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EFFECTS OF MULTIMEDIA APPLICATION ON STUDENTS' ACADEMIC ACHIEVEMENT IN AGRICULTURAL SCIENCE

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Abstract. *The performance of agricultural science students is consistently low as seen in their external examinations. This could be attributed to the poor teaching methods, materials and techniques applied in teaching the subject. This study determined the multimedia application effects on the academic achievement of Agricultural science students. It adopted a mixed-method design. All the students and teachers of Agricultural science in secondary schools in Enugu State, Nigeria formed the population but six schools with 583 students and teachers of agriculture formed the sample. Students' Academic Achievement Test in Agricultural Science (SAATAS) and Convenience Teaching Method Questionnaire (CTMQ) were used to collect data. Mean, ANCOVA and Friedman's test were used for data analyses. Results indicated that students instructed using multimedia significantly performed higher than the students instructed using the conventional teaching method. The performance of males was not different from that of the females. The interaction between the teaching media and gender had a non-significant effect on the academic achievement of students. Moreover, teachers adopted note-taking, lecture, demonstration and project methods but did not use multimedia in teaching. Teachers of agriculture accepted that inconsistent power supply, poor network connectivity, and non-availability of computers, among others, were the problems hindering them from using multimedia in teaching.*

Keywords: *academic achievement, mixed method design, multimedia, agricultural science, teaching and learning*

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Introduction

The nature of secondary education at present in Enugu State, Nigeria lacks the needed quality for the survival of the recipients in the modern economy of the developing world. This is more worrisome as the educational policy is more interested in quantity than quality (Thom-otuya & Inko-tariah, 2016). Ninety-four per cent of secondary school graduates lack the entrepreneurial skills needed to become independent members of society (Asogwa et al., 2021). This was further buttressed in the WAEC Chief Examiner's report where only 48%, 42.5% and 46% of secondary school students passed in 2017, 2018 and 2019 senior school certificate examinations respectively. The poor secondary school education quality hampers the development of effective manpower necessary for national development in some developing countries (Ajagbawa, 2014). Secondary education in agricultural science is aimed at providing technical knowledge and skills necessary for agriculture, commercial and economic development (Federal Republic of Nigeria [FRN], 2013). Poor quality secondary education can be attributed to inadequate teacher qualifications and wrong teaching methods (Arong & Ogbadu, 2010). Qualified teachers should have both content and pedagogical knowledge to impart worthwhile skills to students (Okwduba & Okigbo, 2018). Content knowledge refers to the mastery of the subject matter while pedagogical knowledge refers to the mastery of the teaching methods needed in teaching the content. Competency in the subject matter as well as the adoption of suitable instructional methods are essential to learners' academic performance. Learners' academic performance is an indication of quality teaching which is dependent on the methods, materials and techniques of teaching applied (Ganyaupfu, 2013).

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Unfortunately, some teachers apply instructional methods convenient to them without taking cognizance of the content, learners' needs and interests. Osinem (2008) noted that teachers apply such methods as discussion, lecture, demonstration, and project, among others as convenient to them without evaluating if the method is appropriate to the students or not. A teaching method is appropriate when it employs suitable training values which stimulate learners' activities (Pooja, 2017). The adoption of conventional teaching methods led to the poor academic performance of learners in some subjects (Muema et al., 2018). A classroom situation where the teacher dominates the class by teaching the students the subject matter without the active involvement of the students does not motivate learning. In some schools, students just copy notes from the board without active engagement with the subject being taught (Khurshid & Ansari, 2012). It was noted that the poor performance of the Ghanaian Senior High School students in Biology was the inability of the teachers to adopt the procedures recommended in the syllabus, inability to organize practical work in groups and inability to embark on fieldtrip where students can observe the organisms in their natural environment (Safo-Adu et al. 2020).

Therefore, student-centred teaching methods should be emphasized in schools if educational quality must be promoted to meet the technological requirements for developing countries' national development. One of such methods includes the application of multimedia presentation. The application of multimedia during instructional delivery allows the student to interact with the content. However, Molla and Muche (2018) reported that inadequate knowledge and skills in the application of computer software by teachers result in their inability to utilize multimedia in teaching. The absence of multimedia training is the greatest problem for its' utilization for instructional delivery. Sarowardy and Halder (2019) reported that the negligence of teachers in the application of multimedia was a result of insufficient digital amenities and poor infrastructural facilities in schools. On several occasions, teachers were requested to undergo training without undergoing a needs analysis to find out those who needed the training and the sort of training needed.

When teachers are upskilled in the application of multimedia in instructional delivery, it will be easier to deliver a learner-friendly lesson that would guarantee comprehension. When students are actively engaged, they will certainly learn, and the knowledge will be ploughed back for economic development. In today's global economy that is knowledge-driven, the use of multimedia in teaching especially in developing countries builds students' intellectual capacity and knowledge that will help them compete favourably with their peers in every part of the world as they contribute to national and international economic development.

This study, therefore, sought to determine the effects of multimedia application on the academic achievement of students in Agricultural Science, the influence of gender on the academic achievement of students in Agricultural Science, the interaction effect of different teaching media and gender on students' academic achievement in Agricultural Science, convenient teaching methods utilized by the teachers and problems hindering the application of multimedia in teaching.

Research Questions

1. What are the effects of multimedia application on the academic achievement of students in agricultural science?
2. What is the influence of gender on the academic achievement of students in agricultural science?
3. What are the interaction effects of different teaching media and gender on the academic achievement of students in agricultural science?
4. What are the convenient teaching methods utilized by the teachers of agriculture in teaching agricultural science?

Research Hypotheses

1. There is a significant effect of multimedia application on the academic achievement of students in agricultural science.
2. There is a significant influence of gender on the academic achievement of students in agricultural science.
3. There is a significant interaction effect of different teaching media and gender on the student's academic achievement in agricultural science.

