

# Application of Multimediated Instructional Videos in the Teaching of Physics Practical in Senior Secondary Schools in Osun State, Nigeria

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## Abstract

The study determined the effects of multi-mediated instructional video on students' performance in Physics practical and also assessed the effects of the instructional video on students' retention ability. The study adopted pre-test, post-test, control group quasi experimental design. All the 31,917 Physics students in Osun State secondary schools were the population. Seventy nine SS II students were selected using multistage sampling technique. The students were randomly assigned into experimental and control groups. Students in the experimental group were exposed to the multi-mediated videos while the placebo were taught using the traditional method. Analysis of data showed that multi-mediated video enhanced students' performance in Physics practical ( $t_{77} = 3.54$ ;  $p < 0.05$ ). The students also retained what was learnt ( $t_{76} = 0.87$ ;  $p > 0.05$ ). The study concluded that multi-mediated videos are effective in the teaching of Physics practical in secondary schools and also that students retained what was learnt.

**Keywords:** Multi-mediated videos, Retention ability, Physics Practical, Secondary school students

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## 1. Introduction

The transformation of the world to a global village is one of the enormous contributions of science to humanity. Science has enabled man to make discoveries about the natural world and its components. Through these discoveries, man is able to acquire better understanding of the environment and expertise to manipulate the conditions of the environment to suit his purpose. Through scientific skills acquired in form of inventions and innovations, efforts expended by man in achieving the desired needs and overcoming some challenges have been reduced to the barest minimum.

Physics as a science subject has contributed handsomely to the development of man through the investigation and establishment of facts about cause-effect relationship between physical occurrences. The sound knowledge of Physics concepts is needed by experts that are saddled with the responsibility of manufacturing infrastructures needed in driving the economic engines of the nation. The study of Physics accustoms students with adequate knowledge and skills needed to understand how and why some phenomena occur the way they do. For instance, Physics gives an explicit information on the concept of gravity and gravitational force that are responsible for why objects are easily attracted back to the surface of the earth when projected upwards. To buttress these assertions, Ivovi (1994) opines that Physics plays a major role in the proper understanding of scientific concepts and happenings.

The teaching of Practical in Physics in Osun State public senior secondary schools is bedeviled with some challenges such as inadequate well equipped Physics laboratory, poor attitude of teachers to conducting Physics practical, emphasis on preparing students to pass external examinations instead of understanding Physics concepts, poor preparation of students for external examinations among others. Ojediran, Oludipe and Ehindero (2014) citing Okoye (2002) identified lack of adequate laboratories and equipment, over-crowded classrooms, inappropriate teaching methods and the nature and pressure of external examinations. Other reasons advanced were lack of adequate textbooks, insufficient periods allocated for Physics on the time table, lack of cooperation by school administrators, the pressure of external certificate examinations, lack of proper monitoring and feedback mechanism, poor preparation of teachers who teach new programs and lack of motivation among teachers.

Unfortunately, students' performance in both internal and external examinations has been worrisome and deteriorating. An appraisal of secondary school students' performance in Physics examinations conducted by West African Examinations Council (WAEC) from 2006 to 2015 in Nigeria showed that students' performance in Physics is not encouraging with 2013 to 2015 having the worst results. Apart from poor performance, problem of

negative attitude of students to Physics was recognized by Oteyola, Ojediran and Adeyanju (2016). These problems had become a clog in the wheel of economic growth of the nation.

Furthermore, it has been observed that rote learning is a common practice among the students. Students do not understand the underlining concepts and principles embedded in Physics and as a result of this could not relate what is been taught in the classroom to real life experiences (Oteyola, 2015). It is therefore imperative that Nigeria may not be able to occupy her rightful position as the giant of Africa among the comity of nations. It is therefore a matter of necessity to improve the status of Physics in order to bring about the technological development needed in the country.

Active learning strategy had been advocated in the teaching of Physics in Nigeria (Oteyola, 2015). It is imperative to make the teaching and learning of Physics learner's - centred instead of the traditional teacher-centred method that is in vogue in secondary schools in the country. Learner-centred method of teaching has been found to enhance students' attitude as well as their academic performance in science subjects. The advent of digital technology provided teachers and learners to access information more easily (Smetana & Bell, 2012). The use of multi-mediated instructions is one of the applications of such digital technologies that can be effectively used in teaching.

### *1.1 Literature Review*

Mayer and Johnson (2008) defined video as a form of multimedia that conveys information using multiple modes of presentation through two sensory channels of aural (verbal) and visual (pictorial) that operate simultaneously. Bada (2006) citing Ellington and Race (1993) defines video as a medium of transmitting information in the form of sound and image to be displayed on the screen of television tube (known as cathode ray tube) which is always recorded in tapes and disks.

