have mean performance of 24.52 and standard deviation of 15.95. The mean difference between the two groups is about 1.11. This result revealed that those students in pre lecture group slightly perform better than demonstration group in terms of scoring.

Test of Null hypothesis

A null hypothesis was tested using analysis of T-test (one sample T-test) as statistical tools at 0.05 levels of significance as follows:

Null Hypothesis one: h_{01} : There is no significant differences between mean in the performance of students taught Biology concepts using Demonstration Method and those taught using¹ Lecture Method. To test the null hypothesis one T-test and sig. values were used.

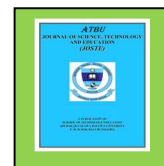


Table 4: Pair sample t-test for significant differences between demonstration method and lecture method.

Group type	N	Std	Mean	Df	teal	P value	Remark
Demonstration Method	71	39.24	14.97	159	4.011	0.001	Significant
Lecture Method	90	33.33	15.94				

Significant at $P < 0.05$

Table 4 revealed the t-test analysis of significant difference between demonstration method and lecture method students' performance. The t-value from the table at a 95% confidence interval is 1.671. Since the calculated t-value (4.011) is less than the tabulated t-value at a 95% confidence interval; calculated $P = 0.001$ is also less than $P = 0.05$ therefore, there is significant difference between the groups. Therefore, we conclude here that there is significant difference between the demonstration method and lecture method in Biology in senior secondary schools, Zaria. Therefore, we conclude here that there is no statistical difference between the ages of lecture group students' Performance in Biology

DISCUSSION OF FINDINGS

The study also revealed that demonstration method was effective in learning concepts in economics among secondary school students in Zaria Secondary Schools. This study was in the agreement with Dantani (2012), Bisht (2012) and Umar, Datida and Mutah (2016) who reported that, teacher demonstration method was effective in learning chemistry subject in secondary schools in Zaria. Achimugu (2018) was in consulate that, demonstration method was effective in learning science subject. He reported that, students performed better results and teachers were encouraged to use more of demonstration method while learning some selected concepts in science. The finding of this study is in support of the finding of Okocha (1994) who reported that demonstration method was more effective in learning physic concepts. This showed that, demonstration method was more effective than the lecture method. This is in line saying there is a great level of significant difference between the two methods of teaching, from the mean scores of achievements, we

conclude that students taught using practical approach were great achievers.

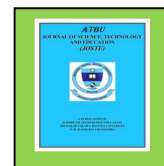
At the end of this research work it was found that even though lecture method and Demonstration methods are the same in some aspect of teaching method, students learning Biology concepts improves their academics performance after teaching and learning using demonstration than lecture methods. When the two methods were compared, demonstration method was more effective in improving students' academic performance than lecture method. The study was also able to identify some areas that need improvement in teaching/learning Biology. It was observed that the teachers interest influence that of the students interest. All the students involved in the study showed interest in the study, especially the demonstration method groups in both schools, became enthusiastic and even wanted to continue with the study after completion of the course.

CONCLUSION

The study found that students demonstrated greater academic achievement in Biology when taught utilising the demonstration method rather than the usual lecture method. This shows that hands-on, interactive teaching approaches boost students' knowledge and recall of biological ideas more effectively than passive learning tactics. Additionally, the study indicated that younger students earned superior academic success when taught utilising the demonstrative method compared to their older counterparts. This implies that age may play a factor in students' capacity to comprehend and remember scientific knowledge through interactive teaching methods.

LIMITATION & FURTHER RESEARCH

The research was conducted within a specific geographical area and focused on a



select group of students and teachers. As a result, the findings may not be fully generalizable to other regions with different educational environments, curricula, or student demographics.

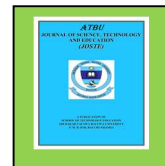
FUTURE RESEARCH RECOMMENDATIONS

Based on the conclusions drawn from this study, the following recommendations for future research are suggested:

1. Future research should explore the effectiveness of various teaching methods, including demonstration, inquiry-based learning, and multimedia-assisted instruction, across different age groups in secondary schools.
2. A longitudinal study should be conducted to examine the long-term effects of the demonstration method on students' retention of biological concepts and overall academic performance.

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