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Exploring the Effectiveness of Video Technology in Senior Secondary Biology Education

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Abstract

This study investigated the effect of Video Technology on Senior Secondary School Biology Students' Academic Performance in Wukari Local Government Area, Taraba State Nigeria. The study adopted pretest, post-test and control group quasi–experimental design. Two Intact classes were taught using video technology as experimental group and another two classes taught using demonstration method as control group. Two research questions and two null hypotheses were formulated to guide the study. Biology Performance Test on Digestive System (BPTDS) with 25 Objective items was developed and validated by two experts in measurement and evaluation and mathematics respectively. Pilot test was carried out with reliability coefficient of 0.68 obtained, prior using it for data collection. The instrument was administered as pre-test and readministered as post-test. The data were analyzed using mean and standard deviation to answer the research questions while ANCOVA statistical tool was used to test the hypotheses at 0.05 significance level. The result of the findings revealed that there is significant difference in the mean academic performance of students taught Biology using Video Technology and those taught same concepts using Demonstration Method. It also revealed that there was a significant difference between academic performance and location. It was recommended that teachers should use video technology in the teaching of students in secondary schools as it promotes understanding of abstract concepts by students.

Keywords: video, technology, biology, academic performance, secondary school.

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INTRODUCTION

Biology as one of the science subjects prepares the students in the senior secondary level of education for further careers in many areas of study in the higher institutions. [15] clearly positioned Biology as a vital science subject, and prerequisite subject in further studies in Medicine, Dentistry, Agriculture, Pharmacy, Genetics Engineers, Microbiology, Biochemistry, Veterinary, Nursing and Biotechnology. [3] opined that Biology is a science subject that enables students to acquire the knowledge to live effectively in the modern age of science and technology. This is in agreement with [8] which said that Education is the key that unlocks the door to modernization. In spite of the importance and popularity of Biology among Nigerian students, their performances at Senior Secondary School level have been poor [10]. Over the years, there has been high enrolment of Biology students in secondary schools but interestingly, students' academic performance has not been encouraging. It is worrisome to note that the performance of these students has continued to deteriorate yearly in Biology despite all stakeholders' efforts. This calls for investigation among the goals of science education, biology curriculum and instruction. The West African Examinations Councils (2016) annual reports revealed poor performances of most candidates who took the Senior School Certificate Examination. On the average the percentage failure is higher as compared to the percentage rate of pass on the subject.

The current method of teaching Biology subject has been identified by [5] as one of the factors responsible for the poor performance of students towards Biology subject. The conventional teaching method is classroom-based and consists of lectures, demonstration and direct instructions conducted by the Biology teachers. This teacher centered approach emphasizes learning through the teachers' guidance at all times; students are expected to only pay critical attention, listen and learn from the teachers. The continuous use of this approach makes Biology students passive participants rather than active learners. It does not promote deep and insightful learning, and long–term retention of some abstract concepts in Biology [12]. These problems have made Biology teachers to focus on how to improve the teaching and learning of Biology with the view to arousing students' interest in the subject and also develop positive attitude in them, so as to change this abysmal situation. In this current technology driven age, the teaching of Biology which forms the foundation for scientific and technological growth and development of any nation requires dynamic and qualitative teaching approaches that are computer oriented. The use of video technology may enhance the quality of education in many ways: by increasing learners' motivation and engagement, facilitating the acquisition of basic skills and enhancing teachers' training. Effective Teaching approach such as video technology when employed by Biology teachers enhances all the senses of students, thereby boosts the academic performance of Biology students. [9] averred that the global acceptance of ICT components has been the landmark of educational system because Computer-Assisted Instruction has revolutionized teaching and learning of sciences by providing information and instructional activities learners need to master concepts. Due to the increasing portability of technological components, students have recently developed internet addiction. However, the concern is not whether these students access the Internet, the concern is on what they actually do online; the time they spend on it, how their online activities affected and shaped their lives, and the economic impact of their online activities [1]. However, simple and new technologies can greatly increase students' engagement outside of the classroom, prepare them for real discussions by providing content and assessment before class time. Hence, it is essential that teachers use instructional guide which ensures students

active participation in learning and provide suitable learning environment to improve academic performance.

