



EFFECTS OF AUDIOVISUAL TECHNOLOGY ON SENIOR SECONDARY SCHOOL STUDENTS' LEARNING OUTCOMES IN BIOLOGY IN EKITI STATE.

BY

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Abstract

The study investigated the effects of Audiovisual Technology on the learning outcomes of Senior Secondary School students in Biology in Ekiti State. It also assessed the influence of Audiovisual Technology on students' performance and attitude compared to conventional teaching methods. A quasi-experimental research design was employed. The population comprised 12,690 SS II students from 206 public secondary schools, with a sample of 140 students selected through a multistage sampling procedure. Data were collected using the Biology Performance Test (BPT) and Students' Biology Attitudinal Scale (SBAS). The instruments were validated by experts in Biology Science Education and found reliable with coefficients of 0.87 and 0.88 respectively. The study lasted eight weeks, and data were analyzed using mean, standard deviation, and t-test at 0.05 level of significance. Findings revealed that students exposed to Audiovisual Technology significantly outperformed those taught via conventional methods in performance and attitude. It is recommended that teachers integrate Audiovisual Technology into Biology instruction to enhance active learning and promote better understanding of biological concepts.

Keywords: Audiovisual tools, Learning Outcomes, Secondary School Students, Science Students

Introduction

Education is the bedrock of any society, serving as the foundation upon which individuals and nations build their future. It serves as a bridge for transferring knowledge, values, and skills across generations. It is a powerful tool for shaping minds, promoting critical thinking, and driving national development. Ayeni (2020) highlighted that education came into existence through the agitations from societal beliefs, needs and values. The national goals of education in Nigeria according to the National Policy on Education (NPE, 2014) include the building of a free and democratic society, a just and egalitarian society, a united, strong, and

self-reliant nation, a great and dynamic economy, and a land full of bright opportunities for all citizens. In line with the Nigerian philosophy of education, it is believed that education is an instrument for national development. Consequently, the formulation of ideas, the education for national development, and the interaction of persons and ideas are all essential aspects of education. These components collectively improve the worth and development of the individual, ensuring that every citizen contributes meaningfully to the growth and progress of the nation. Education, therefore, is not only a tool for intellectual development but also a

catalyst for shaping responsible, productive, and patriotic citizens.

One of the most critical aspects of education is scientific knowledge, which is fundamental to modern development. Science equips individuals with the ability to understand, manage, and efficiently utilize the natural environment's resources. Ayeni (2020) explained, science has become such an indispensable tool that no nation, developed or developing can afford to relegate its study in schools. Science emphasizes evidence-based decision-making, relying on empirical data and rigorous experimentation. In this era of misinformation and fake news, science provides a credible and objective source of knowledge that informs public policy, regulations, and individual choices. Science education, therefore, involves not just the content knowledge of subjects like Biology, Chemistry, and Physics, but also the use of effective teaching methods that make scientific knowledge accessible and meaningful to students. When taught properly, science helps students develop skills to analyze, evaluate, and apply knowledge in solving real-life problems, making them better equipped to contribute positively to their communities and the larger society.

Biology, as a branch of science, focuses on the study of living organisms and their interactions with the environment, from molecular mechanisms within cells to the behaviors of entire ecosystems. Nwuba, Egwu, Awosika, and Osuafor (2022) defined biology as the branch of science that studies plants and animals in their environment. Biology

encompasses a vast range of topics, from molecular mechanisms within cells to interactions within ecosystems (Campbell et al., 2022). However, certain concepts within the biology curriculum are perceived as abstract and challenging by students. For instance, Etobro and Fabinu (2017) identified topics such as nutrient cycling in nature, ecological management, and conservation of natural resources, pests and diseases of crops, and the reproductive system in plants as particularly difficult for senior secondary school students in Lagos State. This and other similar findings highlight the need for innovative instructional strategies to enhance the teaching and learning of complex biological concepts.

