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Methodology Article

Effect of Video-Taped Instruction on Senior Secondary Students' Performance in Physics Practical in Port-Harcourt Metropolis, Nigeria

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Abstract: This study investigated the effect of video-taped instruction on Senior Secondary Students' performance in practical physics. The design for the study is quasi-experimental, of the type, pretest-posttest control group design. The population of the study comprised of all SS3 physics students in Port Harcourt Local Government Area of Rivers State. One hundred and three (103) students in 2 co-educational schools made up the sample size. Two groups namely, the experimental group and control group were used for the study. The experimental group was taught practical physics using video-taped instruction (VTI) while the control group was taught practical physics using the conventional (real handling of apparatus) teaching method (CM). A research question and one hypothesis were formulated to guide the study. The instrument used for the study was Physics Practical Skills Rating Scale (PPSRS). The data generated were analyzed using mean and standard deviation to answer the research question, while t-test was used to test the hypothesis at 0.05 level of significance. The calculated t-value (2.48) was significant at 0.05 level of significance. The null hypothesis H_o was rejected as a result of significant difference between the performance of students taught practical physics using Video-Taped Instruction (VTI) and those taught using conventional method (CM), indicating that students taught with videotaped instruction performed better than those taught with the conventional method.

Keywords: Effect, Video-Taped Instruction, Students' Performance

1. Introduction

The place of science in national development cannot be overemphasized. It is common knowledge that physics as one of the physical sciences is the basis of technology and is described as the most basic science. The development of any nation depends largely on the level of scientific and technological literacy possessed by the citizenry [1]. It is in the light of the above, the subject physics is introduced in Nigerian Secondary Schools at senior level.

Physics is taught at post primary level in order to achieve the following objectives [2]

i). To provide basic literacy in physics for functional living in the society;
ii). To acquire basic concepts and principles of physics as a preparation for further studies;
iii). To acquire essential scientific skills and attitudes as preparation for the technological application of physics and
iv). To stimulate and enhance creativity.

The aim of learning physics in schools is to bring about the technological development needed by the nation through the production of young scientists who would be able to produce the technological devices to make the day- to -day activities easier and living comfortable [1-3]. Unfortunately, these aim/objectives have not been fully realized in Nigeria due to a number of factors such as inadequate teaching materials, teachers not being trained and motivated.

Most worrisome is the fact that most students perceived physics as an abstract subject whose concepts are purely cognitive. This mindset might not be unconnected with the teaching method employed by the teacher, especially "chalk and talk method" as well as poor mathematical background of the students. Physics as a practically oriented subject requires continuous demonstrations and lots of laboratory activities to explain some seemingly abstract concepts and to instil appropriate scientific skills needed for higher study and consequently technological advancement of the nation. This is not so in most of our secondary schools, nationwide. The consequence of this, is the tendency of many students to perceive learning as some of alien culture, and unrelated to their life's goals, therefore not worth pursuing[4]. This could be seen in the very low number of students offering physics as their major discipline at tertiary level of education in Nigeria and the consequence is a decline in the number of Physics teachers in our secondary Schools.

The subject, Physics, is one of the basic requirements for admission into universities and polytechnics to read other professional courses like, engineering, medicine, pharmacy, etc. But poor background of students in physics as a result of poor teaching method and the inability of the teacher concerned to use appropriate modern teaching aid to enhance Teaching - learning process have resulted in poor performance of students in WASCE and NECO examinations. This is evidently shown in Table 1. The table shows performance of students in WAEC and NECO for the past 10 years

Table 1. *Statistics of Students' Academic Performance in WAEC Physics (2004-2013).*

YEAR	TOTAL ENTRY PHYSICS	TOTAL SAT PHYSICS	TOTAL CREDIT	TOTAL PASSED	TOTAL FAILED
			1-6	7-8	(9)
2004	261687	254188	120768	81814	51606
%		97.13	47.51	32.18	20.30
2005	280818	275369	130982	84413	53079
%		98.05	47.56	30.65	19.27
2006	270028	265262	135359	77590	52313
%		98.23	51.02	29.25	19.72
2007	427398	418593	180797	140172	88480
%		97.94	43.19	33.49	21.14
2008	424893	415113	200345	91116	116776
%		97.70	48.26	21.95	28.13
2009	474887	465636	222722	141595	79919
%		98.05	47.83	30.41	17.16
2010	460379	451416	176099	153743	121574
%		98.05	39.01	34.06	26.93
2011	183065	175830	83637	27096	65097
%		96.05	47.57	15.41	37.02
2012	175991	167986	75999	67994	33997
%		95.45	45.24	34.53	20.24
2013	137127	132006	64002	35,336	32668
%		96. 27	48.48	26.77	24.75

Source: WAEC Research and Statistics Unit, Port Harcourt [5]

Data obtained from the examination body showed that it was only in 2006 (51.02) that a little more than 50 percent of students scored credit and above. In 2010 (39.01) more than 60 percent could not get a credit.