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Literature Review

Multimedia Use in Teaching

Media in education involves all the avenues to produce, save and deliver instruction using an instrument like a chalkboard, texts, computer, projectors, cameras, audio facilities, sound and video systems combined (de Sousa et al., 2017). Multimedia is, therefore, the application of many channels in communicating particular information. Multimedia according to Gunawardhana and Palaniappan (2016), is the numerous media elements such as texts, graphics, animations, video, sound, etc. integrated as one whole, which are helping users. When all these media are combined, it makes communication clearer and easier. Almara'beh et al. (2015) affirmed that multimedia can be an integration of several mass media like text, audio and video and can also be the production of computer programmes in a large quantity that individuals can use for studying. Learning can be result-oriented, more inclusive, without time, distance and space barriers, tailor-made to personal style, and increasingly collaborative between students and their teachers when multimedia is involved.

Multimedia is very useful due to its interactivity, pliability, and the use of several media to advance learning, taking into account the different learning styles of the students which motivate their interest (Andresen & Brink, 2013). Multimedia applications in the view of Babiker (2015) are classified into text-based, interactive, web and mobile (smart) phone applications. Babiker emphasized that most educational media are categorized as interactive and graphical applications as it is a good tool that is used in all media formats. When compared with other means of instructional delivery, Patel (2013) noted that multimedia shall be a successor to conventional teaching methods. The author emphasised that multimedia has several options for making teaching interactive and more result-oriented. Conventional teaching methods are not famous while multimedia with fantastic audio and visual animation conveniently allows greater access to information and presents a natural environment which motivates students' interest (Patel, 2013). Mukherjee (2018) noted that multimedia improves students' ideation and practical language skills that are essential for quality education. The application of multimedia could be further developed by investing in the facilities and educating the teachers on the use of the facilities (Gorgoretti, 2019).

Teaching Methods

Conventional teaching methods like the lecture method are not activity-based and, therefore, do not stimulate learners to acquire solutions to real-life problems based on practical knowledge (Ganyaupfu, 2013). Teachers, according to Ganyaupfu, may try to increase the passage of the content while reducing time and effort so that students may learn. In the conventional lecture method, students are not properly engaged and concentration fades after some time. Kola and Langenhoven (2015) noted that the demonstration method is good for practical skills but there is limited time to perform a demonstration in the classroom. In the same vein, the study by Molla and Muche (2018) reported that cooperative learning is an appropriate teaching method but is affected by the classroom size, particularly the number of students and the shortage of instructional materials. Implementation of inquiry-based learning is strenuous largely due to the insufficient laboratory equipment, instructional aids, time available and a large number of students in a class (Ramnarain & Hlatswayo, 2018). An appropriate teaching method assists the learners in asking questions about what they knew earlier which will help them to learn, by compelling them to find answers to their questions, as well as the instrument of responsibilities for change (Shirani et al., 2016). With the audio, video, picture, and animation features of multimedia, learning difficult and complex topics are easy to understand.

Students' Academic Achievement

The academic achievement of students measures the learning outcomes of students who received a particular instruction. The achievement of students is dependent on many factors such as teaching methods, instructional materials, teachers' competence, and teaching environment, among others. Podunggee et al. (2019) noted that teachers' competence positively influences students' academic achievement by increasing the students' intrinsic motivation to study. Nbina (2012) reported a strong correlation between teachers' competence and students' academic achievement in Chemistry. Teachers' subject content knowledge and pedagogical skills were reported to have a significant influence on Junior Secondary school students' academic achievement (Amie-Ogan & Etuk, 2020).

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When teachers apply appropriate methods and materials in teaching, students are motivated to learn. Aydisheh and Gharibi (2015) noted that the constructivist teaching method influenced the cognitive ability of students when appropriately applied. In the analysis of the effectiveness of different instructional methods on the academic achievement of learners, Ganyaupfu (2013) observed that the teacher-student interactive instructional method was the most efficient, which was followed by the student-centred teaching method while the teacher-centred teaching method was the least efficient in enhancing students' academic achievement. Bayrak and Bayram (2010) noted that the computer-aided instructional method positively affected the academic achievement of students in Science and Technology when teaching acid-base subjects. Oladosu et al. (2022) observed a significant relationship between the professional development of teachers, the quality of teachers and students' academic achievement in publicly and privately owned schools.

Theoretical Framework

This study adopted the cognitive theory of multimedia learning by Richard Mayer in 2005. The theory stipulates that learning is active and effective when words and pictures are integrated into the lesson. Active learning can be attained through the combination of sounds and images for a wider experience (Ejimonye et al., 2020). Students learn using different styles such as visual, aural, reading and writing but learning can be optimized when a combination of these styles is presented (Gilakjani, 2012). Presentation of a lesson using the multimedia teaching method lends learners the opportunity to observe the images, texts and movies and also hear the sound or voice, which offers a meaningful experience to the learners. Designing a multimedia environment that appeals to visualization by making the background look attractive, adding pictures, icons, graphics, and bold colour texts combined with voice improves learning in students (Sukma et al., 2018). When students are taught using multimedia, they will apply their eye for seeing, ear for hearing, mind for feeling and hence the brain for proper coordination of all the activities. The study is in alignment with Richard Mayer's theory because it involves the electronic presentation of lessons where graphics, sounds and texts are integrated to appeal to the various sense organs of the students.

Research Methodology

Design

A mixed-method design was adopted in this study. The mixed-method design combines two or more different designs in carrying out a study (Doye et al., 2009). The design was appropriate for the study since quasi-experimental and survey designs were adopted.

