

Effect of Animation Instructional Strategy on Senior Secondary School Students' Interest and Achievement in Biology

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ABSTRACT

This study investigated the Effect of Animation Instructional Strategy (AIS) on Senior Secondary Two (SS II) Students' Interest and Achievement in Biology in Abakaliki Education Zone of Ebonyi State. Six research questions and six hypotheses guided the study. A quasi-experiment of the pre-test, post-test non-equivalence control group research design was adopted for the study. Senior secondary two (SS 2) students from all the 85 public secondary schools in Abakaliki Education Zone numbering 11,758 formed the population of this study. The sample of the study comprised 468 students of the intact classes of 4 randomly sampled schools from the four local government areas in the zone. Biology Interest Inventory adopted from Abonyi (2011) with reliability coefficient of 0.81 and Biology Achievement Test (BAT) with reliability coefficients of 0.79 (for internal consistency) and 0.89 (for stability) were used as instruments for data collection of this study. Mean and standard deviation were used to answer the research questions while analysis of covariance (ANCOVA) was used to test the hypotheses at 95% confidence level. The results revealed that: AIS significantly enhanced the mean interest and achievement scores of the students in biology more than the conventional chalk and talk method. Equally, the result further revealed that there is no significant difference between the mean interest and achievement scores of male and female students taught biology using AIS. In addition, the interaction between the methods and gender on the students mean interest and achievement scores in biology was not statistically significant. The study concluded that AIS was superior to the conventional chalk and talk method in enhancing students' interest and academic achievement in biology. Based on the findings of the study, it was recommended among others that biology teachers should prioritize the use of AIS since it has been proven to have a significant positive effect on the interest and academic achievement of students in biology.

Keywords: Biology, Secondary School Students, Interest, Achievement, Animation Instructional Strategy

INTRODUCTION

Biology is a foundational science subject that not only contributes to students' understanding of the natural world but is also pivotal for addressing global challenges such as disease outbreaks, food security, and climate change. The teaching and learning of biology in secondary schools is critical for fostering interest in scientific disciplines among students, especially in a rapidly developing country like Nigeria. The relevance of biology is further underscored by its applications in health, agriculture, environmental conservation, and biotechnology. In Nigeria, where health issues like malaria and tuberculosis prevail, and where agriculture remains a vital sector, a solid understanding of biology is essential (Adebayo & Adeyanju, 2023; Ojo & Ebenezer, 2022).

Despite the relevance of biology, Nigerian secondary school students often exhibit low interest and achievement in the subject. Aina (2021) posits that many students face difficulties in grasping complex biological concepts due to traditional instructional methods that often rely heavily on lectures and rote

memorization. This submission is further substantiated by Ojo and Ebenezer (2022) who report that factors such as teaching methods, lack of resources, and socio-cultural attitudes towards science education contribute to poor interest and achievement which affects their retentive ability. Equally, Adesoji and Olatunji (2021), posit that traditional teaching methods often fail to stimulate students' interest and motivation, leading to low achievement levels and disengagement from the subject matter. Furthermore, the conventional chalk and talk approach can lead to a limited understanding of biological concepts, resulting in poor academic achievement, and lack of interest among students (Kolawole, 2020; Akinbobola & Daramola, 2019). As a result, exploring innovative teaching strategy like animation could potentially improve students' interest, academic achievement and retention in biology.

