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IMPACT OF MULTIMEDIA INSTRUCTIONAL STRATEGY IN JUNIOR SECONDARY SCHOOL MATHEMATICS PERFORMANCE IN KOGI STATE, NIGERIA

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ABSTRACT
This study examined the use of multimedia instructional strategies on junior secondary mathematics performance in Kogi State, Nigeria, focusing on gender equality. This study is anchored on the Cognitive theory of multimedia learning (CTML) by Mayer (1997), The research design was Quasi-experimental design. *The population of this study consisted of 11603 (6,580 male and 5,023 female) Junior Secondary (JSS II) students in 236 public Junior secondary schools in Kogi State .The sample consisted of 279* (142 males, 137 females) *Junior Secondary school students (JSII) who are offering Mathematics in four intact classes located in four public secondary schools in Kogi State obtained using multi-stage sampling* Mathematics Performance Test (MPT, r=0.94) was used to collect data Research questions were answered using mean and standard deviation, while ANCOVA tested hypotheses at a 0.05 significance level. Findings revealed statistically significant differences in the academic performance mean scores of students taught Mathematics using multimedia instructional strategies and conventional lecture methods, favouring the multimedia approach. There was no significant difference in academic performance mean scores between male and female students taught Mathematics using multimedia instructional strategy. Additionally, no significant interaction effect of instructional strategies and gender on academic performance in Mathematics was found. The study recommends that mathematics teachers employ multimedia instructional strategies to enhance students' algebra performance and promote gender equality in mathematics examinations. This approach can help bridge the gap in academic performance and ensure equal opportunities for both male and female students.

Keywords: Multimedia, instructional strategy, mathematics performance, junior secondary students.

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Introduction

Mathematics can be defined as both the queen and servant of all the sciences. Undoubtedly, Mathematics is the queen of science and language of nature. Its importance should be clear to any reasonable person. Also, the importance of Mathematics studies in Nigeria has continued to generate a great deal of interest (Achimugu&Igboegu 2021). Mathematics is a fundamental subject which plays a cogent role in understanding and applying concepts in sciences as well as in grappling with the complexities of modem technology useful to mankind, which is all about providing solution to human problems (Adeleke 2014). Mathematics is globally acknowledged as the bedrock of scientific and technological development. Mathematics is relevant to everyday life and can be seen as the pivot on which all other subjects revolve. Nations that are seemed to be developed and largely considered as civilized have achieved this status through effective mathematics education for the citizens (Achimugu*et al.,* 2019).

Mathematics is relevant to our everyday life and can be seen as the pivot on which all other subjects revolve. Nations that are seemed to be developed and largely considered as civilized have achieved this status through effective mathematics education for the citizens (Achimugu, 2023). Mathematics as the science of finding patterns, this appears throughout nature in everything from ripples of pond water to the orbits of the planets which fueled the development of today's technologies. According to Achor (2017) Mathematics is the logical language for expressing ideas, shapes, quantities, sizes, order, change and dynamism in the economic system. Mathematics holds a paramount role in the holistic development of students, enhancing cognitive abilities through the cultivation of logical reasoning, problem-solving skills, abstract thinking, and critical analysis. Beyond the confines of the classroom, it serves as a cornerstone for future careers, particularly in science, technology, engineering, and mathematics (STEM) fields, business, finance, education, and healthcare. Mathematics is not merely a subject confined to academic pursuits; it is an indispensable tool for navigating everyday life.

Gender equity refers to the fairness and justice in the distribution of resources, opportunities, and privileges between men and women. It aims to address the disparities and inequalities that exist between genders, promoting equal rights, responsibilities, and opportunities for all individuals regardless of their gender. The Key Aspects of Gender Equity are Equal Access to Education, Economic Empowerment, Decision-Making and Leadership (Amirkhanyan 2021). .According to Nnamani and Oyibe (2016) gender is a social connotation that has sound psychological background, and is used to refer to specific cultural patterns of behaviour that are attributed to male or female students. Gender equality is important and essential for creating a just, equitable, and prosperous society where everyone has equal opportunities to thrive just as; promoting fairness and justice, empower women and girls, drives economic growth, fosters inclusive societies, and upholds human rights. (Cuberes &Teignier 2014).