Also, the need for effective Biology education in Nigeria is very important and so demands considerable attention. One of the major issues that bother Biology students in Nigeria is their academic performance. Poor academic performance of students in internal and external examinations is a reflection of the problems and challenges facing the educational system in Nigeria (Bichi, 2019). Due to the complex nature of Biology as a subject, students seem to have difficulties in learning and understanding basic concepts and their alternative conceptions which seems to be part of the causes of poor academic performance in Biology. The results of the West African Senior School Certificate Examination (WASSCE) from 2019 to 2023 in Ekiti State, as shown in the table below, clearly demonstrate the performance of students in this subject.

Table 1: Students' Performance in Biology in WASSCE between 2019 and 2023

Year of Exam	Total No. of Candidates	A1-B3	%	C4-C6	%	D7-E8	%	F9	%	% Pass	% Fail
2019	6691	744	11	3200	48	1657	25	1060	16	58	41
2020	6022	1622	27	3108	52	668	11	624	10	79	21

2021	5641	1120	20	3333	59	761	13	427	8	79	21
2022	2499	491	20	1509	60	185	7	314	13	80	20
2023	5563	824	15	3098	56	1069	19	572	10	71	29

Source: Ministry of Education, Planning, Research and Statistics Department, Ekiti State (2024)

Table 1 highlights a concerning trend in the West African Senior School Certificate Examination (WASSCE) Biology results in Ekiti State from 2019 to 2023. While the overall performance appears somewhat promising, a closer analysis reveals a fluctuating pattern. Only a small percentage of students ranging from 12% to 27% scored between A1 and B3. Although a significant number of students achieved credit passes (C4, C5, and C6), the percentage of students scoring D7 and E8—though lower—still indicates gaps in the mastery of the subject. These days, most university admission requires an aggregate grade between A1 and B3 for Biology, and going by the analysis of the results presented in Table 1, it implies that many of these students would not qualify for admission due to their grade as a greater percentage of these students had credit passes. This suggests that a majority of students struggle with understanding Biology, possibly due to ineffective teaching methodologies, which remains a major challenge in education. Furthermore, the inconsistency in failure rates over the years highlights the need for improved instructional strategies and stronger student support systems to enhance learning outcomes and academic performance.

One effective approach to improving Biology instruction is the integration of audiovisual technology, which enhances comprehension by combining visual and auditory stimuli to reinforce learning. Audiovisual materials such as animations, instructional videos, and interactive simulations actively engage learners by stimulating both sight and hearing, thereby making learning experiences more dynamic and memorable. These tools play a crucial role in capturing and sustaining students' interest, improving

their attitudes toward Biology, and fostering deeper understanding of complex and abstract concepts. Kassa, Azene, Mengstie, and Ferede (2024) reported that the use of multimedia and dynamic classroom-integrated instruction significantly improves students' academic achievement in Biology by simplifying abstract ideas and promoting interactivity. Similarly, Ibe and Abamuche (2019) emphasized that the incorporation of audiovisual technology transforms students' learning experiences by making abstract concepts more concrete and engaging, thereby enhancing student participation and achievement. These findings underscore the importance of adopting modern instructional strategies not only to improve academic outcomes but also to stimulate long-term interest in Biology. Through the effective use of audiovisual technology, teachers can create immersive learning environments that promote meaningful understanding and long-term retention.

Students' attitudes toward Biology constitute another critical factor influencing learning outcomes. Attitude is often shaped by prior learning experiences, the availability of instructional resources, and the teaching methods employed in the classroom. Many students develop negative perceptions of Biology due to challenges such as complex terminologies, difficulty in visualizing biological structures, and the lack of practical demonstrations. Ahmed (2025) suggests that students' attitudes toward science are influenced by teaching methods, availability of instructional resources, and prior experience with the subject. When instruction relies solely on textbook explanations without the use of visual or interactive aids, Biology is often perceived as abstract and difficult. Audiovisual technology can address these challenges by bringing biological

processes and structures to life, thereby making learning more relatable and accessible. In support of this view, Olusola-Fadumiye and Aderemi (2024) found that engaging learning environments significantly influence students' participation and academic performance. The adoption of audiovisual instructional strategies can therefore foster positive attitudes toward Biology by creating dynamic classroom environments that encourage curiosity and enthusiasm.

