EFFECT OF AN AUDIO-VISUAL INTERVENTION ON ACADEMIC ACHIEVEMENT IN GENETICS AMONG PRE-SERVICE BIOLOGY TEACHERS IN OGUN CENTRAL SENATORIAL DISTRICT, OGUN STATE

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Abstract

Despite the growing use of Audio-visual strategy in science education, their effectiveness in improving academic achievement in Genetics among pre-service Biology teachers in Ogun Central Senatorial District, Ogun State, remains unclear. This study addressed this gap by examining the Effect of Audio-visual Intervention on Academic Achievement of Pre-service Biology teachers in Genetics in Ogun Central Senatorial District, Ogun State. Using a quasi-experimental pre-test and post-test design, sixty participants were assigned to either the audio-visual intervention group or the traditional teaching group. Data were collected through a validated Genetics Achievement Test (GAT) (KR-20 = 0.79), guided by one hypothesis, tested using Analysis of Covariance (ANCOVA) at a 0.05 significance level. The findings revealed no significant effect of audio-visual intervention on academic achievement of pre-service Biology teachers in Genetics ($F_{(1, 57)} = 1.449$, p > 0.05), with the audio-visual strategy accounting for only 2.5% of the variance in performance. It was concluded that, within the context of audio-visual tools used, no significant effect was observed to enhance understanding and achievement of Pre-service Biology teachers in Genetics. Hence, audio-visual aids should be used alongside other teaching methods to effectively address complex genetic concepts.

Keywords: Audio-Visual Intervention, Academic Achievement, Genetics, Pre-Service Biology Teachers, Traditional Teaching Methods

Introduction

Academic achievement reflects students' learning outcomes and skill development, typically assessed through tests and practical evaluations. This is particularly important in science education, where deep conceptual understanding forms the basis for further studies and future professional success. Various factors influence students' academic performance, including teaching strategies, classroom environments, and learner motivation (Cayubit, 2022; Sakineh & Ali, 2020). Research has shown that students exposed to innovative, student-centered instructional strategies tend to achieve better results, especially when these strategies promote active participation and experiential learning (Gisoi, Njagi & Mungiria, 2023). In fields like Science, Technology, Engineering, and Mathematics (STEM),

academic achievement not only indicates students' mastery of content but also predicts their future academic and professional success (Idris, Govindasamy, Nachiappan & Bacotang, 2023).

In tertiary institutions across Ogun State, Nigeria, Biology is a vital discipline for preparing future Biology teachers who play a key role in promoting scientific literacy among secondary school students. Among the various topics in Biology, Genetics stands out as a core area that pre-service teachers must understand to teach effectively. Genetics involves the study of inheritance, DNA replication, gene expression, and mutations concepts that are often complex and abstract (Gericke & McEwen, 2023; Machová & Ehler, 2023). As such, a strong grasp of genetics is crucial for pre-service teachers, not only to pass their courses but to later convey these concepts clearly and accurately to their students.

Despite the importance of Genetics, many students find it difficult due to its abstract nature (Samuelsson, Samuelsson & Thorsten, 2021; Miralles-Cardona, Kitta & Cardona-Moltó, 2023; Adelana, Ayanwale & Sanusi, 2024). Therefore, adopting instructional methods that enhance understanding through visualization and interaction is essential. Innovative teaching strategies such as inquiry-based learning, project-based learning, and cooperative learning have been employed to improve student engagement and performance (Wale & Bishaw, 2020; Firdausih & Aslan, 2024; Ferguson-Patrick, 2020). However, results from these approaches have been mixed, as not all students respond equally to them. This has prompted increased interest in audio-visual and simulation strategies, particularly in subjects like Genetics, where visualization aids comprehension (Ali, Ibrahim, Falode & Daudu, 2024; Arshad, Ishak & Zaharudin, 2024).