Different studies have been conducted to find out the suitability of video instruction to teaching and learning. Researchers like Bada (2000) and Egbowon (2006) also claim that instructional delivery using video is a method that has potentials of increasing the probability that students will learn more, retain better and thus improve performance. Admas (2011) opines that video instruction reduces abstractions as well as boredom among students in the classroom and laboratory. Bada (2006); Lasisi and Daniel (2009) assert that video is a medium that creates and permits a safe environment to observe and test phenomena that might be dangerous to carry out in the classroom or laboratory. An example of such phenomena is radioactivity in which deadly and poisonous radioactive particles are emitted. Through the use of video instruction, students can watch and learn the occurrence of this phenomenon without fear of being injured. Video is one of the most diversify and powerful learning medium that captures, presents and offers information through sensory learning environment that could enhance learners' understanding and retention of instruction (Fern, Givan, & Siskind, 2011). Hartland, Biddle, and Fallacaro (2008) state that video demonstration may have the ability to enliven abstract concepts, demonstrate real-world applications of complex principles, motivate learners, organize thoughts and actions of highly cognitive processes, and reinforce learners' attention and interest. The introduction of video technology to teaching- learning process shows examples of case-based learning by illustrating the actual and complex teaching environments through modelling and developing problem solving skills (Kpanja, 2001; Lee and Wu, 2006).

In a study conducted by Bada (2006) using a locally-produced video instruction in teaching textile design to junior secondary school students, results show that there was a significant difference in the post-test mean scores, retention-test scores and attitude of students exposed to the locally-produced video instructional package. Lee et al. (2016) in a study conducted found that the design and implementation of a mobile-based learning video clip for teaching nursing students enhance student motivation. In the study, it was revealed that a mobile device could be used with video clips to promote students' learning, motivation, and confidence in acquiring skills. Results from the study also revealed significant relationships among students' motivation level, confidence in practice, and satisfaction with the intervention (Lee et al., 2016). He, Mackey, O'Brien, Ng, and Arthur (2011) created video role-play that presented the important aspects of communication skills such as listening, understanding, exploring, and comforting. The study on 74 first year nursing students who watched the videos over a period of 4weeks showed that the use of video role play was a useful educational tool to enhance students' communication skills.

De Grez, Van Steendam, and Raedts (2014) conducted a study by designing an instructional video that would help in the development of presentation skills for business students. The results of the study showed that instructional videos improved students' procedural and cognitive abilities, attention, retention, motivation, and reproduction of knowledge gained. De Grez et al. concluded that the use of instructional videos can aid students' retention of specific information and motivate them to personal and professional development through continuous learning. Hawala-Drury and Hill (2012) designed and implemented video recordings of guest speakers to provide opportunities for healthcare students' engagement in discussion about the different roles that each member of the healthcare team has in providing care for patients. The results show that the healthcare students' levels of cultural competency had improved after participating in the educational activities and group discussions that were

facilitated by the video recordings of guest speakers.

Saiboon et al. (2014) in a study conducted to investigate the effectiveness of teaching some selected topics in basic airway management using self-instruction videos found that students' psychomotor skills are enhanced, their confidence is boosted and the students learning outcome is improved. Sharpnack et al. (2013) conducted a pretest and posttest quasi-experimental design study to examine the effectiveness of videotaped scenario simulations on critical thinking, quality, and safety competence in nursing students. Results show that videotaped scenarios, supplemented with classroom discussion, were helpful in applying knowledge from the classroom to clinical situations.

Woodworth, Chen, and Horn (2014) conducted a randomized study to determine the effectiveness of educational video and simulation on improvement of ultrasound image acquisition and interpretation skills in anesthesia students. The focus of the study was to assess knowledge of anatomy and ultrasound interpretation skills using a designed test item. The research concluded that the introduction of a short educational video on anatomy, key anatomic relationships, and ultrasound imagery presented along with a computer-based interactive simulation significantly improved the performance of the students. In a study conducted by McLain, Biddle, and Cotter (2012) using a randomized control crossover trial to investigate the effect of different teaching methods on recall and performance of student registered nurse anesthetists when exposed to crisis simulations revealed that students who received video-based education had greater improvements in clinical performance compared to the group who received traditional learning methods. Results of a survey of students' beliefs and preferences for video instruction in learning conducted by Chan (2010) showed that students used instructional videos to understand concepts and theories, view step-by-step demonstrations in performing a technical skill, and also familiarized themselves to unknown environments through simulations and virtual tours.

Chi, Pickrell, and Riedy (2014) carried out a retrospective cohort study to evaluate learning outcomes of dental health students associated with technology-driven approaches versus traditional approaches. Patient's case reports were given to both students that were assigned into experimental and control groups for review. The experimental group accessed the case reports in form of a video presentation while the control group received the case reports in a tradition paper format. Results showed that the students who received the video case reports showed significantly higher scores with better cognitive, affective, and overall learning outcomes.

### *1.2 Objectives of the Study*

The objectives of this study are to:

- (i) determine the effects of multi-mediated instructional video on students' performance in Physics practical;
- (ii) determine the effects of the instructional video on students' retention ability.