Gender equity can lead to improved health outcomes, including reduced maternal mortality and morbidity. It promotes social justice, fairness, and equality in education, contributing to a more just and equitable society (Maceira 2017). Despite the benefit of gender equality in national development, some teaching strategy used by mathematics teachers result to gender stereotype and inequality in students 'performance in mathematics. Thus this study poise to determine the effect multimedia instructional strategy in senior secondary schools.

Research Questions

The following research questions were raised

i. What is the difference between the performance mean scores of students taught algebra using multimedia instructional strategy and those taught with conventional lecture method?
ii. What is the difference between the performance mean scores of male and female students taught algebra using multimedia instructional strategy?
iii. What is the interaction effect of instructional strategies and gender on students' performance means scores in algebra?

Hypotheses

The following hypotheses were formulated and tested at 0.5 level of significant.

Ho1: There is no significant difference between the performances mean scores of students taught algebra using multimedia instructional strategy and those taught with conventional lecture method.

Ho2: There is no significant difference between the performances mean scores of male and female students taught algebra using multimedia instructional strategy?

Ho3: There is no significant interaction effects of instructional strategy and gender on students' performance mean scores in algebra**.**

Theoretical framework

This study is anchored on the Cognitive theory of multimedia learning (CTML) by Mayer (1997), This theory suggests that learners can better understand and retain information when it is presented through both words and pictures rather than through words alone. Mayer's theory is based on the idea that humans have separate channels for processing visual and auditory information, and that effective multimedia learning involves managing cognitive load and integrating information across these channels.

The theory relates to this study because multimedia instructional strategies can cater for students of different learning abilities and provides opportunity for learners of Mathematics to actively engage in learning concepts of algebra which may result to improvement in interest and performance. Thus, this will be imbedded in the instructional strategy.

Literature Review

This section focused on the review of related literature. Which are organized under the following subheading: effect of multimedia instructional strategy and academic performance in mathematics, influence of gender on student academic performances in mathematics and interaction effects of instructional strategies and gender on students' academic performance in mathematics.

Effect of Multimedia Instructional Strategy and Academic Performance in Mathematics

According to the study of Enikanolaye (2021) on the effects of multimedia instructional strategy on senior school students' academic performance and retention in Mathematics in Ilorin, Kwara State, Nigeria. The study was a quasi-experimental type of the pre-test, post-test, non- randomized, control group design. The design is a 2x2×1 factorial design. A sample of 81 senior secondary school II students from two secondary schools in Ilorin south local government area of Kwara State. From the study, findings showed that: (1) there was a significant difference between the experimental groups taught Mathematics using multimedia and the control group taught Mathematics using conventional lecture method in favour of multimedia instructional strategy (2) both female and male students were capable of

competing in classroom activities when taught with a better instructional strategy (3) multimedia instructional strategy improve and stimulate students' retention level thus, multimedia instructional package helps to concretize the learning of Mathematics and makes learning more effective. Based on the findings of this study, it was recommended that multimedia instructional strategy may be integrated into Mathematics curriculum and also used to arouse students' interest in Mathematics. The study by Enikanolaye (2021) relates to the present study due to consideration of multimedia instructional strategy, gender, students' performance in Mathematics, quasi-experimental design, used mean and standard deviation to answer the research question and ANCOVA to test hypotheses. However, they differ as the reviewed study did not consider interest but examined retention and utilized t-test. It was conducted in Ilorin, Kwara State, Nigeria while the current study was conducted in Kogi State, Nigeria.