The persistent challenges in students' performance are further corroborated by the Chief WAEC examiners' reports for 2022 and 2023. The 2022 report indicated that candidates experienced difficulties in defining biological terms, explaining key concepts such as transpiration, and drawing or labeling diagrams accurately. These weaknesses point to inadequate conceptual understanding and poor visualization skills. Similarly, the 2023 report identified problems such as incorrect spelling of biological terms, poor interpretation of examination questions, difficulty in solving

genetic problems like Punnett squares, confusion between somatic and reproductive cells, and challenges in organism classification. These recurring weaknesses suggest that many students struggle with both theoretical understanding and practical application of biological knowledge.

Given the persistent poor performance in Biology in Ekiti State, there is a compelling need to investigate instructional approaches that can enhance students' learning outcomes. The integration of audiovisual technology into Biology teaching holds considerable promise for improving students' academic performance and attitudes toward the subject. By presenting biological concepts through videos, animations, and other multimedia resources, audiovisual technology can bridge the gap between abstract ideas and real-life applications, thereby making learning more meaningful and effective. This study therefore seeks to examine the effects of audiovisual technology on the learning outcomes of senior secondary school Biology students in Ekiti State, with particular emphasis on academic performance and attitude toward learning Biology.

Purpose of the Study

The purpose of this study is to examine the effects of audiovisual technology on the learning outcomes of biology students in Ekiti State. Specifically, the study aims to:

1. determine the performance of senior secondary school students in Biology with the use of audiovisual technology.
2. determine the effects of audiovisual technology on students' attitude towards Biology.

Research Questions

The following research questions were raised to guide the study:

1. What is the impact of audiovisual technology on students' performance in Biology?

2. What is the influence of audiovisual technology on students' attitude toward Biology?

Research Hypotheses

The following null research hypotheses were formulated in this study:

1. There is no significant difference in the pre-test performance of students in the experimental and control groups.
2. There is no significant difference in the post-test performance of students in Biology in the experimental and control groups.
3. There is no significant difference in the pre-attitudes of students in the experimental and control groups.

4. There is no significant difference in the attitude of students exposed to audiovisual technology and those exposed to conventional method in Biology.

METHODOLOGY

The study employed pre-test and post-test quasi experimental design. The population of the study consisted of all 12, 690 Senior Secondary School two (SSS II) Biology students in all the 206 public Secondary Schools in Ekiti State. The sample for the study was 140 SSS II Biology students selected through multistage sampling procedure. The first stage involved the selection of one senatorial district from the state through simple random sampling technique. The second stage involved the selection of two Local Government Areas from the selected senatorial district using simple random sampling technique. The third stage involved the selection of two public senior secondary schools from each of the selected Local Government Areas using stratified sampling technique (based on location) and purposive sampling technique for the selection of two public senior secondary schools from the selected four public schools that have audiovisual technology tools.

The two research instruments used for this study, namely: "Biology Performance Test" (BPT) and "Students Biology Attitudinal Scale" (SBAS) were designed by the researcher. The instruments were validated for face and content validity by lecturers in Science Education (Biology), Tests, Measurement and Evaluation experts within Faculty of Education, Ekiti State University, Ado-Ekiti, and experienced WAEC examiners. The reliability of the instrument was determined through test re-test reliability method. The scores obtained for BPT

were analyzed using Pearson's Product Moment Correlation, which yielded a reliability coefficient of 0.87. The internal consistency of the Student Biology Attitudinal Scale was determined using Cronbach's Alpha, which produced a coefficient of 0.88 at the 0.05 level of significance. Based on the consistency of these results, the instruments were considered reliable for the study.