The conventional "chalk and talk" method of teaching, characterized by a teacher-centered approach where information is delivered through lectures accompanied by writing on a blackboard or whiteboard, has been a staple in education for decades (Ojo & Ebenezer, 2022). While this method has its merits, it faces significant criticism in the context of modern educational need and learning theories. One of the primary advantages of the chalk and talk method is its efficiency in delivering information to a large number of students simultaneously (Kolawole, 2020). It allows teacher to cover a substantial amount of material in a relatively short time, making it appealing in tightly scheduled curricula (Adesoji & Olatunji, 2021). Furthermore, this method can be effective for introducing new concepts, providing a structured outline of content, and ensuring that all students receive the same foundational knowledge (Akinbobola & Daramola, 2019). However, the chalk and talk method has several notable drawbacks, particularly in fostering students' engagement and critical thinking (Adesoji and Olatunji, 2021). Modern educational researches (Adebayo & Adeyanju, 2023; Ojo & Ebenezer, 2022; Aina, 2021), emphasizes the importance of active learning, where students engage with the material through discussion, collaboration, and hand-on-activities. The traditional chalk and talk or lecture format often leads to passive learning, where students become mere recipients of information rather than active participants in their learning process. This passivity can result in lower retention rates and a lack of deep understanding of material (Bello & Okeke, 2022). Moreover, the chalk and talk method does not cater to diverse learning styles. Students have varying preferences for how they absorb and process information and a one-size-fits-all approach can alienate those who thrive in interactive or experiential learning environments (Kolawole, 2020). Recent advancements in educational technology like the use of digital tools allow for more dynamic and interactive learning experience. These methods according to Adebayo and Adeyanju (2023), encourage collaboration, critical thinking, and creativity, aligning more closely with the skills needed in the 21st century workforce. Hence the exploration of the efficacy of animated instructional strategy on students' interest, achievement and retention in biology.

Animation refers to the simulation of movement created by displaying a series of individual images, or frames (Mayer, 2021). In education, animations can be utilized to visualize complex concepts, making them more accessible to learners (Hattie, 2021). As a multimedia instructional tool, animation harnesses visual representation to simplify intricate biological processes and concepts, thereby facilitating better understanding among students (Mayer, 2017). Furthermore, animation can simplify processes like cellular respiration, reproduction, genetic inheritance, and ecological interaction, which are often challenging for students to comprehend through text-based or static imagery alone which conventional chalk and talk method offers (Rogers et al., 2021). Studies have indicated that animated content can significantly enhance learning outcomes by promoting active engagement and facilitating better retention of information (Bello & Okeke, 2022). Zhang, Zhou, Briggs, & Nunamaker (2020), report that animation can lead to improved learning outcomes, and retention of scientific concepts, particularly in subjects that require the comprehension of intricate processes, such as biology. This is critical in secondary school education where students are introduced to more advanced biological concepts that necessitate a deeper understanding of processes such as cellular respiration, reproduction, genetics and ecological interactions.

The effectiveness of animation as an instructional approach can be attributed to several cognitive theories. Mayer's cognitive Theory of Multimedia Learning posits that learners can better understand content when it is presented through multiple modalities (Mayer, 2017). Equally, the dual coding theory also supports this notion, suggesting that visual and auditory information is processed in different ways, allowing for a more comprehensive understanding when modalities are employed (Paivio, 1986). Furthermore, engaging animations can stimulate interest and curiosity, which are vital components of the learning process. Research

by Hattie (2021), emphasizes the importance of student engagement in improving academic achievement and retentive ability, underscoring that interest in a subject can significantly impact students' motivation and effort.

Student interest in biology is a critical factor that influences academic achievement. Interest in biology is paramount for students' academic success and future career choices, particularly in a developing nation like Nigeria, where there is a pressing demand for skilled professionals in science and technology fields. Research has shown that students' interest influences their motivation, academic achievement and persistence in science subjects (Zhang et al., 2020). This is corroborated in a study by Ogundipe et al. (2022), which suggests that increasing students interest can lead to improvements in motivation, self-efficacy, and ultimately, academic achievement. Unfortunately, interest in biology has been documented to decline as students' progress through their education, partly due to ineffective teaching methods and a perceived lack of evidence to real-life situations (Zeyer & Roth, 2019). Evidently, encouraging interest in biology not only improves student achievement but also contributes to a more scientifically literate society that can address critical challenges such as public health crises, environmental issues, and food security. In a country like Nigeria where ecological challenges abound, capturing students' interest in biology can particularly empower future generations to address these pressing issues.

