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EFFECTS OF ADDIE INSTRUCTIONAL MODEL ON BASIC SCIENCE STUDENTS' ACHIEVEMENT AND RETENTION IN JUNIOR SECONDARY SCHOOLS IN DELTA NORTH SENATORIAL DISTRICT

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ABSTRACT

This study investigated the effect of ADDIE instructional model on students' achievement and retention on Basic Science students' achievement and retention in Junior Secondary School in Delta North senatorial district. To achieve the main purpose of the study, six research questions and their corresponding hypotheses were raised and formulated to guide the study. The study adopted pre-test, post-test and non-randomized group planned variation quasi-experimental design. And two hundred and thirty (230) JSSII students (98 males and 132 females) constituted the sample of the study using a multi-stage simple random sampling technique. The instrument that used for this study is the Basic Science Achievement Test (BSAT). This instrument was properly validated and reliability were determined before usage. To determine the reliability of the instrument, the data collected were analyzed with Kruder Richardson statistics and it yielded an r value of 0.70. At the end of the treatment, the data collected were analyzed. The research questions were answered using descriptive statistics of mean and standard deviation, and the hypotheses were tested with, independent sample t-test, and analysis of Covariance statistics at 0.05 alpha level of significance. The findings of the study includes: (i) there was a significant difference in the mean achievement in Basic Science students taught with ADDIE instructional design model and Lecture method in Delta North Senatorial District, (ii) there was a significant difference in the mean achievement of male and female students taught with ADDIE instructional design model., (iii) there was a significant interaction effects between methods and sex on achievement of Basic science students taught with ADDIE Instructional design model and lecture method. Based on the findings of the study it was concluded that the use of ADDIE instructional design model is superior to Lecture method in improving students' achievement in Basic Science and recommended that Higher institutions with teacher Education programme should review their curriculum to include ADDIE instructional design model in their curriculum to enable pre-service teachers acquire the knowledge of its usage.

KEYWORDS: ADDIE, instructional design model, Achievement and Retention

INTRODUCTION

Basic science often referred to as the first form of science that students are exposed to, encompasses disciplines that seek to understand fundamental principles of the natural world through observation, experimentation, and theoretical modeling. It includes fields such as physics, chemistry and biology. One of the aims of basic science is to expand knowledge and understanding of phenomena, independent of specific applications or technologies. The aims and objectives for teaching basic science include the following: to enable the learners develop interest in Science and Technology; acquire basic knowledge and skills in science and technology; apply scientific and technological knowledge and skills to meet contemporary societal needs; take advantage of the numerous career opportunities provided by science and technology; avoid drug abuse and related vices; be safety and security conscious and become prepared for further studies of science and technology (Basic Science and Technology Curriculum (BSTC), 2012). This will help prepare students to make informed decisions in their everyday life. Basic science education is meant to foster curiosity and a questioning mindset on students at the basic level of education. By exploring the natural world, students develop a sense of wonder and an intrinsic motivation to learn and investigate (National Science Teachers Association, 2011). A thorough understanding of basic science is essential for students who wish to pursue careers in science, technology, engineering, and mathematics (STEM). It lays the groundwork for more specialized study in these fields . Basic science education also equips students with the knowledge to understand and contribute to discussions on pressing societal issues, such as climate change, health, and technological impacts. This awareness is crucial for fostering responsible citizenship.

Over the years, various methods have been employed to teach Basic Science in schools, including lecture instruction, hands-on experiments (physical laboratory work), inquiry-based learning, and technology-driven approaches but lecture method is predominantly used. Lecture method is a teacher-centered method characterized by direct instruction, where students passively received information. This is one of the oldest methods, where teachers deliver content while students take notes. This method often leads to completion of a large volume of work within the shortest period of time. This method often engages students with mental activities.

