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Article

Effects of 5E Learning Cycle Instructional Strategy on Secondary School Students' Interest and Achievement in Biology in Adamawa State, Nigeria

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Abstract: This study investigated the effects of 5E Learning Cycle Instructional Strategy on Secondary School Students' Interest and Achievement in Biology in Adamawa State, Nigeria. Five research questions were raised and five null hypotheses were formulated and tested at 0.05 level of significance. The study adopted quasi-experimental design, which involves a pre-test, post-test, non-equivalent, control group, design. The population of the study was 18,259 SS II biology students for the 2025/2026 academic session across five education zones of Adamawa State. Sample size of 391 SS II biology students from three intact classes were purposively selected from three education zones for the study. Two instruments for data collection were Biology Achievement Test (BAT) and Biology Interest Inventory (BII) developed by the researcher. For face and content validity, three experts in Faculty of Education, Taraba State University, Jalingo with expertizes in Curriculum and Instruction, Measurement and Evaluation validated the instruments. The reliability of the instruments was established using Guttmann Split-half. The reliability index of 0.74 for BAT and 0.86 for BII were obtained. Data collected were analyzed using descriptive statistics of mean and standard deviation to answer the research questions, while inferential statistics of Analysis of Covariance (ANCOVA) was used to test all the null hypotheses. The result of the study among others, revealed that: there is a statistically significant effect of the 5E Learning Cycle Instructional Strategy on Students' Interest and achievement to Biology. No significant gender differences were found. In conclusion, Adamawa State students' in biology exposed to the 5E strategy showed higher post-test mean scores in interest and achievement, gender did not significantly moderate achievement outcomes under the 5E strategy, though an interaction effect was observed. Failure to adopt innovative, student-centered

strategies such as 5E learning cycle may continue to contribute to low interest and unsatisfactory achievement in Biology. Based on the findings of this study, the researcher among others recommends Biology Teachers in Secondary Schools should be trained and encouraged to teach Biology content using 5E Learning Cycle Instructional Strategy, Adamawa State Ministry of Education and other relevant agencies should organize regular workshop for Biology Teachers, Curriculum Planners and Developers should integrate the 5E Learning Cycle Model Explicitly into the Secondary Biology Curriculum to institutionalize its use across schools. Biology teachers should pay deliberate attention to gender dynamics during the implementation of the 5E Strategy, particularly in the exploration and elaboration phases, to maximize achievement gains for both male and female students in light of the observed interaction effect.

Keywords: 5E Learning Cycle Instructional Strategy, Biology Education, Constructivist Teaching, Students' Interest, Students' Achievement, Students' in Biology, Biology Curriculum, Adamawa State, Nigeria.

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1. Introduction

Biology can be defined as a natural science which studies the existence (evolution, morphology and physiology) of living things, as well as their interactions with non-living components of the earth. Hence, it is that branch of science that studies living things and their interactions with the environment. It can also offer solutions to environmental issues without compromising or sacrificing anything along the way. Environmental protection for example, when a country is experiencing food shortages, biological ideologies can be utilized to develop efficient and long-lasting methods for producing more food to sustain life. Furthermore, Biology can be the key to forming a healthy biosphere where all living and nonliving things have a balanced interaction [1]. Unfortunately, as of the present time, human beings have become the primary reason why other living organisms start to deplete in number. Hopefully, biologists will be able to bring back the sustainability of life here on Earth.

Interest simply entails willingness to acquire skills, knowledge, attitude, and values. It is the eagerness to learn a set out task or activity for positive and near mastery of the skills and knowledge related to the activity. Interest is the notion and image created in the minds of learners by interacting directly with multiple situations. When teachers encourage students during teaching and learning biological concepts, it could positively improve their interests to biology which may subsequently increase their academic achievement.