Furthermore, the integration of animation instructional strategies in teaching biology at the secondary school level in Nigeria has become increasingly essential for enhancing students' academic achievement. Traditional teaching methods (e.g., the chalk and talk method), often fail to engage students effectively, particularly in subjects that require a deep understanding of complex biological processes (Kolawole, 2020). Animation, as a dynamic and interactive form of instruction, addresses these challenges by providing visual representation of abstract concepts, thereby facilitating better understanding and retention (Adebayo & Adeyanju, 2023; Khalid & Al-Nafai, 2021). Research by Mayer (2020) indicates that students who learn through animated content tend to perform better in assessments than those who rely solely on traditional methods. This is owing to visual nature of animation that helps to simplify intricate biological mechanisms; making them more accessible to learners. More so, today's students are accustomed to multimedia content, and incorporating animations into biology lessons can capture their attention and foster greater engagement. This is particularly important in Nigeria where the traditional education system often emphasizes rote memorization over critical thinking and application of knowledge (Bello & Okeke, 2022). By leveraging the power of visual learning and catering for the individual learning needs of 21st – century learners, educators can promote a deeper understanding of biology, ultimately leading to better academic achievement and retentive ability of students irrespective of their gender.

Gender differences in academic interest, achievement and retention have been a significant area of research, particularly in the context of science subjects like biology among secondary school students in Nigeria. Research indicates that female students often show a higher intrinsic interest in biology-related topics, particularly those related to health, environment, and social issues (Ajayi, Eze & Omenyior, 2023). Equally, study by Ogunniyi (2020) have pointed out that girls frequently align their interests in biology with real-world applications, reflecting concerns about community health and environmental sustainability. In contrast, male students might display a greater interest in competitive and theoretical aspects of biology, often driven by social expectations and gender norms that associate masculinity with performance in science and technology. This is consistent with findings by Ajayi, Eze and Omenyior (2021), who noted that boys tend to gravitate towards biological topics that highlight competition and dominant narratives, which can be reflective of traditional masculine identities. Regarding achievement in biology, recent studies indicate that gender differences are nuanced. Despite the engagement levels, statistical outcomes show a mixed picture. For instance, research by Ojo, Adeshina and Oluwaseun (2022) found that girls perform equally well or even better than boys in biology. This trend might indicate not only academic capability but also a higher level of motivation and effort among female students, counteracting some of the stereotypical views of female underachievement in sciences. The inconsistency of research over gender interest, achievement and retention when taught with different instructional techniques, demands for an empirical investigation to find out if an innovative instructional strategy like animation can be gender stereotyped. Thus, the investigation whether animation instructional strategy can lead to significant gender differences in male and female students' interest, achievement and retention in biology.

Problem Statement

The increasing poor achievement of students in science subjects including biology, has been a subject of concern in Nigeria. This ugly development which has continued over the years is mainly attributed to poor instructional strategy like the conventional chalk and talk method. The conventional method has been criticized due to its passiveness, encouragement of rote memorization and inability to concretize lesson. In subject like biology, that necessitates deeper understanding of the processes involved in some concepts such as cellular respiration, reproduction, genetics and ecological interactions, the conventional method has been found ineffective. Recent reports by the West African Examination Council's Chief Examiners report for the years 2022, 2023 and 2024, emphasize that students' performance in biology continues to be below satisfactory levels (West African Examination Council, 2022, 2023, 2024). This trend is indicative of a broader issue: many students struggle to connect with biological concepts, seeing them as abstract and irrelevant to their everyday lives. Thus, there is an urgent need to explore modern pedagogical strategies that can augment traditional teaching strategies, enhance student interest, and improve outcomes in biology education. Consequently, exploring the efficacy of a method like animation that is capable of arousing students' interests and improving understanding as well as academic achievement is essential.

Research Questions

The following research questions guided the study

1. What is the effect of animation instructional strategy on Students' mean interest scores in biology?
2. What is the effect of animated instructional strategy on the mean interest scores of male and female students in biology.?
3. What is the interaction effect of methods and gender on students mean interest scores in biology?
4. What is the effect of animation instructional strategy on students' mean achievement scores in biology?
5. What is the effect of animated instructional strategy on the mean achievement scores of male and female students in biology.?
6. What is the interaction effect of methods and gender on students mean achievement scores in biology?