Using the results in Table 1 as a case study of performance of students in physics examination in schools in Nigeria, it is very clear that general performance of students have been poor which is also evidenced by the Chief Examiners' report (2010-2013). This is of great concern to stakeholders in science education, stressing that if this trend is not reversed, would pose serious problems to the technological development of the nation. It is believed that this observed poor performance could be due to inappropriate methods of teaching [6–8].

From the foregoing, therefore, there is need to explore other methods of teaching like the use of videotape to help the student understand what they are being taught and possibly tackle the problem of poor performance in physics. Video tapes have some inherent attributes that make them very relevant for passing instruction.

1.1. Video-Taped Instruction

The use of video-taped instruction in the teaching of physics quickly comes to mind in view of advances in learning technology.

Video is a medium of transmitting information in the form of sound and image to be displayed on the screen of television tube. It is usually grouped along with television and films [9]. Video is always recorded in tapes and disks. Video tape or video disks are tapes or disks on which sound and pictures are recorded.

Educational technologists are of the view that video-taped instruction has high potential in teaching and learning situation [10–12]. Video-taped instruction like some other audio-visual aids can multiply and widen the channels of communication between the teacher and the students [13]. Video-tapes are not meant to replace practical in the laboratory but to complement them.

Furthermore, videotaped instruction has the qualities of providing a semi-permanent, complete and audiovisual record of events [14]. They also claimed that it is a method that has the potentials of increasing the probability that students will learn more, retain better and thus improve performance. Videotaped instruction reduces abstractions as well as boredom among students in the classroom and laboratory [15]. In the same vein, the benefits of colour, sound and motion attached to videotaped package will be of interest to students who are the target of the study [16]. In order words, students will have positive attitude to the learning of physics. This view is in agreement with Chambers when he asserts that fun and entertainment are natural ways through which students learn and this could be provided by videotaped instruction [17].

Video permits safe observation of phenomena that might be hazardous to view or touch during direct demonstration such as handling of interaction of X-rays with matters and electrical discharge through gases [18].

- It supplements live instruction by providing subsequent individual tuition in the practical classes.
- It eliminates the expense of energy and time involved in

preparing and executing science practical. Admittedly, the expense of energy and time involved in preparing the tapes is significant, but it is incurred only in the initial production [19].

- Students could receive individual instruction with video-tapes at their own pace, and as when they needed it [19].
- There is more advantage when teaching a large class because manipulation of a small piece of apparatus is much more easily seen.
- It is relevant for both homogenous (group) and heterogeneous (individualized) set of learners [20].
- It is the commonest, cheapest, and easiest to operate among ICT gadgets and can be afforded by schools for the purpose of teaching and learning process [21].
- It enhances development of scientific skills in learners since learners can view the package repeatedly till he/she masters the skills.

In spite of the enumerated advantages, video has been criticized as having some shortcomings. It is considered dominant in instructional setting, as learners in most cases remain passive during the period of receiving instruction that is with little or no involvement [22].

The use of video-based laboratory tools (VBL) has increased in recent years with the introduction of low-cost video digitizing boards [23]. VBL enables a user to connect any video source-camera, VCR, or videodisc player and digitize the incoming analog signal. The resulting digital data can be stored on a computer disk. Thus, digital video has the advantage that the entire video scene can be stored directly on the hard disk of a computer in digital form. This technique is relatively new and, at present, no industry standard exists for the format of the video or the hardware on which it is played.

Digital video has the same playback features found in standard videodisc technology. Because the video is digital, computer graphics images and video images are mixed together naturally. By placing the mouse pointer on any location on the screen, the user can easily collect two-dimensional spatial data about any object or part of an object on the video screen. The user can also collect temporal data about the object or part of any object on the video screen by knowing the number of frames from the beginning of the video.

