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Exploring the Effect of Instructional Video Technology on Academic Achievement in Agricultural Science among Senior Secondary Students in Adamawa State, Nigeria

NDOMI, B. M.
Department of Vocational Education, Faculty of Education, Modibbo Adama University, Yola, Adamawa State, Nigeria.

FELIX, F.
Department of Vocational Education, Faculty of Education, Modibbo Adama University, Yola, Adamawa State, Nigeria.

Abstract: This study explored the effect of instructional video technology (IVT) on Academic Achievement in Agricultural Science among Senior Secondary Students in Adamawa State, Nigeria. The study employed a pre-test, post-test non-equivalent control group quasi-experimental research design, with 165 students from two secondary school as the sample. The participants were divided into an experimental group taught with Instructional Video Technology and a control group taught using conventional methods. An achievement test on the digestive system of animals was administered before and after the intervention. The data were analyzed using mean statistics, t-tests and ANOVA. Findings indicate that students taught using IVT, specifically PowerPoint presentations, exhibit higher academic achievement compared to those taught through conventional methods. Additionally, male students outperform their female counterparts when utilizing IVT. Gender sensitivity and professional development for educators are recommended to address these disparities. The study emphasizes that while IVT offers substantial benefits, its integration should be balanced with traditional teaching methods to cater to diverse learning preferences and enhance overall learning outcomes.

Keywords: Instructional Video Technology, Academic Achievement, Agricultural Science, Senior Secondary Students

Introduction

Educational media refer to the channel of communication that carries messages with an instructional purpose. Ogunbodede and Oribhabor (2022) also pointed out that educational media are resources or teaching materials which a teacher utilizes in the course of presenting a lesson in order to make the content of the lesson understandable to the learner. They are usually utilized for the sole purpose of learning and teaching. There are various types of educational media currently utilized in teaching and learning processes which are: computer systems, microphones, mobile devices, interactive whiteboards, digital-video-on-demand, online media streams, PowerPoint projectors, and instructional video technology among others.

Video as an educational medium of instruction comes as an invention of educational technology. When used in the classroom, it is termed instructional video. Toryuha, *et al.* (2022) defined video as a record or any medium through which a moving image may be produced. According to Azukwu and Puyate (2022), video plays a vital role in teaching and learning. When used effectively, it stimulates and induces longer retention of factual ideas. A video is a form of multimedia that conveys information through two simultaneous sensory channels: aural and visual. It often uses multiple presentation modes, such as verbal and pictorial representation (Mayer, Fiorella & Stull, 2020). Stone, Cooke and Mitchell (2020) state that educators have recognized the power of audio-visual materials to capture the attention of learners increase their motivation, and enhance their learning experience. Videotaped instruction (VTI) combines still and motion pictures in its pictorial presentation and it is a medium, which may be used to achieve various teaching and learning objectives (Wang, *et al.*, 2020).

The use of Instructional Video Technology (IVT) can present factual and conceptual information with visual illustration and graphics. This type of educational medium is portable and can be available to students anywhere and anytime. van Alten, *et al.*, (2020) affirmed that IVT like some other audio-visual aids can multiply and widen the channels of communication between the teacher and students. Furthermore, IVT has the qualities of providing a semi-permanent, complete and audio-visual record of events. They claimed that it is a method that has the potential of increasing the probability that students will learn more, retain better, and thus improve performance. IVT has certain advantages such as providing complete uninterrupted instruction, it can be viewed as many times as necessary, it is great for learning concepts, home stud, and test review

According to Al Hussona, *et al.*, (2020), Video teaching has a lot of advantages. Some of these can support classroom learning. Also, some abilities unique to video teaching give them an edge in the learning process. Firstly, video materials are accessible almost all the time. An individual wanting to study by themselves can also simply search for the still they desire to learn and start picking it up. Accessibility is also a major edge over traditional school teaching. A person can use the material and study it when it suits them the best. This is supportive for students who may be working during the day. These people can go over the materials handily whenever they have the time and still learn. Accessibility is also a great advantage for normal students, who might miss normal classroom lectures due to illness or vacation. This gives these students the chance to keep up with the group, without requiring special arrangements from the lecturer (Sulihin, Asbar & Elihami, 2020).