METHODOLOGY

Research Design: This study adopted the quasi experimental of non-equivalent pre-test-post-test control group design. Subjects were not randomly assigned to groups, rather, intact classes were assigned to experimental and control groups through a toss of coin. The choice of this design was because it offers maximum control over extraneous variables. Also, the researcher is not in a position to assign subjects randomly to treatment conditions. The reason is to avoid disruption of normal school periods assigning subjects randomly to treatment conditions will cause. The design is symbolically represented in the table below.

Table 1: symbolical representation of the research design

E	O_1	X	O_2
C	O_1	Y	O_2

Where;

E = Experimental Group;

C = Control Group

O_1 = Pre-test interest and achievement

O_2 = Post-test interest and achievement

X = Animation Instructional Strategy (AIS)

Y = Conventional talk and chalk method (CTCM)

Population of the Study: The population of this study was 11,758 comprising all the senior secondary two (SS 2) biology students in the 85 public secondary schools in Abakaliki Education Zone. The justification for choosing to use SS 2 students in this study is because they have covered enough content areas in biology, unlike those in SS 1 who are freshly introduced to the subject or SS 3 students who are going into their final year examination.

Sample and Sampling Technique: The sample of the study comprised 468 (i.e., 253 in the treatment group comprising 140 male and 113 female and 215 in the control group comprising 99 male and 116 female) students in the intact classes of the sampled schools. Multi-stage sampling was employed. Abakaliki Education zone was stratified into four local government areas it houses. Through simple random sampling by balloting, one school was drawn from each of the four local government areas, making it four schools that were used for the study. Two schools each out of the four schools that were drawn for the study were assigned to experimental and control groups respectively through simple random sampling approach by toss of the coin.

Instruments for Data Collection: Two instruments namely Biology Interest Inventory (BII) adopted from Abonyi (2011) and Biology Achievement Test (BAT) developed by the researcher were used for data collection. The BII consist of 20-items spread across four interest areas (vocational, leisure, general and academic interest), developed and validated by Abonyi (2011) (see appendix 6). While the BAT is a multiple-choice objective test containing 30 questions with each item having five options lettered A – E. The test is based on the units of study (i.e., reproduction, cells and respiration) in SSII biology curriculum.

Reliability of the Instrument: Cronbach Alpha estimate was used to establish the reliability of BII and it yielded a coefficient of 0.81. Equally, the BAT after pilot testing was subjected to test of reliability using Kuder Richardson's formular-20 (K-R20) procedure and it yielded a coefficient of 0.79. Furthermore, the stability of BAT was established after test re-test using Pearson's Product Moment Coefficient (r) and it yielded a coefficient of 0.89 indicating that the instrument is reliable for use in this study.

Data Collection: The classroom teachers of the different schools that were used as research assistants administered the instruments on two occasions to the same students who participated in the experiment. First, pre-test was administered before treatment administration. After six weeks which the experiment lasted, the same instruments items were reshuffled with different paper type and re-administered to the students as post-test. The pre-test and post-test scores were recorded after each marking exercise. The BII items were scored 4, 3, 2, and 1 for Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD), while the BAT items were scored 1 mark each. The maximum mark for the BII was 80 marks while that of BAT was 30 marks.

Data Analysis: The six research questions were answered using mean and standard deviation scores while the null hypotheses were tested at 0.05 alpha level using analysis of covariance (ANCOVA).

RESULTS

Research question 1

For this research question, data obtained using BII on the interest of the students in the treatment and control groups were used to answer the research question. Mean for pre and post tests were adjusted statistically in the analysis to take care of the initial equivalence of the research subjects. Summary of result of data analysis is presented in table 2.

Table 2: summary of mean interest scores of students taught biology using animation instructional strategy and those taught with the conventional method

Group	Mean	Standard deviation	N
Experimental (Animation Strategy)	69.21	5.67	253
Control (Chalk and Talk)	64.65	5.97	215

Summary of result in Table2 showed that students taught biology using the animation instructional strategy had a higher mean interest score (69.21) than their counterparts taught with the conventional talk and chalk approach (64.65). This implies that animation instructional strategy enhanced the interest of students in biology more than those exposed to conventional approach.