Academic achievement is the measurable extent to which a student, teacher, or institution has attained their short-or long-term educational goals. It encompasses the successful mastery of school subjects, core curriculums, and skills like critical thinking, typically evaluated through test scores, grades, and degree. Academic achievements are measurable milestones that demonstrate mastery in educational settings, reflecting sustained knowledge, skill development, or academic growth. They showcase a student's dedication and can range from stellar grades to research contributions and prestigious scholarships [2]. Academic achievement in Biology hinges on hands-on practical activities, active study techniques (like active recall and spaced repetition), and conceptual understanding rather than rote memorization.

The 5E Learning Cycle is an inquiry-based, student-centered instructional model. Developed by Biological Sciences Curriculum Study (BSCS), it relies on constructivism-meaning learners build new ideas on top of prior knowledge. Teachers guide learning through five distinct phrases: Engage, Explore, Explain, Elaborate, and Evaluate. 5E learning cycle as an instructional strategy based on the

constructivist approach to learning which state that learners build or construct new ideas on old ideas [3]. 5E learning as an instructional strategy for designing a series of rich lessons that are conceptually linked to one another and also support student understanding as it develops over time. This 5E learning strategy leads students through five phrases of learning that are easily described using words that begin with the letter E; Engage, Explore, Explain, Elaborate, and Evaluate. The 5E learning may also enhance students' opportunity to construct their understanding of a concept during the teaching and learning process.

The 5E (Engage, Explore, Explain, Elaborate and Evaluate) learning cycle requires students to do more than merely report on a topic but, go beyond the simple memorization of facts and regurgitation of information to the realm of creating new and deeper understanding. The 5E model is an inquiry-based, constructivist framework where students build knowledge through hands-on experiences rather than just memorizing lectures [4]. The teacher acts as a facilitator while students move through five continues phases.

Statement of the Problem

The declining in students' academic achievement in Senior Secondary School Certificate Examination (SSCE) in Biology has been of great concern to scholars, stakeholders, and the government. Workshops, conferences, and seminars have been organized to look into lasting solutions to poor academic achievement of Senior Secondary Schools in science subjects.

Poor teacher quality, students' low confidence, students' age, poor students' motivation and self-confidence, anxiety, shortage of qualified Biology teachers, poor facilities, equipment and instructional materials may lead to poor academic achievement [5]. In the same vein, use of traditional chalk method, poor teacher pedagogical content knowledge, poor teaching strategies and methods, inadequate laboratory materials may also lead to poor students' performance.

There is need therefore to investigate instructional strategy of 5E learning cycle whether it may improve teaching and learning of Biology. Therefore, the problem of this study is to find out whether 5E learning cycle instructional strategy will change students' interest for better and improve students' academic achievement in Biology in senior secondary schools in Adamawa State Nigeria.

Objectives of the Study

This study intends to determine:

I. The effects of 5E learning cycle instructional strategy on Secondary School Students' Interest in Biology in Adamawa State.
II. The effects of 5E learning cycle instructional strategy on Secondary School Students Achievement in Biology in Adamawa State.
III. The effects of 5E learning cycle instructional strategy on Secondary School Students' achievement in Biology with respect to gender in Adamawa State.
IV. The interaction effects of 5E learning cycle instructional strategy with respect to gender on Secondary School Students' Interest in Biology in Adamawa State.
V. The interaction effects of 5E learning cycle instructional strategy with respect to gender on Secondary School Students' Achievement in Biology in Adamawa State.

Research Questions

Based on the specific objectives of the study, the following research questions will be raised to guide the study.

I. What are the pre-test and post-test mean interest scores of Secondary School Students in Biology when taught using the 5E learning cycle instructional strategy in Adamawa State?
II. What are the pre-test and post-test mean achievement scores of Secondary School Students' in Biology when taught using the 5E learning cycle instructional strategy in Adamawa State?
III. What are the pre-test and post-test mean scores of Secondary School students' in Biology by gender when taught using the 5E learning cycle instructional strategy in Adamawa State?
IV. What are the pre-test and post-test mean scores of students' in Biology when taught using the 5E learning cycle instructional strategy with respect to gender on Secondary School Students' Interest in Biology in Adamawa State?