Ethics

The approval to conduct the study was granted by the University of Nigeria Research Ethics Committee (UNN-REEC-22-059) on January 22, 2022 (UNN-REEC-22-059). Before the commencement of the study, a written request was sent to the administrators of the participating schools and permission was obtained to conduct the study in the respective schools. Furthermore, the consent of the Agricultural science teachers was obtained through the letters delivered by the researchers which were read and the request to be part of the study was granted.

Participants

The population of the participants was 11,145 representing 10,385 agricultural science students from 55 secondary schools and 760 teachers of agriculture in Enugu State, Nigeria (Enugu State Ministry of Education, 2022). The sample size was 583 representing all the agricultural science teachers and students in the randomly selected schools. A random sampling technique was adopted to select six schools (two schools each from the three educational zones in the state) where all the 560 students and 23 teachers of agriculture present in the schools were studied. The six randomly selected schools have the students' distribution of 93, 82, 105, 96, 84 and 100, and teachers' distribution of 4, 3, 5, 3, 3 and 5 respectively. The entire 583 agricultural science teachers and students were used to avoid sampling error and to have a reasonable size that would generate a reasonable result.

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Instruments and Procedure

Two research instruments were developed to collect data. Students' Academic Achievement Test in Agricultural Science (SAATAS) was developed to assess the performance of students while Convenience Teaching Method Questionnaire (CTMQ) was developed to ascertain the most convenient teaching method applied by the teachers. At the end of the questionnaire, an open-ended question was asked to find out the problems teachers of agricultural science faced in using the multimedia presentation.

A topic was chosen from the curriculum of senior secondary two (SS2) agricultural science. The topic was Animal Nutrition. Animal nutrition was chosen because it was the topic due for study by the SS2 students when the research commenced. Similarly, SS2 was chosen because it was the most stable class since SS3 students were in their certificate examination preparation and might not be ready to participate in the study. Sixteen lesson plans were developed to teach the topic in eight weeks using multimedia presentation (experimental group) and conventional teaching methods (control group) respectively. The lesson plans were developed based on the preliminary information (date, school, class, age of students, duration, topic), set induction, entry behaviour, instructional materials, specific objectives, instructional procedure, evaluation, summary, and conclusion (Osinem, 2008). The lesson plans were face validated by five experts from the Department of Agricultural Education, University of Nigeria, Nsukka.

The developed SAATAS was guided by the test-blue print developed by the researchers. The test-blue print was developed following the levels of cognitive educational objectives proposed by Benjamin S. Bloom (Nworgu, 2003), which include knowledge, comprehension, application, analysis, synthesis, and evaluation (Table 1). The development of tests using a test-blue print is a means of ensuring content validity as it helps in constructing unbiased and valid tests (Cohen et al., 2007).

Table 1
Test-Blue Print of the Multimedia Application on Students' Academic Achievement

Contents	Knowledge 30%	Comprehension 25%	Application 20%	Analysis 10%	Synthesis 10%	Evaluation 5	Total
Digestion in Farm Animals 20%	4	4	3	1	1	1	14
Classification of Livestock Feed 15%	3	3	2	1	1	1	11
Food Nutrients 15%	3	3	2	1	1	1	11
Types of Ration and Uses 20%	4	4	3	1	1	1	14
Ration Formulation 20%	4	4	3	1	1	1	14
Malnutrition in Farm Animals 10%	2	2	1	1	1	0	7
Total	20	20	14	6	6	5	71

The developed SAATAS contained 71 question items where the objective levels of knowledge, comprehension, application, analysis, synthesis and evaluation contained 20, 20, 14, 6, 6 and 5 questions respectively while the subtopics made up of digestion in farm animals, classification of livestock feed, feed nutrients, types of ration and uses, ration formulation and malnutrition in farm animals contained 14, 11, 11, 14, 14 and 7 questions respectively (Table 1). The SAATAS was face validated by five experts, selected from the Departments of Measurement and Evaluation, Animal Science and Agricultural Education, all from the University of Nigeria, Nsukka.

Furthermore, the test was pilot tested on 40 students of Agricultural Science from Ebonyi State, Nigeria on two separate occasions to determine the reliability using the test-retest method. The result was subjected to the Pearson Product Moment correlation coefficient which had a value of .73. The internal consistency of the instrument was also computed using Kuder-Richardson 20 and it had a value of .78. Moreover, the psychometric properties of the test were computed from the same pilot-test which yielded a discriminatory index of $d = .45$, difficulty index of $p = .68$ and a distractor index of $D = .09$. The results showed that the test items were appropriate as all the indices were positive and the magnitudes were high.

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The CTMQ was pilot tested on 40 teachers of Agricultural Science in Anambra State, Nigeria. The reliability was then computed using Cronbach's alpha method which had a value of α = .82. The questionnaire was structured on a 5-point Likert scale ranging from strongly agree to strongly disagree with the value range of 5 to 1.

In the procedure of the experiment, the six randomly selected schools were randomly allotted to two treatment groups of three replicates each. Three schools representing the control group were instructed in animal nutrition using the conventional teaching method whereas the other three schools representing the experimental group were instructed in animal nutrition using the multimedia presentation. The classes were not manipulated but were used as intact classes. The SAATAS was administered as the pre-test before the beginning of the instruction. The same instrument was also administered as the post-test after the instruction but, the item numbers and the options were reshuffled to make the instrument appear different. The instruction lasted for two months. The CTMQ was administered to the 23 agricultural science teachers in the sampled schools by the researchers and retrieved a week later.

Data Analysis

Data collected from teaching students with different teaching media were analysed by mean and analysis of covariance (ANCOVA) which was tested at a .05 level of significance. Friedman test (r) was applied to analyse the data collected with the CTMQ by ranking the teachers' opinions on the teaching methods adopted in teaching agricultural science. The result of the mean was interpreted following the real limit of numbers as in the table below.