Research question 2

For this research question, data obtained with BII on the interest of male and female students in the treatment group was used to answer the research question. Mean for pre and post tests were adjusted statistically in the analysis to take care of the initial equivalence of the research subjects. Summary of result of data analysis is presented in table 3.

Table 3: summary of mean interest scores of male and female students taught biology using animation instructional strategy

Gender	Mean	Standard deviation	N
Male	69.95	5.54	140
Female	68.28	5.73	113

Summary of result in Table3 showed that male students taught biology using animation instructional strategy had a higher mean interest score (69.95) than their female counterparts taught with the same strategy (68.28). This implies that animation instructional strategy enhanced the interest of male students in biology more than their female counterparts exposed to same strategy.

Research question 3

What is the interaction effect of methods and gender on students mean interest scores in biology?

For this research question, data obtained with BII on the interest of students taught geometry using animation strategy and those taught using conventional talk and chalk method were used to answer the research question. Mean for pre and post tests were adjusted statistically in the analysis to take care of the initial equivalence of the research subjects. Summary of result of data analysis is presented in table 4.

Table 4: summary of interaction between teaching strategies and gender on students mean interest scores in biology

Gender group	Mean for Treatment Group	Mean for Control Group
Males	69.91	65.46
Females	68.34	63.95

Summary of result presented in Table4 reveal clearly that there is no interaction effect of gender and teaching methods on the students' interest scores in biology. Result presented in the table indicated that animation

instructional strategy is superior to conventional chalk and talk method at the two levels of gender (male and female). This is because both male and female students in the treatment group had higher mean interest scores (69.91 and 68.34) respectively, than their counterparts in the control group (65.46 and 63.95) respectively.

Research question 4

For this research question, data obtained using BAT on the achievement of the students in the treatment and control groups were used to answer the research question. Mean for pre and post tests were adjusted statistically in the analysis to take care of the initial equivalence of the research subjects. Summary of result of data analysis is presented in table 5.

Table 5: summary of mean achievement scores of students taught biology using animation instructional strategy and those taught with the conventional method

Group	Mean	Standard deviation	N
Experimental (Animation Strategy)	22.26	2.88	253
Control (Chalk and Talk)	16.58	2.24	215

Summary of result in Table5 showed that students taught biology using the animation instructional strategy had a higher mean achievement score (22.26) than their counterparts taught with the conventional talk and chalk approach (16.58). This implies that animation instructional strategy enhanced the achievement of students in biology more than those exposed to conventional approach.

Research question 5

For this research question, data obtained with BAT on the achievement of the students in the treatment control group was used to answer the research question. Mean for pre and post tests were adjusted statistically in the analysis to take care of the initial equivalence of the research subjects. Summary of result of data analysis is presented in table 6.

Table 6: summary of mean achievement scores of male and female students taught biology using animation instructional strategy

Gender	Mean	Standard deviation	N
Male	23.71	2.48	140
Female	20.46	2.27	113

Summary of result in Table6 showed that male students taught biology using animation instructional strategy had a higher mean achievement score (23.71) than their female counterparts taught with the same strategy (20.46). This implies that animation instructional strategy improved the achievement of male students in biology more than their female counterparts exposed to same strategy.

Research question 6

Adjusted mean for the two levels of gender that were subjected to animation instructional strategy and those subjected to the conventional chalk and talk method were used to access the interaction. Summary of result is presented in table 7.

Table 7: summary of interaction between gender and teaching strategies on students mean achievement scores in biology

Gender group	Mean for Treatment Group	Mean for Control Group
Males	23.66	17.10
Females	20.52	16.13

Summary of result presented in Table7 revealed clearly that there is no interaction effect of gender and teaching methods on students' achievement scores in biology. Result presented in the table indicated that animation instructional strategy is superior to conventional chalk and talk method at the two levels of gender (male and female). This is because both male and female students in the treatment group had higher mean achievement scores (23.66 and 20.52) respectively, than their counterparts in the control group (17.10 and 16.13) respectively.

Hypotheses

Ho₁: There is no significant difference in the mean interest scores of students taught biology using animated instructional strategy and those taught using conventional talk and chalk method.

Ho₃: There is no significant interaction between methods and gender on students' mean interest scores in biology.