Audio-visual interventions combine auditory and visual elements to create dynamic and engaging learning experiences. Rooted in educational psychology, this approach aligns with the dual-coding theory, which emphasizes the effectiveness of presenting information in both verbal and visual formats to enhance understanding and memory retention (Ahmed & Odewumi, 2020; Kahsay, Berhe & Tesfamariam, 2024). For instance, animated videos can help illustrate DNA replication step-by-step, while interactive simulations allow students to experiment with genetic crosses and observe outcomes. Such tools not only simplify difficult concepts but also make learning more engaging and effective (Muhiuddin, Samanta, Aljohani & Alkhaibari, 2023; Feeley, Keller & Kayler, 2023).

In the context of Biology education, especially in teaching Genetics, audio-visual strategies have shown significant promise. They help overcome the limitations of traditional teaching methods by offering clear, concise, and interactive representations of biological processes. Furthermore, they cater to diverse learning needs and styles, making the classroom more inclusive and effective (Hanif, 2020; Akuoma & Juliana, 2021; Novakovsky, Dexter, Libbrecht, Wasserman & Mostafavi, 2023). However, several challenges hinder the widespread adoption of audio-visual interventions, including limited access to technological resources, inadequate teacher training, and the high cost of quality multimedia materials.

Addressing these challenges requires investment in affordable tools, professional development for teachers, and collaboration between educational institutions and technology providers (Ojelade, Aregbesola, Ekele & Olatunde-Aiyedun, 2020; Arshad, Ishak & Zaharudin, 2024). Given these insights, this

study seeks to examine the Effects of Audio-visual Strategy on Academic Achievement in Genetics among Pre-service Biology Teachers in Ogun Central Senatorial District of Ogun State, Nigeria. By focusing on a specific region and subject, the study aims to fill a critical gap in local educational research and provide evidence-based recommendations for improving the teaching and learning of Genetics in Colleges of Education.

Statement of the Problem

Genetics poses significant challenges to many pre-service Biology teachers in tertiary institutions due to its abstract and complex nature. In Ogun Central Senatorial District, consistently low academic achievement in genetics highlights the limitations of traditional lecture-based teaching methods. While active learning strategies like inquiry-based and project-based learning have been introduced, their impact has been inconsistent. Recent studies as earlier indicated suggest that audio-visual strategies can improve comprehension and retention by making complex concepts more engaging and accessible. However, their effectiveness in Colleges of Education in Ogun Central remains underexplored. This study seeks to fill that gap by investigating the Effect of Audio-visual Intervention on Academic Achievement in Genetics among Pre-Service Biology Teachers in Ogun Central Senatorial District, Ogun State, hence aiming to enhance teaching practices and learning outcomes in Genetics.

Purpose of the Study

This study investigated the effect of an audio-visual instructional strategy on academic achievement in Genetics among pre-service Biology teachers in Ogun Central Senatorial District, Ogun State, Nigeria. Specifically, it examined how exposure to audio-visual intervention influenced students' performance in Genetics compared to the traditional teaching approach.

Hypothesis

A null hypothesis was formulated for the study and tested at 0.05 level of significance:

H_0: There will be no significant effect of audio-visual intervention strategy on academic achievement in Genetics among pre-service Biology teachers in Ogun Central Senatorial District of Ogun State, Nigeria.

Methodology

This study employed a quasi-experimental design using a pre-test and post-test approach with a 2-group structure to investigate the effectiveness of different instructional strategies on academic achievement in Genetics among pre-service Biology teachers. A total of 60 participants (30 males and 30 females) from two tertiary institutions in Ogun Central Senatorial District were selected using a total enumeration method, which involved all students from two intact classes offering Biology education. Participants were intactly and randomly assigned to two groups through a balloting process. On of the institutions formed Group A (Experimental Group) and was exposed to the Audio-Visual Strategy (AVIS); while another selected institution formed Group B (Control Group) and was taught using Traditional Teaching Strategy (TTS). The Genetics Achievement Test (GAT), developed and validated for content, face, and construct validity, was used to collect data, with a reliability coefficient of 0.79 using the Kuder-Richardson Formula 20 (*KR-20*) established through a pilot test on 20 comparable students from a University of Education in Ogun State who did not partake in the main study. Over an

eight-week period, trained lecturers delivered the instructional content, and data were analyzed using Analysis of Covariance (ANCOVA) at the 0.05 level of significance to determine the impact of the teaching strategies on student achievement.