Audiovisual Technology instructional package for the experimental group included lesson plans, Audiovisual Technology tools, practical demonstrations, and assessment tools designed to guide teachers in integrating Audiovisual Technology into classroom instruction. The control group was taught using conventional method. The research procedure were in three stages; pre-treatment stage (one week), the Biology Performance Test (BPT) and Students Biology Attitudinal Scale (SBAS) were administered, the treatment stage (six weeks), the experimental group were taught using Audiovisual Technology while the conventional group were taught without Audiovisual Technology, and the post-treatment stage (one week), the same Biology Performance Test (BPT) and Students Biology Attitudinal Scale (SBAS) were administered. Eight weeks were used altogether for the whole study. Data collected were analyzed using descriptive statistics such as means, standard deviation, and bar-chart to answer the research questions while inferential statistics of t-test was used to test the hypotheses. All the hypotheses generated were tested at 0.05 level of significance.

Research Question 1: What is the impact of audiovisual technology on students' performance in Biology?

Table 2: Performance Mean Scores and Standard Deviation of Students in Experimental and Control Groups Respectively

Group	N	Pretest		Posttest		Mean Difference
		Mean	SD	Mean	SD	
Experimental	69	5.43	1.93	9.90	1.926	4.47
Control	71	5.45	1.96	6.23	2.514	0.78

Table 2 shows the mean and standard deviation of the performance mean scores of students exposed to Audiovisual Technology and conventional methods of teaching Biology before and after treatment. Information contained in Table 2 shows that students in the experimental and control groups had pretest mean scores of 5.43 and 5.45 and standard deviation of 1.93 and 1.96 respectively prior to treatment. It appears that the groups are homogenous prior to the treatment. On exposure to treatment, students taught with Audiovisual

Technology had the higher posttest mean score of 9.90 with a standard deviation of 1.93, while those students in the control group had posttest mean score of 6.23 with a standard deviation of 2.51. This implies that the use of Audiovisual Technology appears to be more effective than the conventional method in enhancing the performance of students in Biology. Students' performance in Biology before and after treatment is represented in Figure i

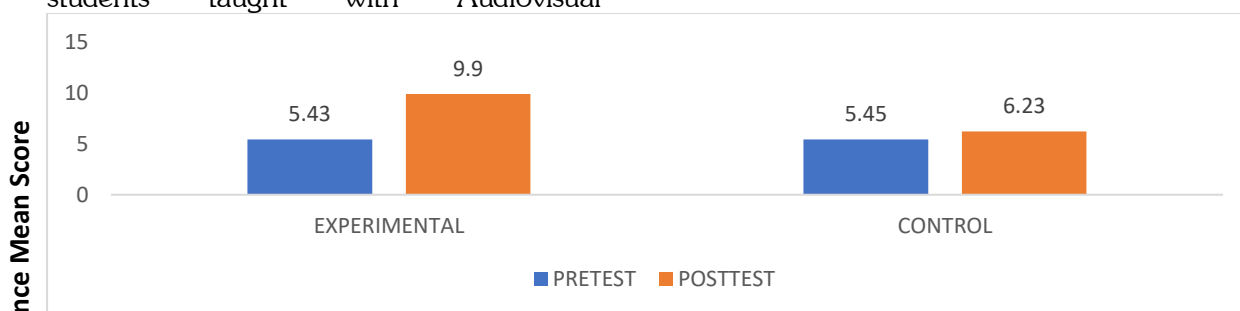


Figure i: Bar Chart Representation of Performance Mean Scores of Students in Experimental and Control Groups Respectively.

Research Question 2: What is the influence of Audiovisual Technology on students' attitude toward Biology?

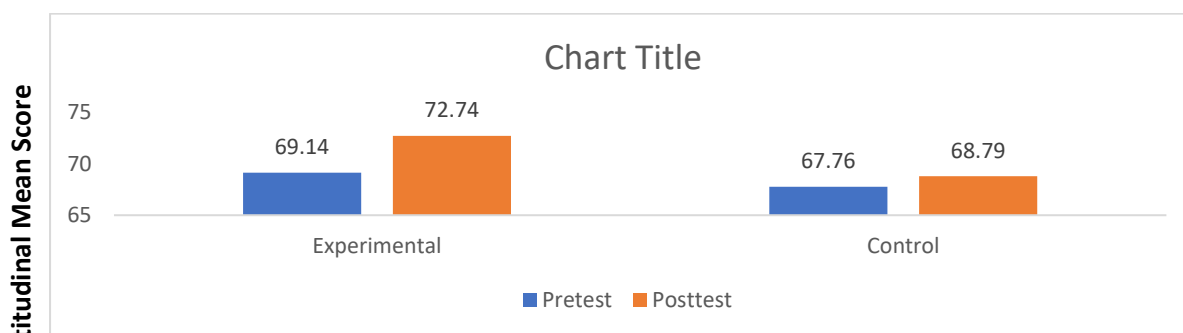
Table 3: Attitudinal Mean Scores and Standard Deviation of Students in Experimental and Control Groups Respectively.