It is quite easy for the students to complete an experiment, collect the data on video, and collect numerical information from a variety of points on the screen. In the simplest case, one can collect data, import it into an analysis program such as a spreadsheet and do standard analyses [23]. Also, digital cameras technology is used to record information from a field trip or excursion and report back to other students [24]. This can be used to record environmental or physical features that are not easily accessible by the students and be shown in the class.

For more complex motion, such as that of an extended body, one can create simplified models of the object and use the mouse pointer to draw these models on top of video images. Thus, digital video enables students to go from observing the real physical event to observing a simplified model of the event. This type of visualization technique can contribute to students' understanding of physical concepts by attaching mental images to these events.

Because the video is digital, all of the image processing techniques used for computer graphics images are now available for video images. "These techniques, often called synthetic video processing, enable the user to combine successive video frames and to playback video frames video from perspectives and in modes different from those used during recording" [25].

The digital video formats have made video-based laboratories, video image processing, and synthetic video processing all available to the physics teacher with a personal computer. "Because these processes provide students with a visual means to answer, "What if?" questions. Digital video may help students better understand the abstract concepts of physics in terms of their own concrete experiences" [25].

1.2. Research Question

What is the level of performance of students in Video-Taped Instruction (VTI) in physics practical and those not exposed to VTI (Conventional Method-CM)?

1.3. Hypothesis

The stated null hypothesis was tested at 0.05 level of significance.

H_o: There is no significant difference between the performance of students taught practical physics using Video-Taped Instruction (VTI) and those taught using conventional method (CM).

2. Methods

The study is a quasi-experimental research of the type pre-test post-test control group design.

This study was carried out in Port Harcourt Local Government Area of Rivers State. The population of this study comprised of all the Senior Secondary class three (SS3) students who offered physics in the 9 public schools in Port-Harcourt Metropolis in 2013/2014 academic session, with a total population of one thousand two hundred and thirty eight (1,238), (Statistics Unit, Post Primary Schools Management Board, Port Harcourt).

Purposive sampling was used to select two co-educational schools in Port-Harcourt. One of the schools which represented the experimental group was chosen because of availability of a computer classroom while the other which represented the control group was selected because it also has qualified physics teachers. The two schools were International Secondary School, University of Science and Technology, Pot-Harcourt and Government Secondary School, Elekahia. The sample size is made up of two classes of 47 and 56 SS 3 students, giving a total of 103 students. Out of this figure, 57 were boys while 46 were girls.

The instrument used was the Physics Practical Skills Rating

Scale (PPSRS) which was an adaptation of Chemistry Practical Skills Rating Scale (CPSRS) developed by Njoku.

Table 2 shows the measured physics skills.

Table 2. *Measured Physics Skills.*

S/No	Measured Skills	Definition of skills
1.	Equipment handling skill	Ability to make use of the different apparatus appropriately
2.	Measurement skill	Ability to measure the different lengths
3.	Recording skill	Ability to record as directed in the table
4.	Reading skill	Ability to read correctly from apparatus e.g. the stop watch
5.	Manipulative skill	Ability to manipulate figures e.g. period (T) = time/no of oscillation(s)
6.	Safety skill	Ability to avoid injuries in the laboratory
7.	Graph plotting skill	Ability to plot the graph of the recorded variables, L against T^2
8.	Mathematical skill	Ability to solve for the slope from the graph of L against T^2 and finally using it to calculate the acceleration due to gravity (g)
9.	Interpretation of data skill	Ability to explain the figures calculated for the acceleration due to gravity
10.	Concluding skill	Ability to state precautions that should be taken to get accurate result

3. Results

To answer the research question, mean and standard deviation (SD) were employed to analyze the data obtained from the pre-test and post-test scores of the practical physics test administered before and after treatment. The results are presented in Table 3.