Table 2
Real Limit of Numbers for Taking Decision on the Mean

Real Limit	Value	Decision
.5 to 1.49	1	Strongly Disagree
1.50 to 2.49	2	Disagree
2.50 to 3.49	3	Undecided
3.50 to 4.49	4	Agree
4.50 & above	5	Strongly Agree

Any item with a mean of 4.50 and above was interpreted as strongly agree. Similarly, any item with the mean range of 3.50 to 4.49 was interpreted as agree, any item with the mean range of 2.50 to 3.49 was interpreted as undecided, any item with the mean range of 1.50 to 2.49 was interpreted as disagree and any item with the mean range of .50 to 1.49 was interpreted as strongly disagree. The data collected from the problems faced by the teachers of agriculture in using multimedia applications were categorized based on related problems. The frequencies of the categories were counted, and data were subjected to percentages.

Research Results

Effects of Multimedia Application on the Students' Academic Achievement

Results on the effect of the multimedia application on the *Students'* academic achievement are presented in Tables 3 and 4.

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Table 3
Mean Academic Achievement of Agricultural Science Students Taught Using Different Teaching Media

Teaching Media	Pre-test		Post-test		$\overline{X}$ Gain
	$\overline{X}$	SD	$\overline{X}$	SD	
Multimedia (experimental group)	38.83	10.45	84.74	14.07	45.91
Conventional (control group)	35.11	10.56	55.23	15.49	20.12
$\overline{X}$ Gain	3.72		29.51		

The students who received instruction through the application of multimedia had a pre-test mean score of 38.83±10.45 while the students taught agricultural science using the conventional method had a mean pre-test score of 35.11±10.56 with a negligible mean gain of 3.72 (Table 3). It was found that students who received agricultural science instruction through multimedia application had a mean post-test score of 84.74±14.07 while the students taught agricultural science using the conventional method had a mean post-test score of 55.23±15.49 with a mean gain of 29.51 in favour of the multimedia application. Similarly, the students taught agricultural science using multimedia applications had a mean pre-test/post-test difference of 45.91 as against the students taught agricultural science using the conventional method with a mean pre-test/post-test difference of 20.12 (Table 3). The result shows that the students of agricultural science had a mean gain achievement of 45.91 after receiving instruction through multimedia whereas the same group had a mean gain achievement of 29.51 over those that received agricultural science instruction through the conventional method. This implies that multimedia applications had a better academic achievement in the students of agriculture than the conventional teaching method.

Table 4
ANCOVA of the Effects of Multimedia Application on the Academic Performance of Students in Agricultural Science

Source	Type III Sum of Squares	*df*	Mean Square	*F*	*p*-value	Partial Eta Squared
Corrected Model	12384.609a	2	6192.305	27.221	<.001	.489
Intercept	22575.663	1	22575.663	99.243	<.001	.635
Pre-test	22.381	1	22.381	.098	.755	.002
Teaching Media	12174.726	1	12174.726	53.520	.001	.484
Error	12966.324	143	227.479			
Total	290952.000	146				
Corrected Total	25350.933	145				

Note. [a]R Squared = .489 (Adjusted R Squared = .471)

A statistically significant difference existed ($p = .001 < .05$, $F = 53.52$) in the mean achievement of the students who received instruction through multimedia applications and conventional teaching methods (Table 4). The result equally shows that a moderate effect size of 48.4% existed and could be attributed to the multimedia application.

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Influence of Gender on the Academic Achievement of Students

Results on the influence of gender on the academic achievement of agricultural science students are presented in Tables 5 and 6.

Table 5
Mean Academic Achievement of Male and Female Students in Agricultural Science

Gender	Pre-test		Post-test		$\overline{X}$ Gain
	$\overline{X}$	*SD*	$\overline{X}$	*SD*	
Male	36.35	11.69	66.35	21.06	30
Female	36.68	9.83	66.68	20.79	30

The result presented in Table 5 shows that the male students who received instruction through multimedia and conventional teaching methods had a mean pre-test score of 36.35±11.69 and a post-test mean score of 66.35±21.06 with a mean achievement gain of 30. Similarly, the female students who received instruction through multimedia and conventional teaching methods had a pre-test mean score of 36.68±9.83 and a post-test mean score of 66.68±20.79 with a mean achievement gain of 30. This implies that males did not perform better than females when multimedia and conventional methods were used.

Table 6
ANCOVA of the Effect of Gender on the Academic Achievement of Students in Agricultural Science

Source	Type III Sum of Squares	*df*	Mean Square	*F*	*p*-value	Partial Eta Squared
Corrected Model	997.306a	2	498.653	1.167	.319	.039
Intercept	12528.169	1	12528.169	29.322	<.001	.340
Pre-test	995.699	1	995.699	2.330	.132	.039
Gender	.602	1	.602	.001	.970	<.001
Error	24353.627	143	427.257			
Total	290952.000	146				
Corrected Total	25350.933	145				

Note. [a]R Squared = .039 (Adjusted R Squared = .006)

The result in Table 6 shows that gender did not have a statistically significant difference ($p = .97 > .05$, $F = 0.001$) in the student's academic achievement in Agricultural Science. No significant effect size (0%) was equally found to exist.

Interaction Effect of Different Teaching Media and Gender on Students' Academic Achievement

Results on the interaction effect of different teaching media and gender on the academic achievement of students are presented in Tables 7 and 8.