V. What are the pre-test and post-test mean scores of students' in Biology when taught using the 5E learning cycle instructional strategy with respect to gender on Secondary School Students' Achievement in Biology in Adamawa State?

Hypotheses

The following null hypotheses are formulated and will be tested at 0.05 level of Significance:

Ho_1: There is no significant effect of 5E learning cycle instructional strategy on Secondary School Students' Interest to Biology in Adamawa state.

Ho_2. There is no significant effect of 5E learning cycle instructional strategy on Secondary School Students' Achievement in Biology in Adamawa State.

Ho_3. There is no significant gender difference on Secondary School Students' achievement in Biology when taught using the 5E learning cycle instructional strategy.

Ho_4. There is no significant interaction effect of 5E learning cycle instructional strategy on gender of Secondary School Students' Interest in Biology in Adamawa State.

Ho_5. There is no significant interaction effect of 5E learning cycle instructional strategy on gender of Secondary School students' Achievement in Biology in Adamawa State.

Concept of 5E Learning Cycle

The 5E Learning Cycle is a philosophy of teaching and learning with strong constructivist foundations by Vygotsky, (1978). The 5E learning cycle was influenced by the work of Piaget and Karplus (1954) at the University of California-Berkeley, began looking at how they might apply cognitive development theory and discovery learning using instructional strategies in elementary science teaching [6]. 5E Instructional Model is a teaching plan with five steps: Engage, Explore, Explain, Elaborate, and Evaluate. These steps help students build their own understanding of new ideas

Concepts of Interest

Interest is educational concepts that determine some aspects of students' effective domain which is very important in the teaching and learning process. Interest is feeling, desire and act of developing affection towards something. In education, interest is characterized by increased attention and concentration in classroom and academic activities. It is a motivational variable and emotionally oriented trait which determines the vigor of the learner in tackling educational activities. Interest simply entails willingness to acquire skills knowledge, attitude, and values. It is the eagerness to learn a set out task or activity for positive and near mastery of the skills and knowledge related to the activity [7]. Okekeokosili and Okigbo (2021) defined interest as an emotionally oriented behavioral trait that determines a students' urge and vigor to tackle educational programs or other activities.

Concepts of Academic Achievement

Academic Achievement may refer to completing educational benchmarks. Achievement is often measured through examinations or continuous assessments. Achievement is the extent to which a student or institution has achieved either short or long term educational goals. Iyekekpolor, Tsue opined that students' interest and achievement in Mathematics are heavily influenced by teaching methods. Research indicates that poor teaching approaches lead to negative attitudes, while active engaging strategies – such as computer – assisted instruction or using improvised materials significantly improve students' interest, retention and performance. Furthermore, Iyekekpolor, Shiaki and Uveruveh explained that research evidence shows that teaching methods that fully engage students' during the learning process significantly improve their concept understanding and problem-solving skills.

Academic Achievement is the amount of academic content a student learns in a specific time period. This can be any way a student has achieved short-time or long-term academic goals within an academic setting. Testing and assessment are usually performed to gauge a students' achievement. Academic achievement is a result that demonstrates how far a person has progressed toward certain goals that are the focus of the activity instructional environment, particularly in school, college, and university. Achievement is an important parameter in measuring students' learning outcomes in various school disciplines. It is commonly measured by assigning scores to the outcome of continuous assessments and examinations. Students over the years have shown that there is a disparity in the

achievement of males and females in the sciences.

This study was anchored on three theories namely:

1. Leev Vygotsky's (1978) Theory of social learning.
2. John Dewey's view on interest in education (1913)
3. Reynolds and Walberg's (1992) theory of academic achievement

Leev Vygotsky's (1978) Theory of Social learning

The theoretical framework adopted for this study was Leev Vygotsky's theory of social learning which proposed that children construct knowledge through social intersection of people, interactions that involve sharing, comparing, solving problems, logical thinking and debating among learners and teachers. Through a highly interactive process, the social interaction of learning is accorded center stage and the learners both refine their own meanings and help others find meaning [8]. This implies that knowledge is mutually built through social interaction among learners.