Anaduaka et al. (2025) investigated the impacts of Multimedia Technology Instruction on public secondary school students' motivation and achievement in Mathematics in Federal Capital Territory, Abuja, Nigeria. Three research questions and hypotheses guided the study. The research design employed was quasi-experimental design of pre-test, post-test non-randomized and control group. The population of the study was made up of 10,936 SS II students. The findings revealed that mean motivation scores of students in experimental group were higher than those in control group, there was significant difference between the mean achievement scores of students taught Mathematics using MTI and those taught using conventional method. Based on the findings, it was recommended among others that implementation of experimental intervention used in this study should be implemented in all schools since it improves students' motivation; secondary schools should adopt MTI as a primary teaching approach in Mathematics as it significantly enhances students' achievement compared to conventional method of teaching. The study by Anaduaka et al (2025) relates to the present study due to the consideration of multimedia instruction, the same research design employed and mathematics and differs as it was conducted in Abuja while the present research was conducted in Kogi State and practically on an aspect of Mathematics Algebra.

In the same vein, Umar et al. (2020) investigated the impact of multimedia instructional strategies on students' achievement and retention in basic science and technology in Minna, Niger State. This study compared the impact of multimedia instructional strategies on students' achievement and retention in basic science and technology in junior secondary schools in Niger State. Four research questions and four research hypotheses guided the study. The design of this study was quasi-experimental research design as there was no randomization of subjects into classes. Intact classes were used. This study was conducted in Minna, Niger State. A sample of one hundred and two (102) SSII students was involved in the study. Research questions were answered using mean and standard deviation while Analysis of Covariance (ANCOVA) was used in testing the hypotheses at 0.05 level of significant. Results from the study revealed that students who were taught basic science and technology using multimedia instructional strategies achieved and retained higher than those taught without instructional strategies. Also students who were taught basic science and technology using multimedia instructional strategies as tool achieved and retained higher than those taught without multimedia as tutor. The study equally revealed no significant difference between the mean achievement and retention scores of male and female students. Some of the recommendations made include; that teachers should pay more attention to using multimedia instruction as tool instead of using it as lecture method for effective teaching and learning of basic science and technology.

The study by Umar et al. (2020) relates to the present study because of variables of multimedia instructional strategies, students' performance, and adoption of quasi-

experimental design, mean and standard deviation to answer research questions and ANCOVA for analysis. The reviewed study utilized retention in basic science and technology in Minna, Niger State but did not consider Mathematics or Algebra, gender and students' perfomance being examined in the present study in Kogi State.

Influence of Gender on Student Academic Performances in Mathematics

Regarding Influence of Gender on Student Academic Performances in Mathematics, Micheal-Aondoaseer et al. (2023) investigated the effect of multimedia teaching strategy on academic performance of senior secondary school students in biology, Benue State. Two research questions were answered and two hypotheses formulated and tested. The study adopted quasi experimental research design of non–randomized pre-test post-test control group type. The population comprised 1,070 while a sample of 168 SS2 Biology students were drawn from four secondary schools using multistage sampling technique made up of 86 males and 82 females... The findings of the study revealed that there was significant differences between the performances mean scores of student taught Biology using MIP and students taught with the conventional method. There was no significant difference between the performances mean scores of male students taught Biology using MIP as against female students taught Biology using MIP. The study recommends that since multimedia instructional strategy has been found to enhance students' performance in Biology, Biology teachers should be encouraged to adopt the instructional strategy for teaching topics in Biology. It was also recommended that Ministries of Education should incorporate the method in Biology curriculum. Both studies utilized multimedia strategy, variable of performance, gender, quasi-experimental design, mean and standard deviation to answer research questions and ANCOVA for analysis. The reviewed study was conducted in Biology in Benue State while the present study was conducted in Algebra in Kogi State

Additionally, Akinoso (2018) carried out a research on the effects of multimedia on students' performance in secondary school Mathematics. The study answered three research questions while three hypotheses were tested at 0.5 level of significance. Quasi-experimental design was adopted. A total of 60 junior secondary school (JSS2) students were randomly selected from two secondary school in Lagos State Findings revealed that there is a significant difference between the performance of male and female students in both experimental and control group in favour of the male. Multimedia use improved students' performance, motivation, and attention. It was recommended that Teachers should have adequate knowledge of computers to effectively use multimedia in instruction. The study also recommended that materials with current technology should be chosen and developed for Mathematics lessons. Schools technological infrastructure should be improved to support multimedia usage Multimedia-based teaching promotes a student-centered approach to learning. In-service training should be provided to upgrade teachers' knowledge of computers. Teachers should be encouraged to teach Mathematics using multimedia. The study by Akinoso (2018) relates to the present study because of use of multimedia learning strategy, performance in Mathematics, use of quasi-experimental design, mean, standard deviation, Analysis of Covariance (ANCOVA) for analysis of data. The reviewed study was conducted in Lagos State among junior secondary school (JSS2) students and did not consider gender. However, the present study was carried out in Kogi State among Senior Secondary (SS II) Students and practically on algebra – an aspect of Mathematics.