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Table 7
Mean Interaction Effects of Different Teaching Media and Gender on the Academic Achievement of Students in Agricultural Science

Teaching Methods	Gender	Pre-test		Post-test		$\overline{X}$ Gain	$\overline{X}$ Gain Difference
		$\overline{X}$	*SD*	$\overline{X}$	*SD*		
Multimedia	Male	42.86	11.70	92.14	6.77	49.28	4.84
	Female	37.07	9.72	81.50	15.34	44.43	
Conventional	Male	33.95	11.03	56.84	15.70	22.89	5.72
	Female	36.33	10.20	53.50	15.52	17.17	

The male students who received agricultural science instruction through multimedia application had a mean pre-test achievement score of 42.86±11.70 and a mean post-test achievement score of 92.14±6.77 with a mean gain score of 49.28 (Table 7). The female students who received agricultural science instruction through multimedia application had a mean pre-test achievement score of 37.07±9.72 and a mean post-test achievement score of 81.50±15.34 with a mean gain score of 44.43. In the same vein, the male students who received agricultural science instruction through the conventional teaching method had a mean pre-test achievement score of 33.95±11.03 and the mean post-test achievement score of 56.84±15.70 with a mean achievement gain of 22.89 while the female counterpart had the mean pre-test achievement score of 36.33±10.20 and the mean post-test achievement score of 53.50±15.52 with a mean gain score of 17.17 (Table 7). It was observed that the mean difference between the male and female students that received agricultural science instruction through the multimedia application was 4.84 while the mean difference between the male and female students that received agricultural science instruction through the conventional teaching method was 5.72. The mean difference between the male and female agricultural science students who received instruction through multimedia applications and conventional teaching methods was 0.88.

Table 8
ANCOVA of the Interaction Effect of Different Teaching Media and Gender on the Academic Achievement of Students in Agricultural Science

Source	Type III Sum of Squares	*df*	Mean Square	*F*	*p*-value	Partial Eta Squared
Corrected Model	13032.105a	4	3258.026	14.546	<.001	.514
Intercept	19351.823	1	19351.823	86.400	<.001	.611
Pre-test	15.055	1	15.055	.067	.796	.001
Teaching Media	12014.245	1	12014.245	53.640	.001	.494
Gender	605.255	1	605.255	2.702	.106	.047
Teaching Media * Gender	146.688	1	146.688	.655	.422	.012
Error	12318.829	141	223.979			
Total	290952.000	146				
Corrected Total	25350.933	145				

Note. [a]R Squared = .514 (Adjusted R Squared = .479)

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Non-significant interaction effect (p=.42>.05, F=.66) of different teaching media and gender on students' academic performance in Agricultural Science was found (Table 8). The table showed that there was a significant difference (p=.001<.05, F=53.64) in students' academic achievement in Agricultural Science when teaching media was considered individually and a statistically significant difference did not exist (p=.11>.05, F=2.70) in students' academic achievement in Agricultural Science when gender was considered separately. The effect size of the interaction between the different teaching media and gender was negligible (1.2%) (Table 8). This implies that teaching media and gender do not collectively have any effect on students' academic achievement.

Convenient Teaching Methods Utilized by the Teachers and Problems Hindering the Application of Multimedia in Teaching

Results on the convenient teaching methods utilized by the teachers and problems hindering the application of multimedia in teaching are presented in Table 9.

Table 9
Convenient Teaching Methods Adopted by the Teachers of Agricultural Science in Teaching the Subject

Teaching Methods	$\overline{X}$	r value
Discussion	3.23	3.56
Lecture	3.88	4.12
Demonstration	3.90	4.11
Multimedia Presentation	2.11	2.35
Project	3.59	4.03
Problem Solving	2.99	3.32
Note Taking	3.71	4.49

Teachers of Agricultural Science ranked the note-taking method as the most appropriate method convenient in teaching agricultural science (r = 4.49), followed by the lecture method (r = 4.12) and demonstration method (r = 4.11) (Table 9). Similarly, teachers of agricultural science ranked the multimedia presentation as the least method (r = 2.35) used in instructing agriculture in schools followed by the problem-solving method (r = 3.32). The result presented in Table 9 also revealed that teachers of agricultural science agree that they use demonstration, lecture, note-taking, and project methods ($\overline{X}$ = 3.90, 3.88, 3.71, 3.59) in teaching agricultural science but disagree that they use multimedia presentation ($\overline{X}$ = 2.11) in teaching agricultural science (Table 9). The result shows that the teachers were undecided whether they use discussion and problem-solving methods or not ($\overline{X}$ = 3.23, 2.99) in teaching the subject.

Results of the problems faced by the teachers of agriculture on the use of multimedia in teaching revealed that the teachers were faced with the challenges of inconsistent power supply (15, 65.23%), poor network connectivity (17, 73.91%), non-availability of computer sets in most schools (16, 69.57%), poor computer usage by the teachers (20, 86.96%) and poor staff development in schools (21, 91.30%).

Discussion

It was found that the multimedia application increased the students' academic achievement greater than the conventional teaching method. The findings equally showed that a statistically significant difference existed (p < .05) in the mean academic achievement of the learners who received instruction through the application of multimedia and conventional teaching method in favour of the multimedia application. The greater performance of students taught using multimedia might be attributed to the varied features of multimedia

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where students are exposed to the lesson content using the combination of pictures, audio and video which appeals to the eye, ear, head, and heart. The result was in agreement with Ezennia et al. (2016) who found out that using visual communication tools of multimedia is among the most efficient means of clarifying complex concepts to students for easy understanding. In the teaching and learning of communication skills, Mukherjee (2018) found out that multimedia improves students' ideation and practical language skills that are essential for quality education. In a study on the effect of multimedia on students' academic performance in geography, Incedayi (2018) reported that using multimedia in teaching was better than the conventional method of imparting knowledge to the learners. Multimedia presents lessons using various modes to prepare a competent workforce capable of contributing to the economic productivity of the nation (Kozma, 2008). When compared with other means of instructional delivery, Patel (2013) noted that multimedia shall be a successor to conventional teaching methods. Well-prepared students impact positively on their surroundings. They are agents of change and future influencers. They comprehend peoples' intentions and actions and contribute maximally to economic development (Organisation for Economic Co-operation and Development [OECD], 2018).