A review of recent Junior School Certificate Examination (JSCE) results indicates a consistent trend of poor performance in Basic Science. According to the Chief Examiner's report, about 60% of candidates scored below the minimum pass mark in Basic Science over the past five years (BECE, 2023). For example, an examination of students' academic performance in Basic Science as indicated by the Basic Education Certificate Examination (BECE) results from 2012 to 2023 shows that, out of the 963 students that sat for basic science in JSSCE in 2012 only 26 students representing 2.7% got distinction (A), 240 students representing 24.9% got credit (C) 676 students representing 70.2% got ordinary pass (P) while 21 students representing 2.2% failed. In 2013 a total of 956 students wrote the exam 160 students (16.79%) got credit (c) 733 students (30.9%) got Pass while 23(2.4%) students

failed. No student got distinction. In 2014 a total of 1039 students wrote basic science in JSSC examination and only 2(0.2%) got distinction. 287 (27.6%) got credit, 736 (70.8%) got ordinary pass while 14 (1.4%) students failed. In 2015 989 students sat for the exam. Only 3(0.3%) got distinction 250 (25.3%) got credit, 706 (71.4%) got ordinary pass while 30 students (3.0%) failed. In 2016, out a total of 1112 students that took the exam, 20 students representing 18% got distinction, 331 students representing 29.8% got credit, 733 students representing 65.9% got ordinary pass while 28 students (2.5%) failed. science is low. This is because the percentage credit passes which includes both distinction and credit in basic science from 2012-2014 is below 30% (27.6% in 2012, 16.7% in 2013, and 27.8% in 2014, 25.6% in 2015). The slight improvement in 2016 (47.8) was not even up to 50% credit pass. From 2018 to 2022, shows a troubling pattern of below-average achievement. Data obtained from the Ministry of Education (2023) reveals a concerning trend in Basic Science performance over the past five years. The percentage of students achieving below average in the subject has shown a steady increase: 42.86% in 2018, 45.9% in 2019, 50.9% in 2020, 54.9% in 2021, and 62.84% in 2022 and 65.45 in 2023. The persistent increase in below-average performance signals a deteriorating scenario, notably peaking in 2022. Should this trend persist unchecked, there is a risk of students opting out of science and technology-related courses in favour of non-science disciplines. Such a shift could carry substantial long-term consequences for individuals and the wider educational framework of the country (Eya,2018). This trend reflects a potential disconnect between teaching methods and students' learning needs, suggesting an urgent need for the application of innovative approaches that has the ability to address the diverse needs of students and enhance their performance in Basic Science.

One method that has the feature to address the diverse needs of students is the ADDIE instructional model. ADDIE is an acronym that stands for, Analysis, Design, Development, Implementation, and Evaluation. It is a widely used instructional design framework that guides educators and instructional designers in creating effective learning experiences. The Analysis phase involves identifying the learners' needs, the learning environment, and defining the learning objectives. It sets the foundation for the other stages. The Design phase outlines the course structure, develop instructional strategies, and determine assessment methods by the instructional designer. This phase emphasizes creating a blueprint for the course. The Development phase involves the creation of educational materials, learning activities, and assessments based on the design plan. This phase often involves collaboration among subject matter experts and designers. The Implementation phase involves delivering the instructional materials to learners. It may include training instructors, organizing resources, and ensuring that technology and materials are accessible. And lastly, the Evaluation phase involves the assessment of the achievement. This could be both formative and summative evaluation. Formative evaluation occurs throughout the ADDIE process to check for effectiveness and areas for improvement, while summative evaluation assesses the overall success of the instructional program.

The application of ADDIE model in teaching helps ensure that instructional design is systematic and learner-centered. Teachers can use ADDIE to design courses that meet specific achievement,

considering students' backgrounds and learning preferences. Some research findings as shown the efficacy of ADDIE instructional strategy on students' achievement in other subjects (Smith and Brown, 2020; Feng and Sangsawang 2023, Lopez, 2021). If an instructional strategy takes care of learner needs, it is believed that there will be an improvement in their achievement.