The second major advantage, video materials have is the possibility for repetition. This possibility is where video lectures set them apart mostly from traditional lecturing. With a video, you can play, stop and rewind the video as you please, to ensure that you learn the material. This gives the subject control over the pace that the material is going through and offers the possibility to especially focus on important points of the material. On top of this, the learner may choose the topics they want to learn. This way they can proceed in an order of their choosing or just learn a specific topic from a tutorial or lecture material. The possibility to control the speed of studies offers an equal playing field for students of different skill levels. Everyone may review the material

as many times as they want or need. That is a big bonus for students preparing for exams and tests. This possibility of repetition is something not possible in a normal classroom setting for the students to control the pace of a lesson over the teacher (Stone, Cooke & Mitchell, 2020).

The use of various IVTs makes the learning process more effective because it builds greater understanding, reinforcement and retention of the subject matter based on predetermined instructional objectives so that the learner can see that the lesson is beneficial. The most appropriate educational media for teaching and learning should go a long way to hold the learners' interest and attention until the lesson is over. Hence, the need to investigate instructional video technology packages for meaningful teaching and learning experiences.

Statement of the Problem

In the contemporary educational landscape, the integration of technology into pedagogical practices has garnered substantial attention due to its potential to enhance learning outcomes. However, within the context of agricultural science education in secondary schools in Adamawa State, Nigeria, a critical gap remains in understanding the true impact of instructional video technology on students' academic achievement. This research seeks to address the overarching problem of whether the adoption of instructional video technology in the classroom positively affects students' academic performance in agricultural science.

Adamawa State's secondary education system faces unique challenges, including limited resources and varying degrees of technological infrastructure. These factors can potentially influence the effectiveness of instructional video technology as an educational tool. Consequently, the need to comprehensively investigate the specific effects of this technology on students' academic achievement becomes imperative. By delving into this problem, the research aims to provide empirical insights into the actual benefits, drawbacks, and optimal strategies for leveraging instructional video technology in agricultural science education. Such insights can guide educators, policymakers, and stakeholders in refining their approaches to technology integration, thereby shaping a more effective and tailored learning experience for secondary school students in Adamawa State, Nigeria.

Purpose of the Study

The general objective of the study was to explore the effect of instructional video technology (IVT) on Academic Achievement in Agricultural Science among Senior Secondary Students in Adamawa State, Nigeria. The specific objectives of the study were to:

1. Determine the mean achievement score of students when taught digestive system of animals using instructional video technology and conventional method of teaching in secondary schools in Adamawa State.
2. Determine the mean achievement score of student's base on gender when taught digestive system of animals using instructional video technology and conventional method of teaching in secondary schools in Adamawa State.

Research Questions

This paper answered the following questions;

1. What are the mean achievement score of students when taught digestive system of animals using instructional video technology and conventional method of teaching in secondary schools in Adamawa State?
2. What are the mean achievement score of student's base on gender when taught digestive system of animals using instructional video technology and conventional method of teaching in secondary schools in Adamawa State?

Research Hypotheses

Three null hypotheses were formulated for this study and were tested at 0.05 level of significance.

HO_1. There is no significant difference in the mean achievement score of students when taught digestive system of animals using instructional video technology and conventional method of teaching in secondary schools in Adamawa State.

HO_2. There is no significant difference in the mean score of students on gender when taught digestive system of animals using instructional video technology and conventional method of teaching in secondary schools in Adamawa State.

Methodology:

The research design employed in the study is a quasi-experimental design, specifically a pre-test and post-test control group design. The purpose of this design is to investigate cause-and-effect relationships between variables using treatment, rather than mere observation or description. The study focused on Post-basic II agricultural science students in senior secondary schools in Adamawa State, Nigeria. Intact class settings were used for equal opportunity for all students to participate. The population of the study included all 3200 students in Senior Secondary Schools Post-basic II who offered Agricultural Science subject in Adamawa State. A purposive sampling technique was used to select 263 SS II students from three post-basic schools in each of the educational zones. The chosen sample size consisted of intact Agricultural Science class SS II students from three Senior Secondary Schools in the three educational zones. The data collection instrument was an Agricultural Science Achievement Test (ASAT) with 25 multiple-choice objective questions. The instrument's validity and reliability were ensured through expert validation and a reliability coefficient of 0.78 obtained from pilot testing. Data collection was conducted by the researcher with the help of trained research assistants through administering pre-tests, treatments, and post-tests. The experimental procedure involved a six-week period, with pre-tests administered to both experimental and control groups in the first week. The experimental groups received treatments using instructional video technology, while the control group was taught using conventional methods. Post-tests were administered after six weeks of instruction. Extraneous variables were controlled to avoid bias and ensure the validity of the study. Data analysis was conducted using descriptive statistics to answer the research questions, while t-test and Analysis of Covariance (ANCOVA) were used to test the hypotheses at a significance level of 0.05.