It was equally found that males did not do better than females in agricultural science when taught through the multimedia application. Similarly, statistically significant differences did not exist ($p > .05$) in the mean academic achievement of male and female students who received instruction through the multimedia application. This might be as a result that male and female students have no significant cognitive ability different from the other. The result had the support of Umar et al. (2015) who reported a non-significant difference in the academic achievement of males and females in Colleges of Education in Borno State. It was found in another study that the academic potentials of male and female pharmacology students were the same (Faisal et al., 2017). Though there was a slightly better achievement of female medical students' education than the male counterparts concerning GPA, this, however, cannot be confirmed that male students perform better than females in other undergraduate programmes (Albalawi, 2019). The result contrasts with the findings of Saida and Mustapha (2018) who reported that female students got better grades in most undergraduate courses in agriculture when compared with males.

The findings on the interaction effect of gender and different teaching media showed a slight mean difference in the achievement of male and female students who received instruction through the different teaching media. However, no statistically significant interaction effects existed ($p > .05$) between gender and teaching media on students' academic achievement. This result might be attributed to the same cognitive ability of male and female students where both perform equally when they are exposed to the same content using the same materials and methods in the same environment. In agreement with the current findings, Okeke (2018) found no statistically significant interaction effect of gender and Mend Mapping Teaching Strategy (MMTS) on students' academic performance in chemistry. The author reported a significant difference in the academic performance of students taught using MMTS and conventional methods, but the interaction effect was not found. A similar study reported no significant interaction effects of teaching methods, gender, and study habit on the learners' academic performance in Basic Science (Gbenga & Effiong, 2015). This signifies that teaching methods, gender and study habit did not influence the student's academic performance in Basic Science when combined. Similarly, Ajayi and Ogbeba (2017) discovered that no significant interaction was found between gender and hands-on activities on the academic achievement of learners in Stoichiometry. In another study, Zudonu and Njoku (2018) reported no interaction between gender and teaching methods on students' attitudes to chemistry.

The findings further revealed that teachers of agricultural science favour the use of some teaching methods like note-taking, lecture, demonstration and project methods at the expense of the application of multimedia presentation in teaching. The findings might be attributed to the non-compliance of agricultural science teachers to information and communication technology (ICT) applications. Innovative teaching method which most teachers fail to use in this computer-mediated education era helps to generate interest, motivate students' greater involvement, and raise their curiosity (Mahajan & Kaushal, 2017). Pooja (2017) reported that teachers predominantly use demonstration, recitation, and memorization in teaching. The appropriateness of a chosen method is highly instrumental to the performance of students and hence, should consider the individual differences of the learners which the application of ICT can take care of. An appropriate teaching method assists the learners to ask questions about what they knew earlier which will help them to learn, by compelling them

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to find answers to their questions (Shirani et al., 2016). Ganyaupfu (2013) noted that many teachers applied teacher-centred methods like note-taking and lecture methods in imparting worthwhile knowledge to the students. Teacher-centred approach is deficient in allowing students' participation and active engagement in the learning process.

Furthermore, the findings on the open-ended question revealed that the teachers were faced with the challenges of inconsistent power supply, poor network connectivity, non-availability of computer sets in most schools, poor computer usage by the teachers and poor staff development in schools. This might be the result of poor funding for education which bedevils developing countries' educational systems. The findings were not different from the work of Sarowardy and Halder (2019) which reported that the negligence of teachers in the application of multimedia was a result of insufficient digital amenities and poor infrastructural facilities in schools. Some areas where schools are located do not have an electricity supply to power computers. Neo and Neo (2001) added that an adequate number of computers must be made available and proper training of teachers on the use of the multimedia application should be done before they embrace the technology. Teachers lack computing skills and therefore find it difficult to apply multimedia in teaching and learning (Zhang, 2016). Bayrak and Bayram (2010) noted that the computer-aided instructional method positively affected the academic achievement of students in Science and Technology, but the application was restricted by insufficient numbers of computer facilities in the school. The application of multimedia in instructional delivery no doubt motivates learners and accelerates their comprehension, but the issue of computer and network access, training of teachers in computer skills and their motivation are paramount to the application of multimedia in classroom teaching and learning.

Conclusions and Implications

The research results confirmed that the application of multimedia in classroom instruction improves the academic achievement of students. This proves its potential to arouse curiosity and activate the spirit of imagination in students through varied means of presentation such as image, audio, video, animation, sound, and colour. The application of multimedia in teaching agricultural science has the same effect on the academic achievement of male and female students. This signifies that the cognitive ability of male and female students does not differ significantly, and when exposed to the same content at the same time will not perform significantly different.

Although the study contributed to the knowledge of teaching and learning, some limitations need to be taken into consideration. Further study may focus on how to equip the curriculum planners in developing countries to integrate the multimedia application into the curriculum and also teachers to apply the media in teaching and learning. Secondly, further study needs to be done on how to increase funding of schools in developing countries to procure ICT facilities that will encourage the application of multimedia in teaching and learning.

Declaration of Interest

The authors declare no competing interest.

References

Ajagbawa, H. (2014). Quality education and financing challenges in Nigeria. *IOSR Journal of Research & Method in Education, 4*(5), 54–75.

Ajayi, O. V., & Ogbeba, J. (2017). Effect of gender on senior secondary chemistry students' achievement in Stoichiometry using hands-on activities. *American Journal of Educational Research, 5*(8), 839–842. https://doi.org/10.12691/education-5-8-1

Albalawi, M. (2019). Does gender difference affect the academic achievements of undergraduate students and later interns? A single medical College experience, Taibah University, KSA. *Allied Journal of Medical Res*earch, *3*(1), 20–25.