Achievement refers to student scores that are obtained after they have been taught. Measuring academic achievement of student in the educational sector is one of the important aspect of schooling. The outcome of academic achievement enables stake holders to evaluate the curriculum process as a whole and the efficacy of an instructional strategy. It has been established by researchers that that an effective instructional strategy promotes effective learning irrespective of sex.

Sex refers to the biological makeup of students in the basic science class room. These biological make up accounts for the observed physical variations in living things. The students at the secondary school who studies basic sciences are classified as male and female base on their biological makeup. These male and female students in the classroom may have different cognitive abilities that could be as a result of the differences in their biological make up. Some researchers are of the view that sex influence student achievement and that an effective teaching method should not be sex-biased. Determine an instructional strategy that is not sex-biased is very important in the field of Science Education. Research in other field (Smith and Lee, 2022; Smith and Brown 2020) have shown that the ADDIE model leads to improved student achievement. It is against this background, that this study seeks to investigate the effect of ADDIE instructional model on Basic Science students' achievement in Junior Secondary School in Delta North Senatorial District.

STATEMENT OF PROBLEM

In the field of education, particularly in the teaching of Basic Sciences at the junior secondary school level, the challenge of improving achievement and retention rates among students persists as a critical concern for educators, policymakers, and administrators alike. Despite various educational reforms and initiatives aimed at enhancing science education, students often demonstrate lack of engagement, poor performance, and low retention of key scientific concepts. For example, a review of students' performances in BECE from 2018 to 2023 shows that the percentage of students achieving below average in the subject has shown a steady increase: 42.86% in 2018, 45.9% in 2019, 50.9% in 2020, 54.9% in 2021, and 62.84% in 2022 and 65.45 in 2023. The persistent increase in below-average performance signals a deteriorating scenario, with a notable peaking in 2022. Should this trend persist unchecked, there is a risk of students opting out of science and technology-related courses in favour of non-science disciplines. This poor performance has been attributed to teaching methods, and lesson development among others. Literature has showed that the dominant teaching method in Nigeria is the lecture method which lesson development process is that of teacher centered which renders students passive and inactive in the teaching and learning process. These challenges underscore the need for alternative instructional development and implementation of student-centered methods that can cater for the diverse learning needs of students.

Also, studies reviewed that well designed and implemented learning experience significantly improve both learning effectiveness, catering to diverse learning styles, increasing student engagements, motivation and fostering critical thinking and problem-solving skills. The intentional development and use of these student-centered teaching strategies have been found to contribute to higher academic achievements, better retention and the cultivation of lifelong learning habits in other areas. Hence this study seeks to answer the following questions (i) what is the effect of ADDIE instructional design model on basic science students' achievement and retention? (ii) is there be variation in the achievement of basic science students as regards sex?

RESEARCH QUESTIONS

The following research questions were raised to guide the study:

1. What is the difference between the achievement of students taught Basic Science using ADDIE instructional design model and the lecture method in Delta North Senatorial District?
2. What is the difference in the achievement of male and female students taught Basic Science using the ADDIE instructional design model using lecture Method in Delta North Senatorial District?
3. What is the effect of interaction between method and sex on students' achievement Basic Science in Delta North Senatorial District?

HYPOTHESES

The following research hypotheses were formulated to guide the study:

- H0₁. There is no significant difference between the achievement of students taught Basic Science using ADDIE instructional design model and lecture method Delta North Senatorial District.
- H0₂. There is no significant difference in the achievement of male and female students taught Basic Science using ADDIE instructional design model and Lecture method Delta North Senatorial District.
- H0₃. There is no significance effect of interaction between method and sex on Students achievement in Basic Science Delta North Senatorial District.