In addition Oribhabor (2020) examined the influence of gender on academic achievement in Mathematics among senior secondary school students in Bayelsa State. Survey research design was adopted for the study. The population of this study comprised all the students in Senior Secondary School Two (SSS II) in the 39 public (mixed) secondary schools in Sagbama and Southern-Ijaw Local Government Areas of Bayelsa State. The study

sample comprised 1,754 Senior Secondary School Two (SSS II) students drawn from 12 public secondary schools, using stratified sampling technique. Result of the analysis revealed that there is a significant difference between the Mathematics achievement of the male and female students in favour of the males. The reviewed study is similar to the present study because both uses cronbach Alpha to test the reliability of the instrument and senior secondary school two students. The reviewed study was conducted in Bayelsa State and survey research design was used while Kogi state was the area of the present study in this current research and it used quasi experimental design and an aspect of Mathematic – Algebra was considered.

Interaction Effects of Instructional Strategies and Gender on Students 'academic performance in Mathematics

A study was also carried out by Nwoke and Ajuzie (2021) on multimedia instructional approach and gender equity in Mathematics achievement among secondary school students. The study aimed at promoting gender equity in Mathematics achievements through Multimedia Instructional Approach (MIA) in secondary schools in Owerri North Local Government Area of Imo State, Nigeria. The study was a quasi-experimental type adopting the pre-test, post-test non-equivalent control design. The population consisted of 5917 senior Secondary school II (SS2) students. A sample of 263 senior secondary II (SS 2) students drawn from two (2) purposively selected co-educational secondary schools was used for the study. The result of the study revealed that Multimedia Instructional Approach (MIA) improved male and female students' achievement in Mathematics and there was no significant interaction effect between treatment and gender achievements in Mathematics. Based on the result it was recommended among others that multimedia should be employed in teaching Mathematics at secondary school level to enhance students' achievement.

The reviewed study is similar to the present study because of variables like multimedia instructional approach, gender, quasi-experimental design, used mean and standard deviation to answer the research question and ANCOVA to test hypotheses. Both studies differ as the reviewed study did not consider Algebra and was conducted in Owerri North Local Government Area of Imo State, while the current study was in Kogi State and focused on Algebra.

However, Anaduaka et al (2025) investigated the impacts of Multimedia Technology Instruction on public secondary school students' motivation and achievement in Mathematics in Federal Capital Territory, Abuja, Nigeria. Three research questions and hypotheses guided the study. The research design employed was quasi-experimental design of pre-test, post-test non-randomized and control group. The population of the study was made up of 10,936 SS II students. The findings revealed that there was significant a difference between the mean achievement scores of students taught Mathematics using MTI and those taught using conventional method also, there was significant a difference between the mean achievement scores of male and female student taught Mathematics using MTI in favour of the females. Based on the findings, it was recommended among others that implementation of experimental intervention used in this study should be implemented in all schools since it improves students' motivation; secondary schools should adopt MTI as a primary teaching approach in Mathematics as it significantly enhances students' achievement compared to conventional method of teaching; teachers and curriculum developers should design gender-responsive teaching strategies within MTI to further support and enhance the performance of male students. The disagreement of this research and the previous once can be as a result of the instrument of data collection, location of the study and the population of the study,

The literature reviewed above focused on concrete evidence supporting the importance of multimedia instructional strategy as it relate to effect of multimedia instructional strategy and academic performance in mathematics, influence of gender on student academic performances in mathematics and interaction effects of instructional strategies and gender on students' academic performance in mathematics. Understanding the relationship between multimedia instructional strategies which has element through teaching of Algebra can be delivered to students both male and female in order to enhance academic performance.