The use of video technology in teaching and learning of Biology subject is not a new phenomenon; according to [7] filmstrips were first studied during World War II as a training tool for soldiers. Teachers have recognized the power of audio-visual materials to capture the attention of learners, increase their motivation and enhance their learning experience. Technology has developed over the time, thereby increasing the availability and the use of audio-visual materials in classrooms. Presently, both adolescents and children are used to seeing dozens of videos daily; it is their basic channel of communication, and they are already in the habit of using videos as sources of information [4]. [11] averted that there are 22 billion daily video views: Snap chat (10 billion), Face book (8 billion), and YouTube (4 billion). He pointed out that Viewers retain 95% of a message when they watch it in a video, compared to 10% when reading it in a text. [2] corroborating with the view opined that learners are more likely to retain and recall contents that are presented visually with a greater percentage than what they hear only. The visual dimensions added to the learning material concretize learners' experiences. [7] in his assertion averred that this generation truly is the media generation, devoting more than a quarter of each day to media activities. As media devices become increasingly portable, cheaper and as they spread even further through young people's environments, anything that takes up this much space in young people's lives deserves full attention.

Video-based learning is the term used to designate knowledge or skills acquired by being taught using video technology [6]. It uses presentation modes, such as verbal and pictorial representations. Videobased learning according to [2] is the production of video programmed directed towards helping students to achieve specific instructional objectives with a specific target population. They could be employed in concepts where teachers find it difficult to carry out practical. [11] opined that videos are popular choice for students of all levels because they are high impact medium and extension of videobased learning create engaging learning experience with high recall and retention. One of the critical attributes of video as stated by [6] is the use of both auditory and visual cues. Visual symbols provide primary source of information, and the audio symbols are utilized to elaborate information. Four major factors that come into play for effective learning as stated by [6] are attention, relevance, confidence, and satisfaction. Video-based learning has the ability to provide all these attributes and thus supports effective learning. The Researcher as a teacher has observed that many students spend most of their time watching video films and engage in long conversation with their friends' using handsets and computers. They have much interest in the present-day technological tools and gadgets to watch those things that are appealing to their sense of sigh or vision. If therefore, teachers that are the facilitators of knowledge can capitalize on this to redirect their teaching approach using Video technology, the outcome will be positive.

STATEMENT OF THE PROBLEM

It has been observed that there has been a persistent decrease in the performance of students in science subjects, especially Biology in senior secondary schools in Wukari Local Government Area of Taraba State. Even in some schools, just few students pass science subjects Biology inclusive as seen from the West African Examinations

Council Examiners' Reports over the years. It has also been observed that, the number of Biology students in higher institutions have been diminishing yearly. It represents one of the lowest populations amongst the departments in most institutions. But Biology still remains a requirement for admission into courses like Medicine and Surgery, Pharmacy, Dentistry, Anatomy, Human

Physiology, MicroBiology, etc. and for national growth and development all over the world. This will positively affect the economic structure and Gross Domestic Products (GDPs) of the nations. This persistent failure by Biology students in secondary schools has been ascribed to many factors which include, ineffectiveness of Biology teachers to handle abstract concepts, lack of teaching aids, lack of preparations by the teachers and lack of attention by the students.

Could it also be due to inadequate instructional material usage such as not using video technology in the teaching and learning of Biology as one of the science subjects, use of obsolete materials, and incompetency of Biology teachers? However, as most studies have been captured on video technology and academic performance of students in senior secondary schools, none has been able to capture Biology as a field of study in Wukari Local Government Area of Taraba State. It is against this background that the researcher embarked on this study on influence of video technology on Biology Students' academic performance in Wukari Local Government Area, Taraba State.

PURPOSE OF THE STUDY

1. To determine the mean difference in the academic performance of Biology Students taught using video technology and those taught same concepts using demonstration method in Wukari Local Government Area, Taraba State.
2. To examine the mean difference in the academic performance of Biology students taught using video technology and those taught same concepts using demonstration method based on location in Wukari Local Government Area, Taraba State.