RESEARCH DESIGN

The study adopted pre-test, post-test and non-randomized group planned variation quasi experimental design. This design is suitable because there was no randomization of subjects into groups but rather intact classes were used. The independent variables for the study were ADDIE instructional strategy and lecture method. The dependent variable is Basic Science Achievement and the moderating variable is sex. This is adequate because there was no randomization of subjects into groups. In the view of

Johnson and Christensen (2000) when design that lacks randomization should be described as quasi-experimental design

STUDY POPULATION AND SAMPLE

The population for the study comprises of 41,802 (forty-one thousand, eight hundred and two) Junior Secondary School II Basic Science students in the twenty (20) mixed public secondary school in Delta North Senatorial District (Ministry of Basic and Secondary Education Asaba, 2024). Two hundred and thirty (230) JSSII students (98 males and 132 females) constituted the sample of the study using a multi-stage simple random sampling technique. To achieve this, in the first stage, the local government areas were selected. In doing this, a list containing the names of the local government areas were listed in a blind bag, using the withdrawal with replacement strategy, four local government Areas were sampled. One school each was selected from these four local government areas. To achieve this, all the schools in sampled local government Areas were listed in a blind bag, from which one school was selected from each strata. Out of the sampled schools, two were used for experimental group (ADDIE Instructional Model), while the other two were used as control group (Lecture Method). This is to ensure a fair judgment as both groups have equal number of schools. The sample size has a total of 98 males and a total of 132 females.

INSTRUMENTS AND MATERIALS

The instrument that used for this study is the Basic Science Achievement Test (BSAT). This instrument has two sections A&B. Section A elicits information on students' bio data while section B contained fifty (50) multiple choice items, with options labeled A to D being drawn from the basic education certificate examination past question in basic science (2019-2022).

The intervention package is the ADDIE instructional strategy manual. This manual has two sections. Section A exposed the teachers to the concept of the ADDIE model, importance of ADDIE model in the teaching and learning processes and the theory upon which the model is built on and section B exposed the teachers to the advantage of ADDIE instructional model and steps followed in using ADDIE instructional model.

Validity of Instrument

The Basic Science Achievement Test (BSAT) which consist of fifty (50) items in Section B was given to three experts to determine its face validity. The three experts were one experienced basic science teacher, one science educator and measurement and evaluation experts. The BSAT was given alongside with the research question and purposes for the study. The experts looked at the instruments separately alongside with the research questions and the hypothesis. They suggested that items 1, 7, 10 and 15 should be rephrased and this was done. To determine the content validity of the instrument, a Table of specification was designed to ensure that all the concepts were rightly represented.

Reliability of the Instrument

The reliability of the instrument was established by administering the instrument to 50 students who were not part of the sample selected for study. The data selected were analyzed using the Kuder-Richardson 21 Formula and it yielded a value of 0.70 which shows that the instrument is reliable. This is valid because according to Wiseman (1999), any reliability value of 0.70 or higher shows that the test is valid and accurately measured.

Treatment Procedure**Step One: Training Manual for Research Assistant**

The experimental group teachers were trained on the skills of using ADDIE instructional model. The training will be conducted for two hours each day for four days with the teaching manual prepared by the researcher and provided in respect of the teaching model (ADDIE instructional model). For day one the teachers were exposed to the concept of the ADDIE model, importance of ADDIE model in the teaching and learning processes and the theory upon which the model is built on. For day two, the teachers were exposed to the advantage of ADDIE instructional model and steps to be followed in using ADDIE instructional model. On day three, the teachers were made to implement the steps to be followed using the model after it has been demonstrated by the researcher. The training came to an end when the researcher is convinced that the teachers have mastered the steps in using ADDIE model.

Step 2: Pre-Testing of both Group

Before the treatment, the experimental and the control group students were administered the Basic science achievement as pre-test

Step 3: Actual Treatment

Both the experimental and control group students will be taught the same contents using different methods. The experimental group students were taught using ADDIE instructional strategy while the control group were taught using lecture method

3a: Teaching of Basic Science Using ADDIE Model

Step 1: Analysis(A): At this phase the teachers stated the objectives to be achieved for each topic, elicit learner's knowledge of the concept to be taught and present the concept to be learnt to the learner.