The review looked at studies form both within and outside Nigeria. Studies on effect of multimedia instructional strategy and gender was seen to have a great impact on students' academic performance in algebra but no study was found to have been carried out in Kogi State and practically on students performance in Algebra. This illumined the need for this study cover the gap in the literature.

Methodology

The research adopted a non-equivalent pre-test post-test control group known as quasi experimental design. The reason for adopting quasi-experimental design was because school schedule were not disrupted or classes reorganized, for the conduct of the study. The target population for the study consisted of 12703 (6,680 male and 6,023 female) Senior Secondary (SS II) students in 279 public senior secondary schools in Kogi State. The sample consisted 239 (male 142 female 137) junior Secondary II students who are offering Mathematics in four intact classes located in four public secondary schools in Kogi State obtained using multi-stage sampling. At the first stage simple random sampling technique will use to select four Educational zones which are Ankpa, Dekina, Idah and Kabba. Secondly, purposive sampling was used to select four senior secondary schools, one in each selected educational zone. This is to ensure uniformity of standard and to ensure that the schools are equidistant from one another. Thirdly random sampling will be utilized to obtain the arm to be use for this study where there is more than one arm, Furthermore, two secondary schools were randomly assigned to experimental group and two to control group using hat and draw method without replacement. This will be done to ensure that equal chance where given to each school to be selected as the experimental group. The researcher wrote the first letter of names of the four sampled schools on a piece of paper, folded and dropped them in a hat. The first two schools drawn were registered as experimental group and were not replaced. Then remaining two was registered as the control group. This sample of 279 students consists of 140 students in the experimental class and 139 students in the conventional class. Two intact classes were assigned to each of the strategies (experimental groups and a control group). The instrument used for this study was the Algebra academic performance test (APT) it was developed by the researcher and consisted of twenty five (25) questions. Each question was scored four marks, making a total of 100% marks. The instrument was validated by the by experts in mathematics and in science Education. Bloom's taxonomy of educational objectives and the number of weeks used for instruction for each subtopic was used to construct the table of specification to take care of content validity.

The researcher adopted the following procedure to control extraneous variables which could introduce bias and error to the study.

1. *Hawthorne Effect:* This occurs when students' performance is affected because they are much aware that they are being used for experiment. To overcome this, the researcher will ensure that students are taught by their regular Mathematics teachers who were recruited as research assistants.
2. *Control of Error due to Teacher differences:* The researcher organized a uniform training programme for recruited research assistants in the sampled schools and use teachers with

relatively same qualification and experience. This will enable the teachers to acquire competences for implementing the experimental conditions for multimedia learning strategy and conventional strategy.

3. ***Control of initial difference:*** The researcher used Analysis of Covariance (ANCOVA) to control for the initial group differences that may be introduced as a result of intact classes. This was done by adjusting the post-test scores/values using the pre-test (initial) scores.

Results

Research Question One:

What is the difference between the mean performance scores of students taught Mathematics using multimedia instructional strategy and those taught Mathematics using conventional teaching strategy?

Table 1

Showing the Pre-test/Post-test academic performance mean scores of Students Taugh Mathematics using Multimedia Instructional Strategy and Conventional lecture method

		Pre-Test		Post-test			
Strategy	N	$\bar{x}$	SD	$\bar{x}$	SD	Mean gain	Mean Difference
Multimedia Inst. Strategy	140	35.400	7.940	65.660	9.300	30.260	22.090
lecture strategy	139	34.760	9.950	42.870	8.320	8.170	