John Dewey's view on interest in education

Another theory used in this study is John Dewey's view on interest in education. Dewey theory explains how interest might manifest itself and interact in an educational environment. According to Dewey, interest can be three things. First, interest can be an action or propulsion towards engagement with content. For example, an individual can take an interest in something. To be interested in any matter is to be actively concerned with it. Second, interest is objective. Interests are things that an individual looks after. Interest is identified with concern or affairs [9]. Thirdly, interest is personal; it signifies a direct concern; recognition of something at stake, something whose outcome is important for the individual. It has its emotional as well as its active and objective sides. Securing interest in facts or ideas is essential for students to direct their energies toward mastering those facts of ideas.

Reynolds and Walberg's theory of academic achievement

Reynolds and Walberg's theory of academic achievement: posits that Psychological characteristics of individual students and their immediate psychological environments influence educational outcome (cognitive, behavioral, and attitudinal) [10]. A theory related to academic performance is the one developed by Walberg according to which academic productivity depends on the personal structure. Walberg's theory of academic achievement posits that psychological characteristic of individual students and their immediate psychological environments influence educational outcome which consist the cognitive, behavioral and attitudinal traits. This theory addresses the learning influences that have an impact on a students' academic success.

Research methods

The design for the study was quasi-experimental design, which involves pre-test, post-test, non-equivalent, control group, design. The independent variable which is 5E Learning Cycle Instructional Strategy was used as treatment for the experimental group, while lecture teaching method was used for the control group. The area of the study of this research is Adamawa State, Nigeria. The Population of this study consisted of all the 18,259 SS II Students' in Biology in all the 404 Public Senior Secondary Schools in Adamawa State for the 2025/2026 academic session.

A sample size of 234 male and 157 female making total of 391 students were randomly drawn out of the 18,259 Secondary School Two (SS2) from all the 404 Public Secondary Schools in Adamawa State

Two instruments were used for data collection namely Biology Achievement Test (BAT) and Biology Interest Inventory (BII). The BAT consists of 50 objective test items with four options. The items in the instrument (BAT) were selected based on each topic of the content of Senior Secondary School SS2 class scheme of work drawn from Biology curriculum while the BII was designed by the researcher by means of selecting some questions from the content of the BAT.

The instruments were given face and content validation by three experts from Curriculum and Instruction, Educational Administration and Planning, and Measurement and Evaluation, all from Faculty of Education, Taraba State University, Jalingo. In this study, the reliability of the instruments was computed using the Cronbach Alpha. The reliability index 0.74 and 0.86 was obtained for both BAT and BII respectively.

2. Method of Data Analysis

The collected data were analyzed using descriptive statistics of mean and standard deviation to answer the research questions, while the null hypotheses were tested using one-way and two-way Analysis of Covariance (ANCOVA) at 0.05 level of significance.

3. Result and Discussion

Presentation and Interpretation of Results

Hypotheses Testing

Ho1: There is no significant effect of 5E Learning Cycle Instructional Strategy on Secondary School Students' Interest in Biology in Adamawa state.

Table 1. One way Analysis of Covariance (ANCOVA) on the Effect of the 5E Learning Cycle Instructional Strategy on Secondary School Students' Interest in Biology in Adamawa State.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial eta squared
Corrected Model	2984.646[a]	4	746.162	16.878	.000	0.042
Intercept	49407.525	1	49407.525	1117.615	.000	0.450
GROUP	2901.737	1	2901.737	65.638	.000	0.002
Interest	**18.569**	**2**	**9.285**	**.210**	**.811**	**0.141**
Error	15826.467	358	44.208			
Total	1043785.000	363				
Correc ted Total	18811.113	362				

a. R Squared = .159 (Adjusted R Squared = .149)