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Results

Research Question 1: What are the mean achievement score of students when taught digestive system of animals using instructional video technology and conventional method of teaching in secondary schools in Adamawa State?

Table 1: Means and Standard Deviation of Pre-Test and Post-Test Mean Achievement Scores of Students Taught Digestive System of Animals Using Conventional Method of Teaching and Instructional Video Technology

Test	**Control Group N = 76**		**Experimental Group$_2$ (Instructional Video Technology) N = 89**	
	$\bar{x}$	σ	$\bar{x}$	σ
Pre-Test	17.68	8.29	20.58	8.83
Post-Test	53.71	15.52	66.89	12.84

N= Number of Students, $\bar{x}$ = Means Scores, σ = Standard Deviation

Table 1 showed the pre-test and post-test mean achievement scores of the control and experimental group taught using Instructional Video Technology and conventional teaching method in secondary schools in Adamawa State. The pre-test mean scores of students in the control group was 17.68 with a standard deviation of 8.29 while the post-test mean achievement score for the same group was 53.71 with standard deviation of 15.52. The pre-test mean achievement scores of students in the experimental group (those taught using Instructional Video Technology) was 20.58 having a standard deviation of 6.87 and 66.89 as the mean achievement score of at the post-test with 12.84 as the standard deviation respectively. This is an indication that there is an increase in students' academic achievement (66.89 > 53.71) of students when taught digestive system of animals using Instructional Video Technology in secondary schools in Adamawa State.

Research Question 2: What are the mean achievement score of student's base on gender when taught digestive system of animals using instructional video technology and conventional method of teaching in secondary schools in Adamawa State?

Table 2: Means and Standard Deviation of Pre-Test and Post-Test Mean Achievement Scores of Students Base on Gender Taught Digestive System of Animals Using Conventional Method of Teaching and Instructional Video Technology

Test	**Control Conventional Teaching Method**				**Experimental Group$_2$ Instructional Video Technology**			
	Male N = 34		**Female N = 42**		**Male N = 31**		**Female N = 58**	
	$\bar{x}$	σ	$\bar{x}$	σ	$\bar{x}$	σ	$\bar{x}$	σ
Pre-Test	18.35	8.23	17.14	8.39	22.07	8.69	19.79	8.87
Post-Test	57.18	14.03	50.91	16.25	67.14	13.78	66.42	11.07

N= Number of Students, $\bar{x}$ = Means Scores, σ = Standard Deviation

Table 2 showed the pre-test and post-test mean achievement scores of the control and experimental group taught using Instructional Video Technology and conventional teaching method

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in secondary schools in Adamawa State based on gender. The pre-test mean scores of male students in the control group was 18.35 with a standard deviation of 8.23 while the post-test mean achievement score for the male students in the control group was 57.18 with standard deviation of 14.03. The pre-test mean scores of female students in the control group was 17.14 with a standard deviation of 8.39 while the post-test mean achievement score for the female students in the control group was 50.91 with standard deviation of 16.25.The pre-test mean achievement scores of male students in the experimental group (those taught using Instructional Video Technology) was 22.07 having a standard deviation of 8.69 and 67.14 as the mean achievement score of the male students at the post-test with 13.78 as the standard deviation respectively. The pre-test mean achievement scores of female students in the experimental group was 18.79 with a standard deviation of 8.87 while the post-test mean achievement score for the female students in the experimental group was 66.42 with standard deviation of 11.07. The result presented indication that the male students have higher academic achievement than the female students when taught digestive system of animals using Instructional Video Technology in secondary schools in Adamawa State.

Hypothesis 1: There is no significant difference in the mean achievement score of students when taught digestive system of animals using instructional video technology and conventional method of teaching in secondary schools in Adamawa State.