Hypothesis (H_0): There will be no significant effect of audio-visual intervention strategy on academic achievement in Genetics among pre-service Biology teachers in Ogun Central Senatorial District of Ogun State, Nigeria.

Result:

Table 1: Tests of Between-Subjects Effects of Audio-Visual Intervention Strategy on Academic Achievement in Genetics among Pre-Service Biology Teachers in Ogun Central Senatorial District of Ogun State, Nigeria

Dependent Variable: POSTTEST

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	4992.996[a]	2	2496.498	3745.994	0.000	0.992
Intercept	3.006	1	3.006	4.510	0.038	0.073
PRETEST	4555.089	1	4555.089	6834.908	0.000	0.992
STRATEGY	0.966	1	0.966	1.449	0.234	0.025
Error	37.987	57	0.666			
Total	18863.000	60				
Corrected Total	5030.983	59				

a. R Squared = 0.992 (Adjusted R Squared = 0.992)

Source: Researcher's Fieldwork, 2025

Table 1 presents the result of ANCOVA on the effect of audio-visual intervention strategy on academic achievement in Genetics among pre-service Biology teachers in Ogun State, Nigeria. From the Table 1, the *F*–statistics [$F_{(1, 57)}$] = 1.449 and the probability (significant) value = 0.234. This indicated that the null hypothesis (H_0) that audio-visual intervention strategy has no significant effect on academic achievement in Genetics among pre-service Biology teachers in Ogun Central Senatorial District of Ogun State, Nigeria should be accepted. Hence, there was no significant effect of audio-visual intervention strategy on academic achievement in Genetics among pre-service Biology teachers in Ogun Central Senatorial District of Ogun State, Nigeria [$F_{(1, 57)}$ = *1.449, p > 0.05*]. The Partial Eta Squared value in the Table 1 indicates the effect size of audio-visual intervention strategy and traditional teaching strategy. This value was 0.025, which was small when compared with Cohen's guidelines (0.2 – small effect, 0.5 – moderate effect, 0.8 – large effect). This suggested that about 2.5% of the variance in the posttest score of pre-service Biology teachers' academic achievement in Genetics was explained by the audio-visual intervention strategy.

Table 2: Parameter Estimates of Audio-Visual Intervention Strategy on Academic Achievement in Genetics among Pre-Service Biology Teachers in Ogun Central Senatorial District of Ogun State, Nigeria

Dependent Variable: POSTTEST

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval Lower Bound	Upper Bound	Partial Eta Squared
Intercept	0.578	0.205	2.814	0.007	0.167	0.989	0.122
PRETEST	1.288	0.016	82.674	0.000	1.257	1.320	0.992
[STRATEGY=Audio-Visual Intervention]	-0.267	0.222	-1.204	0.234	-0.712	0.177	0.025
[STRATEGY=Traditional Teaching]	0.000[a]	0.000	0.000	0.000	0.000	0.000	0.000

a. This parameter is set to zero because it is redundant.

Source: Researcher's Fieldwork, 2025

Table 2 shows the coefficients of the parameters included in the analysis. One could observe from the Table 2 that audio-visual intervention strategy had negative and insignificant effect on the pre-service Biology teachers' academic achievement in Genetics in Ogun Central Senatorial District of Ogun State, Nigeria since the coefficient of the audio-visual intervention strategy was -0.267 and was not statistically significant at 1%, 5% and 10% levels. The outcome implied that audio-visual intervention strategy did not make a statistically significant contribution to the academic achievement of the pre-service Biology teachers in Genetics.