### *1.3 Research Hypotheses*

The following null hypotheses are generated:

**H<sub>01</sub>:** The multi-mediated instructional video has no significant effect on the senior secondary students' performance in Physics practical in Osun State, Nigeria.

**H<sub>02</sub>:** The multi-mediated instructional videos has no significant influence on the students' retention ability.

## **2. Methodology**

The study adopted pre-test, post-test, control group quasi experimental design. The population for the study comprised 31,917 Senior Secondary School Physics Students in Osun State, Nigeria. The sample for the study consisted 74 SS2 students that were selected using multistage sampling procedure. Osun East senatorial district was randomly selected from the three senatorial districts in the State. One local government area was randomly selected from the 10 local government areas in the senatorial districts. Two schools were purposively selected in the local government area based on availability of ICT facilities and access to alternative power supply. The selected schools were randomly assigned to control and experimental groups. An intact class of SS2 Physics students were selected in the schools. Physics Practical Test (PPPT) was used for data gathering.

The PPPT as reported in Oyeniran, Oteyola, Awopetu and Afolabi (2021) contained two standardized Physics Practical questions and it was used at the pre and the posts test. The Content Validity Ratio (CVR) of the instrument was determined by presenting it to 5 Physics teachers in secondary schools in the State. The teachers appraised the suitability of the instrument, clarity of language and the feasibility of the instrument in achieving the objectives of the study. The Lawshe's test produced a CVR ( $\alpha = 1$ ). Although the PPPT was a standardized test. It was adopted from past WASSSCE question papers. The reliability of the instrument was determined by administering it on 20 SS II students who are outside the scope of the study twice at two weeks interval. The Pearson Products Moment Correlations Coefficient was used in analyzing the data and  $r = 0.87$  was obtained. Thus the instrument was considered reliable.

### 3. Results and Discussion

H<sub>01</sub>: The multi-mediated instructional videos have no significant effect on the senior secondary students' performance in Physics practical in Osun State, Nigeria.

Table I: t-test comparison of the mean of the pretest and posttest scores of students exposed to the multi-mediated instructional videos and those that were not

	Group	N	Mean	Std. Deviation	df	t	p
Pretest	Experimental Video	39	11.37	2.92	77	0.32	0.75
	Control	40	11.58	2.72			
Posttest	Experimental Video	39	34.97	3.89	77	3.54	0.00
	Control	40	31.69	4.34			

Table I presents the t-test comparison of the mean of the pretest and posttest scores of students exposed to the multi-mediated instructional videos and those that were not. This was to determine the effect of the instructional videos on students' academic performance. The mean of the pretest of those exposed to the videos was 11.37 while the control had mean of 11.58. The mean of the posttest of those in the experimental group was 34.97 while the control had a mean of 31.69. The t-test analysis showed no significant difference in the pretest ( $t_{77} = 0.32$ ;  $p > 0.05$ ) while the posttest showed significant difference ( $t_{77} = 3.54$ ;  $p < 0.05$ ). Therefore, the hypothesis which state that the multi-mediated instructional videos have no significant effect on the senior secondary students' performance in Physics practical in Osun State, Nigeria was rejected.

The finding is in agreement with Lee et al. (2016) who found that the design and implementation of a mobile-based learning video clip for teaching nursing students promotes students' learning, motivation, and confidence in acquiring skills. Similar to this finding is that of De Grez, Van Steendam, and Raedts, (2014) that the design of an instructional video would help in the development of presentation skills for business students.

H<sub>02</sub>: The multi-mediated instructional videos has no significant influence on the students' retention ability.

Table II: t-test comparison of the mean score of the posttest and retention test of students exposed to the multi-mediated instructional videos

Retention test video	N	Mean	Std. Deviation	df	t	p
Posttest	39	34.97		3.89	76	0.87
Retention test	39	35.78		4.33		0.39

Table II presents the t-test comparison of the mean of the posttest and retention scores of students exposed to the multi-mediated instructional videos. This was to determine the effect of the videos on students' retention of Physics concept. The mean of the posttest was 34.97 while that of the retention test was 35.78. The t-test analysis showed no significant difference in the pretest ( $t_6 = 0.87$ ;  $p > 0.05$ ). Therefore, the hypothesis was not rejected.

This finding concurs with the findings of Idowu (2014) that there was no significant difference in the retention ability of fine arts students exposed to three different packages of computerized simulation, drill and practice and tutorial. Also, Video is one of the most diversify and powerful learning medium that captures, presents and offers information through sensory learning environment that could enhance learners' understanding and retention of instruction (Fern, Givan, & Siskind, 2011).

### 4. Conclusion and Recommendations

Multi-mediated videos are effective and efficient in the teaching of Physics practical in senior secondary schools. It can be useful where laboratories are inadequate. It can provide the required alternative for students' Physics practical work. Multi-mediated videos also aid students' retention. Secondary school Physics teachers should be trained on how to produce multi-mediated videos for teaching Physics practical. The effectiveness of the videos in the teaching of practical in Chemistry, Biology and other practical based subjects should also be experimented.

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