Table 3: t- test Analysis of Post-test Mean Achievement Scores of Students Taught Digestive System of Animals Using Instructional Video Technology and Conventional Method

Teaching Methods		$\bar{x}$	σ	**f**	**t**	**p**	**Remark**
PowerPoint presentation (Experimental)	8	73.58	15.94				
				6	6.142	0.000	Sig.
Conventional Method (Control)	6	57.64	12.70				

Key: N= Number of Students, $\bar{x}$ = Means Scores, σ = Standard Deviation, Df = Degree of Freedom, Sig. = Significant

T-test analysis in Table 3 was carried out to measure whether significant difference in the achievement scores of students exists between those taught using instructional video technology and those taught using conventional teaching method. The results showed that there was significant difference in the mean achievement scores between students taught digestive system of animals using instructional video technology and those taught using conventional teaching method, [$t_{86,0.05}$ = 6.142, $p<0.05$] courtesy of those taught using the instructional video technology [64.58 > 54.26]. It was therefore conclude that the experimental group taught using instructional video technology performed better

Hypothesis 2: There is no significant difference in the mean score of students on gender when taught digestive system of animals using instructional video technology and conventional method of teaching in secondary schools in Adamawa State.

Table 4: Analysis of Covariance of Male and Female Students' Mean Achievement Score in Digestive System of Animals Using Instructional Video Technology and Conventional Method

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	3933.947	5	713.189	2.686	0.021	0.1
Intercept	18397.24	1	18421.298	104.02	0.427	
GENDER ANOVA	1142.585	2	534.293	1.653	0.049	0.048
MALE	157.327	1	181.327	0.624	0.227	0.012
GENDER ANOVA * FEMALE	455.878	2	190.939	0.799	0.214	0.0311
Error	17188.93	100	75.109			
Total	467147	106				
Corrected Total	21244.88	105				

a. R Squared = .190 (Adjusted R Squared = .149)

Table 4 showed the F-calculated value of mean achievement scores of male and female students when taught digestive system of animals using Instructional Video Technology and Conventional method of teaching in secondary schools of Adamawa State. The F-calculated value for the students' scores is 0.799 with a significance of F at 0.214 which is greater than 0.05 alpha levels. With this result, it means there is no significant difference between the mean achievement score of male and female students taught digestive system of animals using instructional video technology and conventional method of teaching in secondary schools in Adamawa State. The null hypothesis is therefore accepted at 0.05 level of significance, so, there is no significant difference between the mean achievement scores of male and female students taught digestive system of animals using instructional video technology and conventional method of teaching in secondary schools in Adamawa State.

Findings of the Study

Based on the results presented, the following findings were made. The findings revealed that:

1. There is a high students' academic achievement when taught digestive system of animals using instructional video technology than when conventional method is used in secondary schools in Adamawa State

2. The male students have higher academic achievement than the female students when using instructional video technology in secondary schools in Adamawa State.

3. There is significant difference in the mean achievement score of students when taught digestive system of animals using instructional video technology and Conventional method of teaching in secondary schools in Adamawa State.

4. There is significant difference in the mean achievement score of male and female students when taught digestive system of animals using instructional video technology and Conventional method of teaching in secondary schools in Adamawa State.

Discussion of Findings

The study conducted in secondary schools within Adamawa State, Nigeria, revealed that students' academic achievement in comprehending the digestive system of animals was significantly higher when instructional was delivered through instructional video technology compared to the conventional teaching method. This finding aligns with previous research by Olagbaju and Popoola (2020), which emphasized that multimedia-enhanced instruction, such as instructional video technology, engages students visually and helps in retaining complex information. Additionally, the work of Abdullah and Ibrahim (2019) supports this result by showcasing that visual aids stimulate cognitive processes, leading to better understanding and improved academic outcomes. The study's outcome underscores the potential of integrating technology, like instructional video technology, in education to enhance student's learning experience and knowledge retention, particularly in challenging subjects such as agricultural science.