Group	N	Pretest		Posttest		Mean Difference
		Mean	SD	Mean	SD	
Experimental	69	69.14	7.64	72.74	4.81	3.60
Control	71	67.76	7.56	68.79	9.53	1.03

Table 3 shows the mean and standard deviation of students' attitudinal mean scores exposed to Audiovisual Technology and conventional method of teaching Biology before and after treatment. Prior to treatment, results in Table 3 show that students in the experimental and control groups had pre-attitudinal mean scores of 69.14 and 67.76 with standard deviation of 7.64 and 7.56 respectively. After exposure to treatment, students exposed to Audiovisual Technology recorded a higher post-attitudinal mean score of 72.74 with a standard deviation of 4.81, while students in the control

group had a post-attitudinal mean score of 68.79 and a standard deviation of 9.53. The mean gain scores indicate that the experimental group achieved a greater improvement in the attitude (mean gain = 3.60) compared to the control group (mean gain = 1.03). This signifies that Audiovisual Technology was more effective in improving students' attitudes towards Biology than the conventional method used in the control group. Students' attitude towards Biology before and after treatment is represented in Figure ii.

Figure ii: Bar Chart Representation of Attitudinal Mean Scores of Students in Experimental and Control Groups Respectively



Testing of Hypotheses

Hypothesis 1: There is no significant difference in the pre-test performance of students in the experimental and control groups respectively.

Table 5: t-test summary of Pretest Mean Scores of Students in Experimental and Control Groups Respectively.

<i>Experimental</i>	69	5.43	1.96	138	-0.48	0.961
<i>Control</i>	71	5.45	1.93			

$p > 0.05$ (Not Significant)

Table 4 presents the paired sample t-test comparing the academic performance of students in the experimental group and the conventional group before the treatment in Biology. It shows that ($t_{138} = -0.48, p > 0.05$). Since the p-value is greater than 0.05, the hypothesis is not rejected. This implies that there is no significant difference in the pre-test mean scores of students in experimental and control groups. This shows that the

two groups were homogeneous at the commencement of the experiment.

Hypothesis 2: There is no significant difference in the post-test performance of students in Biology in the experimental and control groups. To test Hypothesis 2, posttest mean scores of students in experimental and control groups were computed and compared for statistical significance using t-test at 0.05 level. The result is presented in Table

Table 5: t-test summary of Post-test Mean Scores of Students in Experimental Control Groups

Group	N	Mean	SD	Df	T	P
<i>Experimental</i>	69	9.90	1.93	138	9.685	0.000
<i>Control</i>	71	6.23	2.51			

$p < 0.05$ (Significant result)

Table 6 presents the paired sample t-test comparing the academic performance of students in the experimental group and the conventional group after treatment in Biology. The result above shows that ($t_{138} = 9.685, p < 0.05$). Since the p-value is less than 0.05, the hypothesis is rejected. This indicates that there is a significant difference in the performance mean scores of students in the experimental and control groups after treatment. It further shows that students

in the experimental group performed better than those in the control group.

Hypothesis 3: There is no significant difference in the pre-attitudes of students in the experimental and control groups. To test Hypothesis 3, pre-attitudinal mean scores of students in the experimental group and those in the control group were computed and compared for statistical significance using t-test at 0.05 level. The result is presented in Table 7.

Table 6: t-test summary of Pre-Attitudinal Mean Scores of Students in Experimental and Control Groups Respectively.