Almara'beh, H., Amer, E. F., & Sulieman, A. (2015). The effectiveness of multimedia learning tools in education. *International Journal of Advanced Research in Computer Science and Software Engineering, 5*(12), 761–764.

https://doi.org/10.33225/jbse/23.22.1074

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

Amie-Ogan, O. T., & Etuk, E. F. (2020). Influence of Teachers' Competence on Students' Academic Performance in Public Senior Secondary Schools in Ikot Ekpene and Essien Udim Local Government Areas of Akwa Ibom State. *International Journal of Innovative Social Sciences & Humanities Research, 8*(4), 118–128.

Andresen, B. B., & Brink, K. (2013). *Multimedia in the education curriculum*. Moscow, Russia: UNESCO Institute for Information Technologies in Education. https://www.eportal.igbajopolytechnic.edu.ng/pdf/multimedia-in-education-nbte-curriculum-67.pdf

Arong, F. E., & Ogbadu, M. A. (2010). Major causes of declining quality of education in Nigeria from administration perspective: A case study of Dekina Local Government Area. *Canadian Social Science, 6*(3), 183–198.

Asogwa, V. C., Isiwu, E. C., & Ugwuoke, C. U. (2021). Effects of instructional materials on the students' academic achievement in the fishery in senior secondary schools. *Global Journal of Educational Research, 20,* 153–161

Aydisheh, F. H., & Gharibi, H. (2015). Effectiveness of Constructivist Teaching Method on Students' Mathematics Academic Achievement. *Mediterranean Journal of Social Sciences, 6,* 572–579. https://doi.org/10.5901/mjss.2015.v6n6s2p572

Babiker, M. E. A. (2015). For effective use of multimedia in education, teachers must develop their educational multimedia applications. *The Turkish Online Journal of Educational Technology, 14*(4), 62–68

Bayrak, B. K., & Bayram, H. (2010). The effect of computer-aided teaching method on the student's academic achievement in the science and technology course. *Procedia Social and Behavioural Sciences, 9,* 235–238. https://doi.org/10.1016/j.sbspro.2010.12.142

Cohen, C., Manion, L., & Morrison, K. (2007). *Research Methods in Education*. London, 544 Routledge Taylor & Francis Group.

De Sousa, L., Richter, B., & Nel, C. (2017). The effect of multimedia uses on the teaching and learning of social sciences at tertiary level: A case study. *Yesterday and Today, 17*, 1–22. https://doi.org/10.17159/2223-0386/2017/n17a1

Doye, L., Brady, A. M., & Byrne, G. (2009). An overview of mixed methods research. *Journal of Research in Nursing, 14*(2), 175–185. https://doi.org/10.1177/1744987108093962

Ejimonye, J. C., Ugwuanyi, C. S., Okeke, C. I. O., & Nwoye, M. N. (2020). Two-dimensional animation and students' achievement in Mathematical Economics: Implications for science teaching. *International Journal of Engineering Research and Technology, 13*(6), 1220–1230. https://doi.org/10.37624/IJERT/13.6.2020.1220-1230_

Enugu State Ministry of Education, (2022). *Enugu State Ministry of Education Statistics*.

Ezennia, I. S., Uwajeh, P. C., Agbonome, P. C., & Iyendo, T. O. (2016). The benefits of digital multimedia as a teaching and learning in Architectural design studios. *International Journal of Current Research, 8*(9), 39210–39271.

Faisal, R., Shinwari, L., & Hussain, S. S. (2017). Academic performance of males in comparison with female undergraduate medical students in pharmacology examinations. *Journal of the Pakistan Medical Association, 67*(2), 204–208

Federal Republic of Nigeria, (2013). *National Policy on Education.* NERDC Press.

Ganyaupfu, E. M. (2013). Teaching methods and students' academic performance. *International Journal of Humanities and Social Science Invention, 2*(9), 29–35.

Gbenga, A. J., & Effiong, O. E. (2015). Effects of two methods of teaching on students' achievement in Junior secondary schools in Yakurr, Cross River. *International Letters of Social and Humanities Sciences, 61,* 70–81. https://doi.org/10.18052/www.scipress.com/ILSHS.61.70

Gilakjani, A. P. (2012). A study on the impact of using multimedia to improve the quality of English language teaching. *Journal of Language Teaching and Research, 3*(6), 1208–1215. https://doi.org/10.4304/jltr.3.6.1208-1215

Gorgoretti, B. (2019). The use of technology in music education in North Cyprus according to student music teachers. *South African Journal of Education, 39*(1), 1–10. https://doi.org/10.15700/saje.v39n1a1436

Gunawardhana, L. K. P. D., & Palaniappan, S. (2016). *Using multimedia as an education tool*. Paper presented at the 9th international conference on computer games multimedia and allied technologies, Singapore, 28-29 March. https://www.researchgate.net/publication/313512325_Using_Multimedia_as_an_Education_Tool

Incedayi, N. (2018). The impact of using multimedia technologies on students' academic achievement in the Bakirköy final College. *International Journal of Humanities Social Sciences and Education, 5*(1), 40–47. https://doi.org/10.20431/2349-0381.0501007

Khurshid, F., & Ansari, U. (2012). Effects of innovative teaching strategies on students' performance. *Global Journal of Humanities Social Science Linguistics & Education, 12*(10), 47–53

Kola, A. J., & Langenhoven, K. (2015). Teaching method in science education: The need for a paradigm shift to peer instruction (PI) in Nigerian schools. *International Journal of Academic Research and Reflection, 3*(6), 6–15

Kozma, R. B. (2008). *ICT, Education reform and economic growth: A conceptual framework*. Intel Corporation. https://www.intel.com/content/dam/www/public/us/en/documents/brochures/kozma-wp1-conceptual-framework.pdf

Mahajan, A., & Kaushal, K. (2017). Impact of innovative pedagogical teaching methods on students' academic performance. *New Nigerian Journal of Clinical Research, 6*(10), 41–44. https://doi.org/10.4103/2250-9658.225332

Mayer, R. E. (2005). Cognitive theory of multimedia learning. In R.E. Mayer (Ed.), *The Cambridge handbook of multimedia learning*. Cambridge University Press.