Result in Table 4.2 shows the pre-test and post-test mean performance scores of Students taught algebra using multimedia instructional strategy and those taught using lecture strategy. Result showed that students who were taught Mathematics using multimedia instructional strategy had mean performance score of (= 35.40, SD = 7.94) at the pre-test and mean performance of (= 65.66, SD = 9.30) at the post-test level while the mean gain score was 30.26. Furthermore, the students taught Algebra using conventional lecture method had a pre-test mean performance score of (= 34.76, SD = 9.95), and post-test mean performance score of (= 42.87, SD = 8.32) with mean gain of 8.17 and mean difference of 22.09. Meanwhile, the higher gain scores of 30.26 for multimedia instructional strategy showed that multimedia instructional strategy improved students' academic performance in Mathematics more than conventional lecture method with multimedia instructional strategy proving more efficacious. This implied that multimedia instructional strategy had positive effect on the mean performance scores of students in Mathematics. This further implies that the treatment was effective. The closeness of SD varies in the two groups indicate that the respondents were homogenous in their responses to the Mathematics achievement test items

Research Question two:

What is the difference between the mean performance scores of male and female students taught Mathematics using multimedia instructional strategy?

Table 2

Showing the Pre-Test/Post-Test of the Academic Performance Mean Scores of Male and Female Students Taught Mathematics Using Multimedia Instructional Strategy

		Pre-test		Post-test			
Gender	N	$\bar{x}$	SD	$\bar{x}$	SD	Mean Gain	Mean Difference
Male	74	42.88	6.21	61.50	5.51	18.620	0.3
Female	66	42.10	8.42	60.44	6.53	18.340	

Result in Table 4.4 showed the influence of gender on the mean academic performance of students' taught algebra using multimedia instructional strategy. Result showed that male students had pre-test academic performance mean score of ($\bar{x}$ =42.88, SD = 6.21) and a post-test academic performance mean score of ($\bar{x}$ = 61.50, SD = 5.51), while the female students had a pre-test academic performance mean score of ($\bar{x}$ =42.10, SD = 8.42) and a post-test academic performance mean score ($\bar{x}$ = 60.44, SD = 6.53). Result showed that the male students performed slightly higher than their female counterparts with mean gain of 18.62 while the female students had mean gain of 18.34 resulting to a mean difference of 0.3 in favour of the male counterpart.

Research Question three:

What is the interaction effect of instructional strategies and gender on students' means performance scores in Mathematics?

Table 3

Pre-test/Post-test Mean Interaction Effects of Instructional Strategies and Gender on Students' Performance in Mathematics

Strategy	Gender	N	Pre test $\bar{x}$	SD	Post-test $\bar{x}$	SD	Mean gain
Multimedia Int. Stra.	Male	74	34.81	4.64	64.25	4.73	29.44
	Female	66	34.45	2.88	58.48	4.74	24.03
Conventional Lec. Stra.	Male	71	31.42	4.52	44.26	4.63	12.84
	Female	68	30.12	3.22	42.62	4.42	12.50

Performance in Algebra. Result showed that after the treatment, the male and female students taught Mathematics using instructional strategies had academic performance mean gains of 29.44 and 24.03 respectively, while the male and female students taught the same topics with conventional lecture method had academic performance mean gains of 12.84 and 12.50 respectively. These imply that male students showed greater academic performance with higher gain scores in all the two groups. To test for the significant interaction effect of instructional strategies and gender on students' mean academic performance in Mathematics, see hypothesis three. The Standard deviation presented in Table 3. above show that the interaction effect of teaching instructional strategies among the two groups are relatively low judging from the amount of variation of values in their performance mean scores and gender on students' academic performance in Mathematics taught in this study. This is because of the homogeneity of items response among the male and female students in Algebra. Hence, gender has a substantial influence on students' academic performance in mathematics.

Hypothesis

HO1: There is no significant difference between the mean performance scores of students taught Mathematics using multimedia instructional strategy and those taught with conventional teaching strategy.