Step 2: Design(D): The learning materials and set of activities to be carried out were presented to learners.

Step 3: Development(D): Students were made to generate ideas using the learning materials presented.

Step 4: Implementation (I): Students were made to discuss the concepts to be studied using the idea generated at stage three and their learning were monitored by the teacher.

Step 5: Evaluation (E): Teachers asked question and give assignment in order to determine if the concept has been learnt and also summarizes.

3b: Teaching of Basic Science using Lecture Method

Step 1: Introduction: Teachers introduces the topic to the student to determine their pre-instructional knowledge and to grab learners' attraction.

Step 2: Presentation: Teacher delivers the lecture based on the topics, explain concepts and provide examples.

Step 3: Explanation: Teacher clarifies complex concepts, answer questions in relation to the topic taught.

Step 4: Evaluation: Teachers assess students understanding using quizzes, discussion and assignment and also provide feedback.

Step 5: Conclusion: Teacher recap main points, clarify key points, addresses question

Step 4: Post Testing

At the end of the treatment, the both groups of students were post-tested using the BSAT.

METHOD OF DATA ANALYSIS

Data collected were analyzed using means and standard deviations to answer the research questions, Hypotheses 1, 2 and 3 were tested with independent t-test statistics while hypotheses 4 was tested with Analysis of Covariance (ANCOVA) and 6 was tested using Analysis of Variance (ANOVA) at 0.05 level of significance.

RESULTS

Research Question One: What is the difference between the achievement of students taught Basic Science using ADDIE instructional design model and the lecture method in Delta North Senatorial District?

To establish the difference in the mean achievement of Basic Science students taught with ADDIE instructional design model and Lecture method descriptive statistics of mean and standard deviation was used to analyze the scores of both groups at post-test.

Table 1 Mean and Standard deviation showing the mean scores of Basic Science students taught with ADDIE instructional design model and Lecture Method

Groups	N	Mean	Mean Diff	SD
ADDIE	110	70.38	7.08	10.50
Lecture Method	120	63.30		18.50

In Table 1, the analysis of post test scores of Basic science students taught with ADDIE instructional design model and Lecture method were presented. From the Table, students taught with ADDIE instructional design model got a post-test mean score of 70.38 with a standard deviation of 10.50 and those taught with Lecture method obtained a post-test mean score of 63.30 and a standard deviation of 18.50. Comparing the Mean score, it can be seen that the ADDIE instructional design model group of students obtained a high mean score with a difference of 7.08. To ascertain if the difference is significant, hypothesis one was tested.

H0₁: There is no significant difference between the achievement of students taught Basic Science using ADDIE instructional design model and lecture method Delta North Senatorial District.

To determine the appropriate statistics to use to test hypothesis one, Basic science students taught with ADDIE instructional design model and Lecture method pre-test scores were analyze with inferential statistics of independent sample t-test statistics and this presented in Table 2.

Table 2: Inferential statistics of independent sample t-test comparing the pre-test mean scores of Basic Science students taught with ADDIE instructional design model and Lecture Method

Groups	N	Mean	Mean Diff	SD	df	tcal	Sig(2-tail)
ADDIE	110	34.12		3.59			
			0.01		228	0.21	0.98
Lecture Method	120	34.11		3.58			

In Table 2 the analysis of pre-test scores of Basic science students taught with ADDIE instructional design model and Lecture method were presented to ascertain if there will be a significant difference between scores. The Table shows there is no significant difference in the pre-test scores of Basic science students taught with ADDIE instructional design model and those taught with Lecture since the computation yielded a sig value of 0.98 which is greater than 0.05 critical value Base on this, independent sample t-test statistics was used to test the corresponding hypothesis.