RESEARCH QUESTIONS

The following research questions were raised to guide the study:

1. What is the mean academic performance scores of Students taught Digestive System using Video Technology and those taught using Demonstration Method in Wukari Local Government Area, Taraba State?
2. What is the mean academic performance of students taught Digestive System using Video Technology and those taught using Demonstration Method based on location in Wukari Local Government Area, Taraba State?

RESEARCH HYPOTHESES

The following null hypotheses were formulated to guide the study:

H_{O1}: There is no significant mean difference in the academic performance scores of students taught Biology using video technology and those taught using demonstration method in Wukari Local Government Area, Taraba State.

H_{O2}: There is no significant mean difference in academic performance scores of students taught Biology using video technology and those taught using demonstration method based on location in Wukari Local Government Area, Taraba State.

METHODS

This study adopted quasi-experimental (using two groups) by randomly assigning intact classes from four different public secondary schools in Wukari Local Government Area, Taraba State. The population of the study comprised of all public secondary school students in Wukari Local Government Area with a total number of 4,785 students. Four schools were purposely selected from to cover the location in terms of Urban and Rural location. Two schools were taken to be the experimental group: one school from the urban and the other from the rural, while the other two schools used as the control group in the same order. From each of the four schools, one intact class of SS 2 students offering Biology were selected. Two hundred and forty students (240) from the four selected schools (135 students from Urban schools and 105 from Rural schools) formed the sample size for the study. The instrument for data collection was Biology Performance Test on Digestive System (BPTDS) made up of 25 objective multiple choice items with four options (A–D). The research instrument was validated by experts in measurement and evaluation, and Science Education. A reliability test was conducted and the reliability coefficient value of 0.68 was obtained. BPTDS was administered to both the experimental and the control groups before the commencement of the teaching (pretest). The treatment was administered to the students which lasted for four years after which a post-test was administered. Data generated from the study were analyzed at 0.05 level of significance using mean and standard deviation to answer research questions and Analysis of Covariance (ANCOVA) was used to test the hypotheses.

RESULTS

Research Question 1: What is the mean academic performance scores of Students taught Digestive System using Video Technology and those taught using Demonstration Method in Wukari Local Government Area, Taraba State?

Table 1: Difference in Mean and Standard Deviation Scores of Students Academic Performance in Biology for both Video Technology and Demonstration Method.

Group	N	Pre-test Mean (X)	Pre-test SD	Post-test Mean (X)	Post-test SD	Mean Gain
VT	116	20.43	8.80	63.56	15.43	43.13
DM	124	20.42	8.30	53.73	14.34	33.31
Mean Difference (MD)	—	0.01	—	9.83	—	—

The pretest Mean Difference score between Video Technology and Demonstration Method group were 0.01. A closer look at the pretest scores for both groups show a similar value which is an indication that the groups were equivalent before treatment. The mean gains were 43.13 for Video Technology and 33.31 for Demonstration Method with mean difference score of 9.82. This shows

that students taught Digestive System using Video Technology performed better than their counterparts taught using Demonstration Method (DM).

Research Question 2: What are the mean academic performance of students taught Digestive System using Video Technology and those taught using Demonstration Method based on location in Wukari Local Government Area, Taraba State?

Table 2: Pretest and Post-test Mean Difference Scores of Students taught Biology using Video Technology and Demonstration based on Location.

Location	Group	N	Pre-test Mean (X)	Pre-test SD	Post-test Mean (X)	Post-test SD	Mean Gain (MD)
Urban	VT	62	22.53	7.18	61.88	15.13	39.35
Urban	DM	73	22.51	7.06	56.50	9.74	33.97
Urban	Mean Diff	—	0.02	—	5.38	—	—
Rural	VT	54	18.33	9.90	65.23	15.68	46.90
Rural	DM	51	18.30	8.94	50.97	17.45	32.67
Rural	Mean Diff	—	0.03	—	14.26	—	—

The post-test mean difference scores for Urban Biology Students were 5.38 while that of

Rural were 14.26. The table also revealed the Mean Difference scores for students in Urban area in the experimental group to be 39.35 while students in Rural area in the same group was 46.90. The Mean difference scores for students in Urban area in the control group was 33.97 while for students in Rural in the same control group was 32.67.