Table 4

Analyses of Covariance (ANCOVA) of Difference between the academic performances mean scores of Students Mathematics When Exposed to Multimedia Instructional Strategy and Conventional lecture method

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared	Dec.
Corrected Model	1841.297[a]	13	141.638	16.685	0.00	0.24	
Intercept	50.641	1	50.265	5.921	0.16	0.78	
Pre-test	298.828	1	298.641	35.180	0.00	0.00	
Strategy	55.034	1	54.049	6.483	0.01	0.15	S
Gender	164.133	3	54.711	59.640	0.00	0.08	
Strategy * Gender	1.000	2	.000	.010	0.45	0.00	
Error	984.711	214	19.681				
Total	496735.000	237					
Corrected Total	2826.008	239					

Note: S = Significant, NS = Not Significant and η^2_p = partial eta squared

The result in Table 4 showed the ANCOVA of the difference between the academic performance mean scores of students in Algebra when exposed to multimedia instructional strategy and conventional lecture method. The result was statistically significant at (F) =6.483, p= 0.01, η^2_p = 0.15). Since the associated probability value of 0.01 is less than 0.05 set as level of significance, the null hypothesis was rejected. Thus, inference drawn is that there was statistically significant differences in the academic performance mean scores of students in Algebra when exposed to multimedia instructional strategy and conventional lecture method in favour of the treatment group with high mean. The result further showed the effect size (η^2_p = 0.15), which indicates that fifteen percent (15%) variance in the academic performance mean scores of students in Algebra when exposed to multimedia instructional strategy can be accounted for by conventional lecture method.

Ho2: There is no significant difference between the mean performance scores of male and female students taught algebra using multimedia instructional strategy in Kogi State.

Table 5

Analysis of Covariance (ANCOVA) of the Difference between the academic performance mean scores of Male and Female Students Taught Mathematics Using Multimedia Instructional strategy in Kogi State

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared	Dec.
Corrected Model	1806.728[a]	10	180.673	17.940	0.00	0.75	
Intercept	0.004	1	.004	.000	0.98	0.00	
Pre-test	416.941	1	416.941	41.401	0.00	0.42	
Strategy	90.066	2	45.033	4.472	0.16	0.17	
Gender	120.578	1	60.289	6.232	0.23	0.18	NS
Strategy *Gender	0.000	2	0.00	.060	0.10	0.08	
Error	523.684	275	10.071				
Total	235535.000	278					
Corrected Total	2330.413	279					

Note: S = Significant, NS = Not Significant and η^2_p = partial eta squared

The result on Table 5 shows the ANCOVA of the difference in the academic performance mean score of male and female students taught algebra using multimedia instructional strategy in Kogi State. The result was statistically significant at (F) = 6.232, p = 0.23, η^2_p = 0.18). Since the associated probability value of 0.23 is greater than 0.05 set as level of significance, the null hypothesis was accepted. Thus, inference drawn is that there was no statistically significant differences in the academic performance mean score of male and female students taught algebra using multimedia instructional strategy in Kogi State secondary schools. The result further showed the effect size (η^2_p = 0.18), which indicates that eighteen percent (18%) variance in the performance of students in algebra can be explained by the modes of multimedia instructional strategy.

HO3: There is no significant interaction effects of instructional strategy and gender on students' mean performance scores in Mathematics in Kogi State.

Table 6

Analysis of Covariance (ANCOVA) of Interaction Effect of Instructional Strategies and Gender on Students' academic Performance in Algebra

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared	Dec.
Corrected Model	1806.728[a]	10	180.673	17.940	0.00	0.75	
Intercept	0.004	1	.004	.000	0.98	0.00	
Pre-test	416.941	1	416.941	41.401	0.00	0.42	
Strategy	90.066	2	45.033	4.472	0.16	0.17	
Gender	120.578	1	60.289	6.232	0.23	0.18	
Strategy *Gender	0.000	2	0.00	.060	0.10	0.08	NS
Error	523.684	275	10.071				
Total	235535.000	278					
Corrected Total	2330.413	279					

Note: S = Significant, NS = Not Significant and η^2_p = partial eta squared

The result in Table 6 showed the ANCOVA of the significant interaction effect of instructional strategies and gender on academic performance of students in algebra. The result was not statistically significant at (F) = 0.060, p= 0.10, η^2_p = 0.08). Since the associated probability value of 0.060 is greater than 0.05 set as level of significance, the null hypothesis was accepted. Thus, inference drawn is that there was no statistically significant interaction effect of instructional strategies and gender on academic performance of students in Algebra.