To establish the if the difference in the mean achievement of Basic Science students taught with ADDIE instructional design model and Lecture method at post-test is significant, the scores of both group of students were analyzed with independent sample t-test statistics and the result is reflected in Table 3

Table 3 Inferential statistics of independent sample t-test comparing the difference in the mean scores of Basic Science students taught with ADDIE instructional design model and Lecture Method

Groups	N	Mean	Mean diff	SD	df	tcal	Sig(2-tailed)
ADDIE	110	70.38		10.50			
		7.08		228	4.01	0.00	
Lecture Method	120	63.30		18.50			

In Table 3, the analysis of post-test scores of Basic science students taught with ADDIE instructional design model and Lecture method after analysis ascertained that there was a significant difference between the scores, because the calculated sig value of 0.00 which is less than the alpha value of 0.05 was obtained, based on this, hypothesis one which states that there is no significant difference in the mean achievement of Basic Science students taught with ADDIE instructional design model and Lecture method on in Delta North Senatorial District is therefore rejected.

Research Question Two: What is the difference in the achievement of male and female students taught Basic Science using the ADDIE instructional design model using lecture Method in Delta North Senatorial District?

To determine the difference in the mean achievement of male and female Basic Science students taught with ADDIE instructional design model and Lecture method, descriptive statistics of mean and standard deviation was used to analyze the scores of male and female students in both groups at post-test.

Table 4 Mean and Standard deviation showing the mean scores of male and female Basic Science students taught with ADDIE instructional design model and Lecture Method

Groups	Sex	N	Mean	Mean Diff	SD
ADDIE	Male	51	73.27	5.39	6.31
	Female	59	67.88		12.62
Lecture Method	Male	48	45.35	30.25	18.03
	Female	72	75.60		6.24

In Table 4 the analysis of post test scores of male and female Basic science students taught with ADDIE instructional design model and Lecture method were presented. From the Table, male students taught with ADDIE instructional design model got a mean post test score of 73.27 with a standard deviation of 6.31 whereas their female counterparts obtained a mean score of 67.88 with a standard deviation of 12.62. the male students obtained a high mean score which is greater than that of the females with a difference of 5.39. The male taught with Lecture method obtained a mean score of 45.35 with a standard deviation of 18.03 whereas their female counterparts obtained a mean score of 75.60 and a standard deviation of 6.24. Comparing the Mean score, it can be seen that the female students obtained a high mean score with a difference of 35. 25. To ascertain if the difference is significant, hypothesis two was tested.

H0₂: There is no significant difference in the achievement of male and female students taught Basic Science using ADDIE instructional design model and Lecture method Delta North Senatorial District

To establish if the difference in the mean achievement of male and female Basic Science students taught with ADDIE instructional design model and Lecture method is significant, independent sample t-test statistics was used to analyze the scores of male and female students at post-test since there was no significant difference obtained in Table 2.

Table 5 Mean and Standard deviation showing the mean scores of male and female Basic Science students taught with ADDIE instructional design model and Lecture Method

Groups	Sex	N	Mean	Mean Diff	SD	df	tcal	Sig(2-tailed)
ADDIE	Male	51	73.27		6.31			
				5.39		108	2.77	0.007
	Female	59	67.88		12.62			
Lecture Method	Male	48	45.35		18.03			
				30.25		118	12.26	0.000
	Female	72	75.60		6.24			

In Table 5, the analysis shows the independent sample t-test analysis comparing the difference in the mean scores of male and female students taught with ADDIE instructional design model and lecture method. The output is reflected on the table shows that the difference is significant since the calculated sign values of 0.007 and 0.000 which are lesser than the alpha values of 0.05 were gotten. With this, hypothesis two which shows that there is no significant difference in the mean achievement of male and female Basic Science students taught with ADDIE instructional design model and Lecture method on in Delta North Senatorial District was rejected.

Research Question Three: What is the effect of interaction between method and sex on students' achievement Basic Science in Delta North Senatorial District?

To establish if there is an effect of methods and sex on Basic Science students' achievement, descriptive statistics of mean and standard deviation was used to analyze the scores of both groups at post-test.