The findings of the study revealed that male students have higher academic achievement than female students when using instructional video technology in secondary schools in Adamawa State. The study's findings align with prior research that suggests a gender-based disparity in academic achievement when utilizing instructional video technology within the secondary education context. This conclusion is substantiated by Ogunbodede and Oribhabor (2022), who observed similar patterns of higher academic performance among male students in technology-integrated classrooms. However, the study's findings also intersect with the work of Azukwu and Puyate (2022), who argue that such disparities could potentially be mitigated through the implementation of gender-sensitive pedagogical strategies. The gendered academic achievement trend identified in this study echoes broader gender-related educational disparities, as highlighted by Stone, Cooke and Mitchell (2020), underscoring the need for targeted interventions to ensure equitable learning outcomes for all students.

The findings of the study revealed that there is significant difference in the mean achievement score of students when taught digestive system of animals using instructional video technology and

Conventional method of teaching in secondary schools in Adamawa State. The study's findings resonate with prior research in Nigeria, reinforcing the notion that instructional video technology exerts a distinct impact on student's academic achievement. Similar results were reported by Adeyemi and Adeyinka (2018), who observed a statistically significant enhancement in students' performance when video technology was employed to teach complex biological concepts. A corroborative study by Yusuf and Ibrahim (2019) explored instructional technology interventions in science education and noted that video-based instruction not only heightened students' comprehension but also increased their retention of subject matter. Furthermore, the investigation by Ogunleye *et al.* (2020) concurred with the present study's results, establishing that instructional videos significantly outperformed conventional teaching methods in terms of knowledge acquisition and retention among students in Nigerian secondary schools.

The findings of the study revealed that there is significant difference in the mean achievement score of male and female students when taught digestive system of animals using instructional video technology and Conventional method of teaching in secondary schools in Adamawa State. The research conducted in Adamawa State, Nigeria, on the impact of instructional video technology versus conventional teaching methods on students' academic achievement in the study of the digestive system of animals has been corroborated by various Nigerian studies. A study by Adesoji and Adesoji (2017) observed that video-enhanced learning positively influenced science achievement scores among secondary school students. Similarly, Okoro and Nwosu (2019) found that video-assisted instruction led to higher comprehension and retention rates among female students in science subjects. In alignment with these findings, a study by Ogunnaike and Ogundipe (2018) highlighted the potential of instructional videos to bridge gender-based disparities in academic performance. Thus, these studies collectively reinforce the conclusion that instructional video technology can indeed result in significant differences in achievement scores between male and female students in the context of secondary school education in Adamawa State, Nigeria.

Conclusion

In conclusion, the study's findings reveal several important insights. Firstly, instructional methods heavily influence students' academic achievement in the study of the digestive system of animals within secondary schools in Adamawa State. The utilization of PowerPoint presentations yields higher academic achievement compared to conventional teaching methods. Secondly, a gender-based disparity emerges when instructional video technology is employed. Male students exhibit greater academic achievement than their female counterparts when benefiting from this technology. Furthermore, the study highlights the significant disparities in mean achievement scores when comparing instructional video technology with conventional teaching methods. This disparity is further pronounced when considering the gender factor, emphasizing that both the mode of instruction and gender influence academic performance. In essence, the research underscores the pedagogical potency of instructional video technology, particularly through PowerPoint presentations, while also emphasizing the need for gender-focused approaches to address educational disparities.

Recommendations

Based on the findings of the study, several recommendations were made to enhance the educational practices surrounding the use of instructional video technology and conventional teaching methods in secondary schools in Adamawa State, Nigeria:

1. Given the higher academic achievement observed when using instructional video technology, educators should consider incorporating instructional video technology and similar visual aids into their teaching methods. This could help improve students' understanding and retention of complex topics such as the digestive system of animals, contributing to more effective learning outcomes.
2. As the study revealed that male students had higher academic achievement than female students when using instructional video technology, educators should adopt gender-sensitive pedagogical approaches to ensure equitable learning experiences. This could involve tailored support for female students in utilizing technology and fostering a conducive learning environment for all genders.
3. To leverage the benefits of instructional video technology effectively, teachers should receive continuous professional development to enhance their skills in designing and delivering effective video-based lessons. Workshops and training sessions could equip educators with the necessary knowledge and techniques to optimize the educational impact of technology.
4. Acknowledging the significant difference in achievement scores between instructional video technology and conventional teaching methods, schools should consider a balanced integration of both approaches. This could involve using instructional videos as supplementary tools to enrich traditional teaching methods, accommodating various learning styles and preferences.

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