Table 3. *Mean and Standard Deviation of the Pre and Post Test Scores of Students' in the VTI and CM Groups.*

Group	N	Pre-test mean	SD	Post-test mean	SD	Mean gain
VTI	47	46.74	22.42	76.19	16.31	29.45
CM	56	42.89	21.58	66.82	21.18	23.93

VTI = Video Taped Instruction = Experimental group
CM = Conventional Method = Control group

Table 3 shows that the pre tests mean and SD for VTI was 46.74 and 22.42 while that of CM was 42.89 and 21.58 respectively. A look at the means of the pre test for the two groups revealed that students in VTI scored higher on the pre test than those in the CM group. Similarly, the post test mean and SD for VTI were 76.19 and 16.31 while that of CM were 66.82 and 21.18 respectively. Furthermore, the mean gain on the basis of the differences between the pre test scores and post test scores of each group was 29.45 for VTI, and 23.93 for CM. This is shown in Table 3. Consequently, a cursory look at the post test mean scores for the two groups shows that students in VTI group (76.19) scored higher than those in CM group (66.82). The result is that students exposed to Video-Taped Instruction did better than those exposed to the Conventional Method.

Table 4 shows the analysis of the null hypothesis using t-test statistics. The post test scores of the students in the two groups were subjected to the test. Pre test was given prior to treatment and scores were used to establish equivalence of the group as indicated in Table 4.

Table 4. *A t-test Analysis of the Mean Scores of Students' in the VTI and CM Groups.*

Test	Groups	N	$\bar{X}$	SD	df	t-cal	Sig (0.05)
Pre-test	VTI	47	46.74	22.42	101	0.89	0.38 NS
	CM	56	42.89	21.58			
Post test	VTI	47	76.19	16.31	101	2.48*	0.02
	CM	56	66.82	21.18			

*Significant at P < 0.05 level of significance
NS = Not significant
VTI = Video Taped Instruction = Experimental group
CM = Conventional Method = Control group

Table 4 shows that the calculated t-value (0.89) for the pre test scores for the two groups was not significant at 0.05 level of significance. This is an indication that the two groups were equivalent before treatment was administered. After treatment, the calculated t-value (2.48) was significant at 0.05 level of significance. Therefore the null hypothesis H_o was rejected. The result is that, there is significant difference between the performance of students taught practical physics using Video-Taped Instruction (VTI) and those taught using conventional method (CM).

4. Discussion

The null hypotheses $H_{o,}$ which states that there is no significant difference between students exposed to video-taped instruction and those who were exposed to conventional method, was rejected. This is because students exposed to video-taped instruction performed better than those who were not. This result is in agreement with the findings of Agommuoh & Nzewi [13] and Israel [26] who said that there is indeed a significant difference between students who were exposed to video-taped instruction and those who were not, but contrary to the results obtained by Lasisi & Daniel whose findings indicated that utilization of video in teaching and learning is as effective as conventional teaching method [18]. The use of videotape in education has always been positive, especially physics and chemistry, but does not produce tangible effects in languages and literature [27]. A number of unique advantages for understanding classroom activity have been attributed to video [28]. It has been stated that classrooms are complex environments and instruction is also complex, but video could help surmount this problem [29]. According to Zane Education, over 94% of teachers have effectively used video in a given academic year to aid teaching in their classrooms [30]. It has been noted that in some learning and teaching processes, video can be as good as an instructor in demonstrating procedures to students to enhance their understanding of complex clinical or mechanical procedures as many times as they need to view it [31]. More so, not only has videotape enhances classroom learning, but can significantly help in research work. Video affords the teachers certain advantages over live observation of research lessons in terms of repeated viewing [32]. However, students' learning from video is greatly increased when appropriate principles are purposefully and clearly utilized [33].

5. Implication of Result

The implication of result of this study is that the type of teaching method and instructional material utilized in teaching and learning process affects students' performance.

6. Conclusion and Recommendations

This study showed that the use of video-taped instruction in the teaching and learning of physics practical improves students' performance and also solves the problem of unavailability/shortage of practical equipments as against the number of students in a class.

Based on the findings of this study, it is recommended that:

I. Video-taped instruction as a method of teaching should be included in the senior secondary physics curriculum to improve students' performance.
II. Curriculum planners should engage Educational technologists to develop video-taped instructional packages on topics in the physics curriculum to aid teaching and learning in our secondary schools.
III. Professional educational bodies should organize workshops and seminars to train physics teachers on the use of video-taped instruction in order to keep them abreast with modern innovative teaching strategies.
IV. Physics teachers should opt for the production of video-taped instructional packages that can be used in physics practical to address the problem of shortage of equipment for physics practical.
V. Finally, government should do more by funding or by providing well furnished ICT centres and computer classrooms in our secondary schools to enable teachers and students teach and learn with video-taped instruction.

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