Molla, E., & Muche, M. (2018). Impact of cooperative learning approaches on students' academic achievement and laboratory proficiency in Biology subject in selected rural schools, Ethiopia. *Educational Research International, 2018*, 1–9. https://doi.org/10.1155/2018/6202484

https://doi.org/10.33225/jbse/23.22.1074

Muema, J. S., Mulwa, D. M., & Mailu, S. N. (2018). Relationship between teaching method and students' performance in Mathematics in public secondary schools in Dadaab sub-County, Garissa County, Kenya. *IOSR Journal of Research & Method in Education, 8*(5), 59–63.

Mukherjee, S. (2018). Roles of multimedia in education. *Edelweiss Applied Science and Technology, 2*(1), 245-247. https://doi.org/10.33805/2576-8484.149

Nbina, J. B. (2012). Teachers' competence and students' academic performance in senior secondary schools Chemistry: Is there any relationship? *Global Journal of Educational Research, 11*(1), 15–18.

Neo, M., & Neo, K. T. K. (2001). Innovative teaching: Using multimedia in a problem-based learning environment. *Education Technology & Society, 4*(4), 19–31.

Nworgu, B. G. (2003). *Educational measurement and evaluation: Theory and practice*. University Trust.

Okeke, O. J. (2018). Effect of gender on the mean achievement score of chemistry students taught using Mend Mapping Teaching Strategy (MMTS) in Enugu. *International Journal in Physical and Applied Sciences, 5*(8), 32–50.

Okwuduba, E. N., & Okigbo, E. C. (2018). Effect of teaching methods on student's academic performance in Chemistry in Nigeria: Meta-analytical review. *Bulgarian Journal of Science and Education Policy, 12*(2), 418–434.

Oladosu, C. T., Ayoola, R. A., Olokede, N. O., & Ojo, A. O. (2022). Teachers' professional development, teachers' quality and students' academic achievements in the public-private partnership schools. *Current Research in Language, Literature and Education, 4*(9), 93–105.

Organisation for Economic Co-operation and Development, (2018). *The future of education and skills education 2030*. https://www.oecd.org/education/2030/E2030%20Position%20Paper%20(05.04.2018).pdf

Osinem, E. C. (2008). *Managing agricultural education and training: Resources, principles and methods.* Belony.

Patel, C. (2013). Use of multimedia technology in teaching and learning communication skills: An analysis. *International Journal of Advancement in Research & Technology, 2*(7), 116-123.

Podungge, R., Rahayu, M., Setiawan, M., & Sudiro, A. (2019). Teacher competence and student academic achievement. *Advances in Economics, Business and Management Research, 144*, 69–74. https://doi.org/10.2991/aebmr.k.200606.011

Pooja, G. (2017). Study of the effect of teaching method on the academic achievement of school-going children of the semi-urban area, S school of Lucknow City. *International Journal of Home Science, 3*(2), 447–453.

Ramnarain, U., & Hlatswayo, M. (2018). Teacher beliefs and attitude about inquiry-based learning in a rural school district in South Africa. *South African Journal of Education, 38*(1), 1–10. https://doi.org/10.15700/saje.v38n1a1431

Safo-Adu, G., Quansah, R. E., & Ofori-Appiah, C. (2020). Appraisal of biology teachers' practices in organising practical work in second cycle institutions in Eastern Region, Ghana. *International Journal of Academic Research and Reflection, 8*(1), 1–16.

Saida, H., & Mustapha, F. (2018). The effect of gender on university student school performance: The case of the National School of Agriculture in Meknes, Morocco. *Kultūra ir Visuomenė. Socialinių tyrimų žurnalas, 9*(1), 67–78. https://doi.org/10.7220/2335-8777.9.1.4

Sarowardy, M. H., & Halder, D. P. (2019). The issues and challenges of using multimedia at a district level, specialized Girls' College in Bangladesh. *Creative Education, 10*, 1507–1524. https://doi.org/10.4236/ce.2019.107110

Shirani, B. N., Nasr-Isfahani, A.R., Rouhollahi, A., & Khalili, R. (2016). Effectiveness of teaching methods in higher education: Requirements and barriers. *Journal of Advances in Medical Education & Professionalism, 4*(4), 170–178.

Sukma, D. M., Nurkamto, J., & Drajati, N. A. (2018). Multimedia-based presentation: Exploring interactivity emergence in the academic speaking classroom. *Science, Engineering, Education and Development Studies (SEEDS): Conference Series, 2*(1), 29–40. https://doi.org/10.20961/seeds.v2i1.24250

Thom-otuya, B. E. N., & Inko-tariah, D. C. (2016). Quality education for national development: The Nigerian Experience. *African Educational Research Journal, 4*(3), 101–108.

Umar, G., Yagana, W. S. B., Kaltum, A., & Mohammed, W. B. (2015). Gender differences in students' academic performance in Colleges of Education in Borno State, Nigeria: Implications for counselling. *Journal of Education and Practice, 6*(32), 107–114.

WAEC Chief Examiner' Report, (2017), (2018) & 2019. West African Examination Council, Lagos, Nigeria.

Zhang, Z. (2016). The use of multimedia in English teaching. *US-China Foreign Language, 14*(3), 182–189. https://doi.org/10.17265/1539-8080/2016.03.002

Zudonu, O. C., & Njoku, Z. C. (2018). Effect of laboratory instructional methods on students' attitude in some chemistry concepts at the senior secondary school level. *Global Scientific Journals, 6*(7), 46–61.

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