The Analysis of Covariance (ANCOVA) results in Table 1 indicate that the instructional group (GROUP) had a statistically significant effect on students' post-test interest scores, $F(1, 358) = 65.638$, $p < .001$, partial eta squared =0.141. This result shows that there is a significant difference in interest between students taught using the 5E Learning Cycle and those taught using the Lecture Method. Based on the descriptive statistics presented earlier, students exposed to the 5E Learning Cycle demonstrated higher Post-test interest scores [11]. The overall model was statistically significant, $F(4, 358) = 16.878$, $p < .001$, indicating that the combined effect of the predictors significantly influenced students' interest. The model explained 15.9% of the variance in post-test interest scores ($R^2 = .159$; Adjusted $R^2 = .149$), suggesting a moderate level of explanatory power. However, the Interest subgroup variable (FR, QR, JM) was not statistically significant, $F(2, 358) = 0.210$, $p = .811$, implying that differences among the subgroups did not significantly affect post-test interest after controlling for instructional method. Therefore, the null hypothesis (Ho_1) is rejected, indicating that there is a statistically significant effect of the 5E Learning Cycle instructional strategy on secondary school students' interest in Biology in Adamawa State.

Ho2. There is no significant effect of 5E learning cycle instructional strategy on Secondary School Students' Achievement in Biology in Adamawa State.

Table 2. One way Analysis of Covariance (ANCOVA) on the Effect of the 5E Learning Cycle Instructional Strategy on Secondary School Students' Achievement in Biology in Adamawa State.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial eta squared
Corrected Model	13077.286[a]	3	4359.095	272.927	.000	0.017
Intercept	155848.638	1	155848.638	9757.822	.000	0.093
GROUP	2716.825	1	2716.825	170.103	.000	0.017
Achievement	**10111.209**	**1**	**10111.209**	**633.072**	**.000**	**0.016**
Error	5733.827	359	15.972			
Total	1043785.000	363				
Corrected Total	18811.113	362				

a. R Squared = .695 (Adjusted R Squared = .693)

The ANCOVA results in Table 2 reveal that the instructional group (GROUP) had a statistically significant effect on students' post-test achievement scores, $F(1, 359) = 170.103$, $p < .001$, partial eta squared =0.16. This indicates that students taught using the 5E Learning Cycle performed significantly better than those taught using the Lecture Method [12]. The Achievement covariate was also statistically significant, $F(1, 359) = 633.072$, $p < .001$, indicating that students' prior achievement levels strongly predicted their post-test performance. The overall model was statistically significant, $F(3, 359) = 272.927$, $p < .001$, and explained a substantial proportion of the variance in post-test achievement scores ($R^2 = .695$; Adjusted $R^2 = .693$), indicating a very strong explanatory power. Consequently, the null hypothesis (Ho_2) is rejected, implying that there is a statistically significant effect of the 5E Learning Cycle instructional strategy on secondary school students' achievement in Biology in Adamawa State.

Ho3. There is no significant gender difference on Secondary School Studzents' Achievement in Biology when taught using the 5E Learning Instructional Strategy.

Table 3. Two way Analysis of Covariance (ANCOVA) of Gender Differences in Secondary School Students' Achievement in Biology When Taught Using the 5E Learning Cycle Instructional Strategy.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial eta squared
Corrected Model	2981.530[a]	3	993.843	22.539	.000	0.16
Intercept	155832.744	1	155832.744	3534.140	.000	0.91
Group	2903.209	1	2903.209	65.842	.000	0.18
Gender	**15.453**	**1**	**15.453**	**.350**	**.554**	**0.17**
Error	15829.583	359	44.094			
Total	1043785.000	363				
Corrected Total	18811.113	362				

a. R Squared = .158 (Adjusted R Squared = .151)

The ANCOVA results in Table 3 shows that gender did not have a statistically significant effect on students' achievement, F(1, 359) = 0.350, P = .554, partial eta squared =0.17. This indicates that there is no significant difference in achievement between male and female students when taught using the 5E Learning Cycle Instructional Strategy [13]. However, the instructional group (GROUP) remained statistically significant, F(1, 359) = 65.842, P < .001, confirming that the 5E Learning Cycle is more effective than the Lecture Method in improving students' achievement. The overall model was statistically significant, F(3, 359) = 22.539, P < .001, and accounted for 15.8% of the variance in students' achievement scores (R^2 = .158; Adjusted R^2 = .151), indicating a modest level of explanatory power. Therefore, the null hypothesis (Ho_3) is retained, indicating that there is no significant gender difference in students' achievement in Biology when taught using the 5E Learning Cycle instructional strategy.