Table 11: Analysis of co-variance for students' overall biology interest scores by teaching methods and by gender/teaching methods (interaction)

Source	Type III Sum of Squares	df	Mean Square	F	Significance
Corrected Model	14919.446 ^a	4	3729.862	533.533	.000
Intercept	313.597	1	313.597	44.858	.000
Pretest	12226.554	1	12226.554	1748.930	.000
Method	1247.811	1	1247.811	178.491	.000
Gender	254.009	1	254.009	36.334	.000
Method*Gender	28.948	1	28.948	4.141	.420
Error	3236.776	463	6.991		
Total	2125982.000	468			
Corrected Total	18156.222	467			

For hypothesis 1, the ANCOVA table shows the sig. value of 0.000 is less than 0.05. The decision rule is to reject the null hypothesis when the sig. value is less than alpha value of 0.05. Since the sig. value is less than 0.05, the null hypothesis was rejected. The researcher concludes that there is a significant difference in the mean interest scores of students taught biology using animated instructional strategy and those taught biology using conventional chalk and talk method. For hypothesis 3, result in table 11 revealed that for two-way interaction, F.Sig. is 0.420 which is greater than 0.05. Based on the decision rule, the researcher upheld the null hypothesis and concludes that there is no significant interaction between gender and teaching strategies on students' mean interest scores in biology.

Ho₂: There is no significant difference in the mean interest scores of male and female students taught biology using animation instructional strategy.

Table 12: Analysis of co-variance for male and female students' overall biology interest scores

Source	Type III Sum of Squares	df	Mean Square	F	Significance
Corrected Model	7965.871 ^a	2	3982.935	6663.038	.000
Intercept	109.937	1	109.937	183.914	.000
Pretest	7792.147	1	7792.147	13035.454	.000
Gender	250.225	1	250.225	418.600	.637
Error	149.441	250	.598		
Total	1219835.000	253			
Corrected Total	8115.312	252			

Summary of result on Table 12 shows that the sig. value of 0.637 is greater than 0.05. The decision rule is to uphold the null hypothesis when the sig. value is greater than alpha value of 0.05. Since the sig. value is greater than 0.05, the null hypothesis was upheld. The researcher concludes that there was no significant difference in the mean interest scores of male and female students taught biology using animated instructional strategy. This implies that animated instructional strategy enhanced the interest of male and female students without a significant difference.

Ho₄: There is no significant difference in mean achievement scores of students taught biology using animated instructional strategy and those taught using conventional talk and chalk method.

Ho₆: There is no significant interaction between methods and gender on students' mean achievement scores in biology.

Table 13: Analysis of co-variance for students' overall biology achievement scores by teaching methods and by gender/teaching methods

Source	Type III Sum of Squares	df	Mean Square	F	Significance
Corrected Model	5019.131 ^a	4	1254.783	306.789	.000
Intercept	2508.736	1	2508.736	613.375	.000
Pretest	604.092	1	604.092	147.698	.000
Method	3431.588	1	3431.588	839.008	.000
Gender	477.656	1	477.656	116.785	.000
Method*Gender	102.019	1	102.019	24.943	.385
Error	1893.696	463	4.090		
Total	187571.000	468			
Corrected Total	6912.827	467			

For hypothesis 4, the ANCOVA table shows the sig. value of 0.000 is less than 0.05. The decision rule is to reject the null hypothesis when the sig. value is less than alpha value of 0.05. Since the sig. value is less than

0.05, the null hypothesis was rejected. The researcher concludes that there was significant difference in the mean achievement scores of students taught biology using animated instructional strategy and those taught biology using conventional chalk and talk method. For hypothesis 6, result in table 13 revealed that for two-way interaction, F.Sig. is 0.385 which is greater than 0.05. Based on the decision rule, the researcher upholds the null hypothesis and concludes that there is no significant interaction between gender and teaching strategies on students' mean achievement scores in biology.

H0₅: There is no significant difference in the mean achievement scores of male and female students taught biology using animation instructional strategy.