Table 6: Mean and Standard deviation showing the interaction mean scores of Basic Science students taught with ADDIE instructional design model and Lecture Method

Groups	Sex	N	Mean	Mean Diff	SD
ADDIE		110	70.38	7.08	10.50
Lecture Method		120	63.30		18.50
ADDIE	Male	51	73.27	5.39	6.31
	Female	59	67.88		12.62
Lecture Method	Male	48	45.35	30.25	18.03
	Female	72	75.60		6.24

In Table 6 the analysis of post test scores of Basic science students taught with ADDIE instructional design model and Lecture method were presented. From the Table, students taught with ADDIE instructional design model got an interaction mean post test score of 70.38 with a standard deviation of 10.50 and those taught with Lecture method obtained a mean score of 63.30 and a standard deviation of 18.50. Comparing the Mean score, it can be seen that the ADDIE instructional design model group of students obtained a high mean score with a difference of 7.08. Going further, the Table shows that the male students taught with ADDIE instructional design model got a mean interaction score of 73.27 with a standard deviation of 6.31 whereas their female counterparts obtained a mean interaction score of 67.88 with a standard deviation of 12.62. the male students obtained a high mean interaction score which is greater than that of the females with a difference of 5.39 and the male taught with Lecture

method obtained a mean interaction score of 45.35 with a standard deviation of 18.03 whereas their female counterparts obtained a mean interaction score of 75.60 and a standard deviation of 6.24. Comparing the Mean score, it can be seen that the female students obtained a high mean interaction score with a difference of 35. 25 To ascertain if the difference is significant, hypothesis five was tested with Analysis of Covariance statistics.

H0₃: There is no significance effect of interaction between method and sex on Students achievement in Basic Science Delta North Senatorial District.

To determine the if there is a significant interaction effect between method and sex on students' achievement, the pre and post test scores of both group of students were analyzed with Analysis of Covariance statistics and the result is reflected in Table 7

Table 7 Inferential statistics of Analysis of Covariance comparing the interaction effects between Method and sex on achievement

Source	Type III Sum of Square	df	Mean Square	F	Sig
Corrected Model	27517.261	4	6879.315	52.870	0.00
Intercept	10503.186	1	10503.186	80.721	0.00
Pre-test	.164	1	.164	.001	0.972
Method	6916.690	1	6916.690	53.157	0.000
Sex	7242.879	1	7242.879	55.664	0.000
Method*Sex	15857.069	1	15857.069	121.867	0.000
Error	29276.461	225	130.118		
Total	1063696.000	230			
Corrected Total	56793.722	229			

The Analysis of Covariance statistics of the pre and post test scores shows that there is a significant interaction effects between methods and sex on Basic science students achievement is significant, since the calculated sig value of 0.000 which is less than 0.05 alpha level of significant was obtained, based on this, hypothesis five which states that there is no significant interaction effect of method and sex on Basic science Students achievement in Delta North Senatorial District is rejected. To determine the type of interaction effect, a graph was plotted and this is shown in Table Fig 4.1

Fig 4.1: Graph showing the effects of interaction between method and sex on achievement

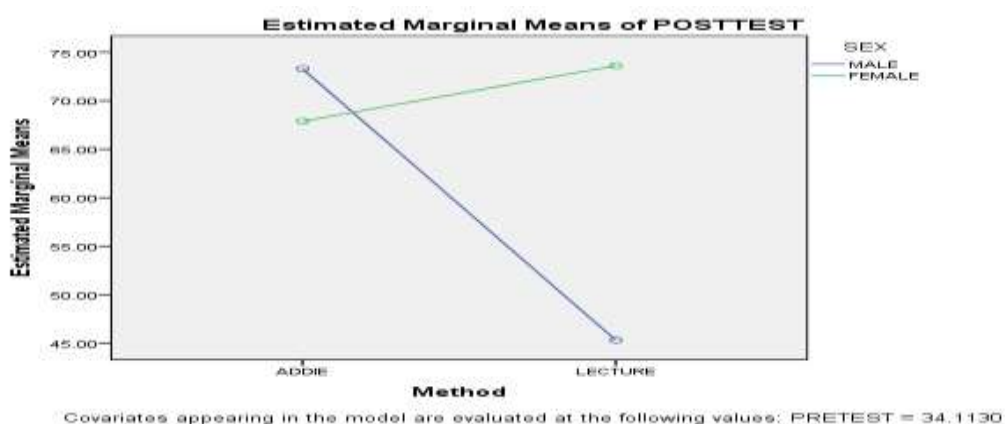


Fig 1 shows that the interaction effect is disordinal.