Hypothesis 1 ($H0_1$): There is no significant mean difference in the academic performance scores of students taught Biology using video technology and those taught using demonstration method in Wukari Local Government Area, Taraba State.

Table 3: Summary of ANCOVA Analysis on the Difference in Academic Performance between Video Technology and Demonstration Method groups.

Source	Type III Sum of Squares	DF	Mean Square	F	Sig.
Corrected Model	15420.083*	2	7710.041	42.321	.000
Intercept	67787.987	1	67787.987	37.920	.000
Protest	9628.245	1	—	52.850	.000
Group	5777.287	1	5777.287	31.712*	.000
Error	43176.813	235	182.181	—	—
Total	884037.000	240	—	—	—
Corrected Total	58596.896	237	—	—	—

Analysis of Covariance (ANCOVA) statistics presented in Table 2 showed that significant difference exists in the mean performance scores students taught Biology with Video Technology and their counterparts taught using Demonstration Method. Since the calculated F (1.235) = 31.712, P = 0.000 at 0.05 level of significance. Therefore, the null hypothesis was rejected. The result is that, there is significant difference in the mean academic performance of students taught Biology using Video Technology and those taught same concepts using Demonstration Method.

Hypothesis 2 ($H0_2$): There is no significant mean difference in academic performance scores of students taught Biology using video technology and those taught using demonstration method based on location in Wukari Local Government Area, Taraba State.

Table 4: Summary of ANCOVA Analysis on the Difference in Academic Performance between VT and DM Groups Based on Location.

Source	Type III Sum of Squares	DF	Mean Square	F	Sig.
Corrected Model	16860.589*	4	4215.147	23.734	.000
Intercept	62399.108	1	62399.108	357.344	.000
Pretest	9813.543	1	9813.543	55.256	.000

Location	5776.680	1	5776.680	32.526	.000
Error	41736.307	235	177.601	—	—
Total	884037.000	240	—	—	—
Corrected Total	58596.896	237	—	—	—

From Table 4, Analysis of Covariance (ANCOVA) statistics showed that there is no significant difference in the mean scores of students taught Biology using Video Technology and those taught same concept using Demonstration Method based on location. Reasons being that the calculated F(1,235) =32.526, P=0.00 at 0.05 level of significance. This means that significant differences exist between location and academic performance, therefore, the null hypothesis which states that there is no significant difference in academic performance of students taught Biology using Video Technology and those taught same concept using Demonstration Method based on location is hereby accepted and rejected.

DISCUSSION

The research indicated significant difference in the performance of students taught Biology using Video Technology and those taught same concept using Demonstration Method. This significant difference is attributed to the fact that the use of video technology encourages the students to learn at their own pace especially the slow learners. Video Technology as a self-learning technique helped the students to use the audio-visual property of the video to gain deeper understanding of the concept which were considered to be abstract and difficult. The students in the experimental group were able to comprehend the concept of Digestive system better than the students in the control group because they could see it being played out in front of them. This implies that Video
Technology improves students' academic performance more than the use of Demonstration Method. The statistical analysis of the study revealed that location has significant effect on academic performance of students taught Biology using Video Technology and Demonstration Method.

CONCLUSION AND RECOMMENDATIONS

This study conclusively shows that video technology improves the academic performance of senior secondary school biology students when compared to demonstration method. Students who were taught through video technology showed a considerably greater mean gain in post-test scores, showing a more in-depth comprehension of digestive system principles. Furthermore, the study discovered that school location (urban vs. rural) had significant impact on academic performance when video technology was used. The study further recommend the findings:

i. The Ministry of Education and Administrators of Science Education should always organize seminar, conferences and workshops to sensitize Science teachers on the use of the Video Technology in teaching most especially Biology in Senior Secondary Schools.

ii. Science teachers should adopt the use of Video Technology approach in teaching of Biology especially those topics that are considered to be abstract.

iii. Further studies can be carried out to ascertain the availability of these technology based instructional tools in the schools and t uses in learning Biology and other science subjects in secondary schools.

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