Discussion of Findings

The result showed that there was statistically significant differences between the academic performances mean scores of students in Mathematics when exposed to multimedia instructional strategy and conventional lecture method in favour of the treatment group with high mean. The finding further showed the effect size (η^2_p = 0.15),

In contrast multimedia instructional strategies increased interaction between students and concepts, along with the practical application of the skills they learn. The use of multimedia in Mathematics classroom increases students' motivation and makes them active learners. With multimedia teachers can motivate students to learn by using their different senses and through audio-visual presentation of information, the students obtained clearer and more complete knowledge of the outside world and themselves. Multimedia resources, such as videos, animations, and simulations, help students visualize complex concepts, making them easier to understand and retain. Interactive multimedia elements, like quizzes, games, and discussions, encourage active learning, which enhances retention and recall of information. Instructional strategies can be tailored to individual students' needs, learning

styles, and pace, promoting personalized learning experiences. Multimedia resources can provide students with access to current, relevant, and accurate information, which may not be available through traditional textbooks.

The study also agrees with Enikanolaye (2021) who studied the effects of multimedia instructional strategy on senior school students' performance and retention in Mathematics and found that there was a significant difference between the experimental groups taught Mathematics using multimedia and the control group taught Mathematics using conventional strategy. Instructional strategies incorporate visual, auditory, and interactive elements that capture students' attention, promoting engagement and motivation. The finding agrees with Umar et al. (2020) who investigated on the impact of multimedia instructional strategies on students' achievement and retention in basic science and technology in Minna, Niger State and found that students who were taught basic science and technology using multimedia instructional strategies achieved and retained higher than those taught without instructional strategies. The study is in line with the finding of Chikendu (2018) who studied the effects of instructional computer animation on secondary school students' achievement and interest in chemistry in Awka Education Zone and found that instructional computer animation had significant effect on students' achievement and interest in chemistry. From the discussion, multimedia instructional strategy showed a significant result on student's academic performance in Algebra and this supersedes the conventional lecture methods which limits and hinder effective learning, leading to negative academic performance. The finding of this study was so because multimedia instructional strategy improved student engagement and motivation. It enhances retention and recall of information because students often remember what they see, hear and do. Hence teachers can create more dynamic and interactive learning experiences that cater to the needs of modern learners.

The finding that there significant difference between the academic performance mean scores of male and female students suggests that multimedia instructional strategies can help narrow the gender gap in Mathematics education. The study's outcome implies that multimedia instructional strategies can provide equitable learning opportunities for both male and female students, which can help promote gender equality in education.The outcome demonstrated that, in Algebra, male students outperform their female counterparts in terms of interaction effect mean academic performance. The test of hypothesis three, which concluded that there was no statistically significant interaction effect of gender and instructional strategies on students' academic performance in Algebra The study's results suggested that both the teaching strategies are flexible and effective for diverse learners, regardless of gender.

Conclusion

The finding shows that, there was significant differences in the performance mean scores of students in algebra when exposed to multimedia instructional strategy and conventional lecture method in favour of multimedia instructional strategy with high mean. It reveals that there was no statistically significant difference in the performance mean rating score of male and female students taught algebra using multimedia instructional strategy. The result showed that, there was no significant interaction effect of instructional strategies and gender on academic performance of students in Mathematics in Kogi State implying that multimedia instructional strategy can be used to ensure gender equality in Mathematics.

Recommendations

Based on the results of the study the following recommend are made

i. Teachers should adopt multimedia instructional strategy in teaching Algebra to enhance students' academic performance.

ii. In order to overcome the gender gap in junior secondary school mathematics students' academic performance, mathematics teachers should employ multimedia instructional strategies in the teaching of Mathematics.
iii. Educational institutions should provide necessary infrastructure and resources to support the use of multimedia instructional strategy in the classroom.
iv. Professional bodies like Science teacher Association of Nigeria (STAN) and Mathematical Association of Nigeria (MAN) should on a continuous basis organise training workshop, conferences and seminars on how to use multimedia instructional strategy in teaching of mathematics including Mathematics.

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