Ho4. There is no significant interaction effect of 5E Learning Instructional Strategy on gender of Secondary School Students' Interest in Biology in Adamawa State.

Table 4. Two way Analysis of Covariance (ANCOVA) of Gender Differences in Secondary School Students' Interest in Biology When Taught Using the 5E Learning Cycle Instructional Strategy.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial eta square
Corrected Model	3222.020[a]	6	537.003	12.263	.000	0.000
Intercept	63750.508	1	63750.508	1455.837	.000	0.0671
GROUP	2805.867	1	2805.867	64.076	.000	0.606
GENDER * Interest	**256.014**	**5**	**51.203**	**1.169**	**.324**	**0.159**
Error	15589.093	356	43.790			
Total	1043785.000	363				
Corrected Total	18811.113	362				

a. R Squared = .171 (Adjusted R Squared = .157)

The ANCOVA results examining the interaction effect of gender and interest level on students' interest scores indicate that the interaction term (Gender × Interest) was not statistically significant, F(5, 356) = 1.169, P = .324, partial eta squared =0.159 [14]. This suggests that the combined effect of gender and subgroup classification did not significantly influence students' interest in Biology. The instructional group (GROUP), however, remained statistically significant, F(1, 356) = 64.076, p < .001, indicating that the 5E Learning Cycle continued to have a strong positive effect on students' interest regardless of gender. The overall model was statistically significant, F(6, 356) = 12.263, P < .001, and explained 17.1% of the variance in interest scores (R^2 = .171; Adjusted R^2 = .157), reflecting a moderate explanatory capacity. Therefore, the null hypothesis (Ho_4) is retained, indicating that there is no statistically significant gender difference in students' interest in Biology when taught using the 5E Learning Cycle strategy.

Ho5. There is no significant interaction effect of 5E Learning Instructional Strategy on gender of Secondary School Students' Achievement in Biology in Adamawa State.

Table 5. Two way Analysis of Covariance (ANCOVA) on the Interaction Effect of the 5E Learning Cycle Instructional Strategy and Gender on Secondary School Students' Achievement in Biology in Adamawa State

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial eta square
Corrected Model	13131.874[a]	4	3282.968	206.947	.000	0.002
Intercept	961959.976	1	961959.976	60638.698	.000	0.481
Group	2731.085	1	2731.085	172.158	.000	0.041
Gender * Achievement	**10165.869**	**3**	**3388.623**	**213.607**	**.000**	**0.079**
Error	5679.239	358	15.864			
Total	1043785.000	363				
Corrected Total	18811.113	362				

a. R Squared = .698 (Adjusted R Squared = .695)

The ANCOVA results in Table 5 shows that the interaction effect between gender and achievement (Gender × Achievement) was statistically significant, F(3, 358) = 213.607, P < .001, partial eta squared =0.79 [15]. This indicates that the effect of the 5E Learning Cycle Instructional Strategy on students' achievement differs significantly across gender groups. The main effect of instructional group was also statistically significant, F(1, 358) = 172.158, P < .001, confirming that students taught using the 5E Learning Cycle achieved higher scores than those taught using the Lecture Method. The overall model was statistically significant, F(4, 358) = 206.947, P < .001, and explained a very large proportion of the variance in achievement scores (R^2 = .698; Adjusted R^2 = .695), indicating a very strong model fit. Therefore, the null hypothesis (Ho_5) is rejected, implying that there is a statistically significant interaction effect of the 5E Learning Cycle instructional strategy and gender on students' achievement in Biology.