Table 14: Analysis of co-variance for male and female students' overall biology achievement scores

Source	Type III Sum of Squares	df	Mean Square	F	Significance
Corrected Model	834.936 ^a	2	417.468	83.137	.000
Intercept	2441.887	1	2441.887	486.290	.000
Pretest	175.699	1	175.699	34.990	.000
Gender	580.073	1	580.073	115.519	.472
Error	1255.364	250	5.021		
Total	127419.000	253			
Corrected Total	2090.300	252			

Summary of result on Table 14 shows that the sig. value of 0.472 is greater than 0.05. The decision rule is to uphold the null hypothesis when the sig. value is greater than alpha value of 0.05. Since the sig. value is greater than 0.05, the null hypothesis was upheld. The researcher concludes that there is no significant difference in the mean achievement scores of male and female students taught biology using animated instructional strategy. This implies that animated instructional strategy enhanced the academic achievement of male and female s students without a significant difference.

DISCUSSIONS

Findings of the study as evident in Table2 revealed that students who were exposed to animation instructional strategy (AIS) had higher mean interest score than those who were exposed to conventional chalk and talk method. Equally, there was significance difference in the mean interest scores of the students exposed to AIS and those who were exposed to the conventional approach as evident in table4. This implies that through AIS, secondary school students' interest in biology can be improved. This further justifies the need for AIS to be prioritised by biology teachers across all public secondary schools in Ebonyi State as a means to a sustainable end in enhancing students' interest in biology. The above finding is validated by Muhammad and Saleh (2025) who examined the Effects of Animated-Media Strategy on students' Academic Achievement and Interest in Ecology Concept and found that students taught ecology using media animated strategy has more positive impact in interest level than those taught using conventional method of teaching. Equally, the findings align with that of Nnalue, Christian-Eke and Orafu (2023) investigated the effect of computer animation on secondary school students' interest in Biology and found out students taught biology using computer animation yielded greater interest mean gain score than those taught using expository method. Furthermore, the findings of this study agree with that of Nnorom and Emeka-Ifeanyi (2021) investigated the effect of computer animation on secondary school students' interest and academic achievement in Biology and reported that students taught biology using computer animation yielded greater achievement and interest mean scores than those taught using conventional method. Consequently, it is crucial that AIS be prioritised

by biology teachers as it has been proven empirically in this study and other related studies to enhance interest of students in biology and science subjects generally.

Result of analysis in table3 showed that male students taught biology using AIS had higher mean interest score than their female counterparts taught with the same method. However, there was no significant difference in the mean interest of students of both gender as evident in table 12. The finding is in tandem with that of Nnalue, Christian-Eke and Orafu (2023), who investigated the effect of computer animation on secondary school students' interest in Biology and reported no significant difference in the mean interest scores of male and female students taught biology using computer animation strategy. Equally, the findings are validated by Muhammad and Saleh (2025) examined the Effects of Animated-Media Strategy on students' Academic Achievement and Interest in Ecology and found that female students had higher mean interest than their male counterpart; although the difference was not significant. This shows that animation instructional strategy is a veritable method that biology teachers can rely on to boost students' interest in the subject.

Result as evident on tables 4 and 12 showed that there was no significant interaction between methods and gender on the students mean interest scores in biology. This is because male and female students taught biology using animation instructional strategy had higher mean interest scores respectively than their counterparts taught with the conventional chalk and talk approach. By implication, the AIS is suitable for use in teaching biology to both male and female students in the same class. The findings are in tandem with that of Muhammad and Saleh (2025) examined the Effects of Animated-Media Strategy on students' Academic Achievement and Interest in Ecology Concept and found that there was no interaction between the methods and gender on the students' interest in ecology. Equally, the findings are validated by Nnalue, Christian-Eke and Orafu (2023) investigated the effect of computer animation on secondary school students' interest in Biology and found no interaction between methods and gender on the students mean interest scores in biology.