<i>Group</i>	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>df</i>	<i>T</i>	<i>P</i>
<i>Experimental</i>	69	69.14	7.64	138	1.078	0.283
<i>Control</i>	71	67.76	7.56			

$p > 0.05$ (Not Significant)

The result in Table 7 shows the paired sample t-test comparing the attitudinal mean scores of students in the experimental group and the conventional group before treatment in Biology which shows that ($t_{138} = 1.078$, $p > 0.05$). Since the p-value is greater than 0.05, the null hypothesis was not rejected. This indicated that there is no significant difference in the pre-attitudinal mean scores of students in the experimental

and control groups. In other words, the two groups began the study with the similar level of attitude, showing that their attitudes were the same at the commencement of the study.

Hypothesis 4: There is no significant difference in the attitude of students exposed to audiovisual technology and those exposed to conventional methods in Biology.

Table 7: t-test summary of Post-Attitudinal Mean Scores of Students in Experimental and Control Groups Respectively.

<i>Group</i>	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>Df</i>	<i>T</i>	<i>P</i>
<i>Experimental</i>	69	72.74	4.81	138	2.528	0.013
<i>Control</i>	71	68.79	9.53			

$p < 0.05$ (Significant result)

The result in Table 8 shows that ($t_{138} = 2.528$, $p < 0.05$). Since the p-value is less than 0.05, the hypothesis is rejected. This indicated that there is a significant difference in the post-attitudinal mean scores of students in the experimental and control groups. This implies that the treatment had a positive effect on the attitude of students in the experimental group compared to those in the control group.

Discussion

Findings from this study indicated that both the control and experimental groups had similar low performance levels in the pretest. This suggests that both groups were homogeneous at the commencement of the experiment which the researcher believes might be linked to the general ineffectiveness of the traditional teaching methods often used in science classes, including Biology. As a result, any notable difference observed later can be attributed to the specific interventions applied, rather than mere chance.

The findings further revealed that students taught Biology using Audiovisual Technology performed significantly better than those taught using the conventional method. This suggests that the use of Audiovisual Technology was effective in enhancing students' academic performance in Biology at the secondary school level. This result aligns with the findings of Asuzu and Okoli (2019), who reported that students exposed to multimedia-integrated instruction outperformed their counterparts taught through traditional approaches. Their study also emphasized the need for increased teacher training and stronger government support to promote the use of multimedia resources in science classrooms.

It is noteworthy, however, that there was no significant difference in the pre-attitudinal scores of students in the experimental and control groups, indicating that both groups commenced the study with similar attitudes toward Biology.

However, the significant difference observed in the post-attitudinal scores after the treatment highlights the effectiveness of Audiovisual Technology in improving students' attitudes toward the subject. This improvement may be attributed to the use of audiovisual instructional materials, which made Biology lessons more concrete, engaging, and easier to understand, thereby stimulating students' interest and positive disposition toward learning Biology compared to the conventional teaching approach. This finding is in line with the study of Olu-Ajayi (2016), who reported that the use of audio-visual aids in Biology instruction significantly enhanced students' learning outcomes and interest in Biology, particularly among senior secondary school students.

Retention of knowledge is a critical indicator of effective learning. The study showed a significant difference in retention scores between the experimental and control groups, with students exposed to Audiovisual Technology demonstrating higher retention of Biology concepts. This supports the assertion that multimedia learning enhances memory retention by engaging multiple senses, reinforcing learning through visual and auditory channels, and promoting active cognitive processing (Mayer, 2017).

Overall, the findings of this study indicated that Audiovisual Technology significantly enhances students' performance, attitude, and retention in Biology. The results provide strong empirical support for integrating Audiovisual Technology into the teaching of Biology in secondary schools, especially in contexts where conventional teaching methods have shown limited effectiveness.

Recommendations

Based on the findings of the study, the following recommendations were made:

1. Biology teachers should be equipped with audiovisual gadgets and adequately trained to implement Audiovisual

Technology effectively, to improve students' learning outcomes.

2. Educational policymakers and school administrators should support the integration of Audiovisual Technology in

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