Findings of this study

i. There is a statistically significant effect of the 5E Learning Cycle instructional strategy on students' interest to biology F (4, 358) = 16.878, P<.001,
ii. There is a statistically significant effect of the 5E Learning Cycle instructional strategy on th achievement score of students, F(1, 359) = 170.103, P<,001,
iii. There is no significant gender difference in students' achievement in Biology when taugh the 5E Learning Cycle instructional strategy, F(1. 359) = 0.350, P. .554,
iv. There is no statistically significant gender difference in students' interest in Biology when taught using the 5E Learning Cycle instructional strategy, f (5, 356) = 1.169, p =.324, and
v. There is a statistically significant interaction effect of the 5E Learning Cycle Instructional Strategy and gender on students' achievement in Biology, F(3, 358) = 213.607, p<.001.

Summary

This study examined the effects of 5E Learning Cycle Instructional Strategy on Secondary School Students' Interest and Achievement in Biology in Adamawa State, Nigeria. The main purpose of the study was to investigate the effects of 5E learning cycle instructional strategy on Secondary School Students' Interest and Achievement in Biology. The specific objectives included determining the effects on interest, achievement, gender differences, and interaction effects with gender. Five research questions and five null hypotheses guided the study. The design adopted for the study was a quasi-experimental pretest-posttest non-equivalent control group design.

4. Conclusion

Based on the findings of this study, the following conclusion was drawn in direct response to the research questions and hypotheses. There was no significant effect of 5E Learning Cycle Instructional Strategy on Secondary School Students' Interest in Biology in Adamawa State.

There was no significant effect of 5E Learning Cycle Instructional Strategy on Secondary School Students' Achievement in Biology in Adamawa State. There was no significant gender difference on Secondary School Students' Achievement in Biology when taught using the 5E Learning Cycle Instructional Strategy in Adamawa State. There was no significant interaction effect of 5E Learning Cycle Instructional Strategy on gender of Secondary School Students' Interest in Biology in Adamawa State.

There was no significant interaction effect of 5E Learning Cycle Instructional Strategy on gender of Secondary School Students' Achievement in Biology in Adamawa State.

Based on the findings of this study, the following recommendations were proffered.

Adopt 5E Learning Cycle Instructional Strategy**:** Biology teachers in Secondary Schools in Adamawa State should adopt the 5E learning cycle instructional strategy as the primary method for teaching Biology concepts to enhance students' interest in Biology. Encourage Teacher Training on 5E learning cycle instructional strategy**:** The Adamawa State Ministry of Education, SUBEB, and other relevant agencies should organize regular workshops, seminars, and in-service training programs for Biology teachers focused on the effective implementation of the 5E learning cycle and other student-centered instructional strategies to promote students' achievement in Biology**.** Incorporation of 5E learning cycle in Biology Curriculum**:** Curriculum planners and developers in Biology should integrate the 5E learning cycle model explicitly into the secondary Biology curriculum to institutionalize its use across gender in students' achievement in Biology. Role of School Administrators on provision of School Facilities: School administrators should ensure the provision of adequate laboratory facilities, instructional materials, and conducive learning environments to support the full implementation of the 5E strategy (engage, explore, explain, elaborate, and evaluate phase) to maximize interest gains for both male and female in light of the observed interaction effect. Role of Biology Teachers on using 5E learning cycle instructional strategy in Teaching: Biology teachers should pay deliberate attention to gender dynamics during the implementation of the 5E strategy, particularly in the exploration and elaboration phases, to maximize achievement gains for both male and female students in light of the observed interaction effect. The major limitation encountered was that, the sample was drawn from only three Education Zones out of five in Adamawa State. The inclusion of more zones or private schools would have ensured a more generalized result but, it was not possible in this study. The conclusion and generalization of the study is also limited to Public Senior Secondary Schools (SS II) in Adamawa State and the selected topics in Biology. However, the findings of this study cannot be generalized to the entire Nation or other science subjects because the present study focused only on Biology in public secondary schools in Adamawa State.

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