Findings of the study as evident in Table5 revealed that students who were exposed to animated instructional strategy had higher mean achievement score than those who were exposed to conventional chalk and talk method. Equally, there was significance difference in the mean achievement scores of the students exposed to AIS and those who were exposed to the conventional approach as evident in table 11. This implies that through AIS, secondary school students' achievement in biological concepts, can be improved. This further amplifies the need for AIS to be prioritised by biology teachers across all public secondary schools in Ebonyi State as a means to a sustainable end in enhancing students' achievement in biology. The findings agree with that of Oтуру (2022) investigated the effect of computer animation instructional package on students' academic performance in environmental concepts in Biology and found that the mean scores of students taught environmental concepts in biology with computer animation was higher than the mean scores of students taught with lecture method. Furthermore, this study findings align with that of Gongden, Yame and Gongden (2020) examined the effects of animation instructional strategy (ANIS) on senior secondary one chemistry students' interest and achievement in chemical bonding and reported that it significantly enhanced achievement more than the conventional method. Consequently, it is imperative that AIS be prioritised by biology teachers as it has been proven empirically in this study and other related studies to enhance both achievement and retentive memory in biology and sciences generally. Considering the wealth of empirical evidence in literature substantiating the efficacy of animation instructional strategy in improving students' academic achievement and retention in biology, and other science subjects, it therefore portends that biology teachers should embrace its adoption during classroom interaction as a means to a sustainable end in advancing the teaching and learning of biology contents at the senior secondary level.

Result of analysis in table6 showed that male students taught biology using AIS had higher mean achievement score than their female counterparts taught with the same method. However, there was no significant difference in the mean achievement of students of both genders as evident in table 14. The findings are in tandem with that of Sakiyo, Musa and Waziri (2018) investigated the effects of multimedia instructional strategy on secondary school students' academic achievement in biology and reported that students' male students outperformed their female counterparts. Equally, the findings are in line with that of Oтуру (2022) who investigated the effect of computer animation instructional package on students' academic performance in environmental concepts in Biology and reported that gender was not a significant factor. The results of

these studies coupled with that of the present study, justifies the need for biology teachers to prioritize the use of AIS to enhance the teaching and learning of biology at the secondary school level due to its proven gender friendliness.

Result as evident on tables 7 and 13 showed that there was no significant interaction between methods and gender on the students mean achievement scores in biology. This is because male and female students taught biology using animation instructional strategy had higher mean achievement scores respectively than their counterparts taught with the conventional chalk and talk approach. By implication, the AIS is suitable for use in teaching biology to both male and female students in the same class.

The result is in consonance with that of Oтуру (2022) who investigated the effect of computer animation instructional package on students' academic performance in environmental concepts in Biology and found that it enhanced the achievement of both male and female students in the treatment group more than their counterparts in the control group. The findings equally align with that of Gongden, Yame and Gongden (2020) who examined the effects of animation instructional strategy (ANIS) on senior secondary one chemistry students' interest and achievement in chemical bonding and found that there was no interaction between the methods and gender on the students' achievement and interest in chemistry. Thus, signifying that biology teachers can adopt AIS at the classroom due to its proven gender friendliness.

CONCLUSIONS

The study concluded that animation instructional strategy was superior to the conventional chalk and talk method in enhancing students' interest and academic achievement in biology. Equally, animation instructional strategy enhanced the mean interest and achievement scores of male students than their female counterparts although the differences were not statistically significant. Furthermore, the interaction of instructional methods and gender did not affect the interest and achievement of the students because both male and female students in the treatment group had higher mean interest and achievement scores more than their counterparts in the control group.

RECOMMENDATIONS

In line with findings of this study, the following recommendations were made:

1. Animation instructional strategy should be given serious consideration by biology teachers because of its proven positive effect on student's' interest, and academic achievement in biology.
2. Biology teachers should improve on their instructional behaviour leveraging on the benefits of animation instructional strategy in order to enhance students' interest, and academic achievement in biology.
3. The state ministry of education in conjunction with school authorities should conduct workshops and seminars to enlighten science teachers more on the benefits of innovative teaching strategies like the animation instructional strategy in enhancing students' interest, and academic achievement.

Authors Contributions

1. Developed the content of the study
2. Reviewed and edited the study
3. Carried out data analysis and interpretation.
4. Contributed to enriching the content
5. Contributed in the review and editing

6. Contributed in content development

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There was no conflict of interest among the researchers

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