Table 3: Pairwise Comparisons of Audio-Visual Intervention Strategy on Academic Achievement in Genetics among Pre-Service Biology Teachers in Ogun Central Senatorial District of Ogun State, Nigeria

Dependent Variable: POSTTEST

(I) Strategy	(J) Strategy	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a] Lower Bound	Upper Bound
Audio-Visual Intervention	Traditional Teaching	-0.267	0.222	0.234	-0.712	0.177
Traditional Teaching	Audio-Visual Intervention	0.267	0.222	0.234	-0.177	0.712

Based on estimated marginal means

a. Adjustment for multiple comparisons: Bonferroni.

Source: Researcher's Fieldwork, 2025

Table 3 presents the results of the post hoc tests (i.e., pairwise comparisons) that were carried out to see which groups differ. The tests showed that there was no significant difference between audio-visual intervention strategy and traditional teaching strategy ($p > 0.05$).

Table 4: Estimates of Audio-Visual Intervention Strategy on Academic Achievement in Genetics among Pre-Service Biology Teachers in Ogun Central Senatorial District of Ogun State, Nigeria

Dependent Variable: POSTTEST

STRATEGY	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Audio-Visual Intervention	15.041[a]	0.159	14.723	15.358
Traditional Teaching	15.308[a]	0.148	15.012	15.604

a. Covariates appearing in the model are evaluated at the following values: PRETEST = 11.4333.
Source: Researcher's Fieldwork, 2025

Table 4 shows the results of the estimated marginal mean, which gives the adjusted means (controlling for the covariate 'pretest score') for each strategy group. This simply means that the effect of 'pretest score' has been statistically removed. The outcomes of the estimated marginal means showed that higher academic performance was recorded for the pre-service Biology teachers in Genetics with traditional teaching strategy (M= 15.308 unit) on average after adjusting for pretest score, compared to the audio-visual intervention strategy (M = 15.041).

Discussion of Findings
The study revealed that the audio-visual intervention strategy did not have a significant effect on the academic achievement of pre-service Biology teachers in Genetics within Ogun Central Senatorial District, Ogun State. This outcome contrasts with several previous studies. For example, a study by Ali, Ibrahim, Falode and Daudu (2024) in North Central Nigeria reported a significant difference in retention scores among pre-service Biology teachers exposed to technology-mediated dynamic and static visuals, highlighting the effectiveness of such instructional aids in improving learning. Although both studies involved similar content and teaching aids, differences in geographical and educational contexts may explain the conflicting outcomes. Similarly, Ahmed and Odewumi (2020) found that visual learning tools significantly enhanced academic performance among secondary school Biology students in Ilorin.

Another study by Ojelade, Aregbesola, Ekele and Olatunde-Aiyedun (2020) in Abuja also demonstrated a positive impact of audio-visual materials on students' achievement in science. Additionally, Akuoma and Juliana (2021) reported that Biology students in Port Harcourt who were taught using video-based instruction performed significantly better than those taught through conventional means. These contrasting results suggest that while video and audio-visual strategies can be powerful tools for internalizing complex scientific concepts, their effectiveness may depend on various factors such as location, educational level, and learning environment. Consequently, teachers are encouraged to incorporate video instruction when suitable, as it has shown promise in enhancing science education outcomes in diverse settings.

Conclusion

The study concluded that the audio-visual intervention strategy had no significant effect on the academic achievement of pre-service Biology teachers in Genetics in Ogun Central Senatorial District, Ogun State. Statistical analysis showed that only 2.5% of the variance in achievement scores could be attributed to the intervention, indicating a minimal impact. Therefore, traditional teaching methods and other factors likely play a more substantial role in influencing students' performance in Genetics within this context.

Recommendation

Educators should combine audio-visual tools with other effective teaching methods to improve Genetics learning. Further research is needed to understand how context affects the impact of audio-visual strategies in science education.

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