DISCUSSION

The first finding of the study showed a significant difference in the mean achievement of Basic Science students taught with ADDIE instructional design model and Lecture method in Delta North Senatorial District. From Table 1, it was shown that students taught with ADDIE instructional design model had a mean score of 70.38 and their counterparts taught with lecture method obtained a mean score of 63.30. The difference between the mean scores of both group of students was found to be significant in Table 3. This significant difference found is as a result of the differences in the mode of application of both methods. The application of ADDIE instructional design model ADDIE promotes social interaction among students and between students and teachers. This interaction occurs during the execution of phases 2, 3,4, which are the design, development, implementation, stage of the instructional model. These phases promotes active participation and construction of knowledge from prior experience. At the Design phase. the course structure outlined, instructional strategies developed and assessment methods are determined by the instructional designer. This phase emphasizes creating a blueprint for the course. In doing all these, the teacher ensures that elements of students' participation are infused into the activities to be carried out. At the development phase educational materials, learning activities, and assessments based on the design plan are created in such a way that students will be made to participate in the learning process in collaboration with themselves and their teacher. And the implementation phase involves delivering the instructional materials to learners. At this phase, the learners practically get involved in the teaching and learning process, in line with the identified the

learners' needs, the learning environment, and defined the learning objectives. Where as in the Lecture method groups, the mode of application promotes mainly mental activities. These differences must have accounted for the significant difference. This finding agrees with that of Smith and Lee (2022) Johnson (2023) whose results indicated a significant difference in the achievement of students taught with ADDIE instructional design model and lecture method.

Furthermore, the second finding showed a significant difference in the mean achievement of male and female students taught with both methods. This significant difference found is an indication that the male and female students do not equally benefit at the same level when the methods were used. In the group when ADDIE instructional model was used, the male students obtained a high mean score (Table 4) when compared with their female counterparts. This could be due to the male students learning style preferences. The male students may be more of kinesthetic learners and this may have account for the difference that was found to be significant in Table 4 in the lecture method group, the female obtained a high mean score (Table 4) and this was found to be significant (Table 5). This also can be due to the fact that most females are inclined to the auditory learning styles which makes them good note takers and females are more likely to follow giving instructions in the classroom. This finding disagrees with the findings of Lopez and White (2021) whose results showed that male and female students benefitted equally when ADDIE instructional design was used and Edah et al (2026) who found no significant difference in the achievement of male and female students.

The third finding showed a significant interaction effect between method and sex on Basic Science students' achievement as shown in Table 7. This implies that both sex and methods interacted to improve students' achievement in Basic science. This disagrees with the finding of Agboro-Eravwoke, Edah and Iyayi (2025) whose finding indicated a non-significant interaction effect between method and sex on students' achievement

CONCLUSION

- The use of ADDIE instructional design model is superior to Lecture method in improving students' achievement in Basic Science in Delta North Senatorial District
- ADDIE instructional design model is sex biased in improving Basic science students' achievement in Delta North Senatorial District

RECOMMENDATION

In line with the findings of the study, it was recommended that

- Higher institutions with teacher Education programme should review their curriculum to include ADDIE instructional design model in their curriculum to enable pre-service teachers acquire the knowledge of its usage
- Ministry of Education should organize training and workshop so that in service teacher will acquire the knowledge for its usage

- Curriculum planners should specify in the curriculum the contents to be taught with ADDIE instructional design model

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