EFFECTIVENESS OF VIDEO - BASED INSTRUCTIONAL STRATEGIES ON SENIOR SECONDARY SCHOOL STUDENTS' ACHIEVEMENTS IN PRACTICAL PHYSICS IN LAGOS STATE, NIGERIA.

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ABSTRACT

The dominant system of instruction in teaching practical Physics is the conventional method of demonstrating experiments, which had promoted teacher-centered instruction. Thus, this study is initiated to solve the prolonged persistent problem of teacher-centered instruction to student-centered instruction. Therefore, this study was designed and conducted to determine the effectiveness of Video - Based Instructional Strategies on Senior Secondary School Students' Achievements in Practical Physics in Lagos state, Nigeria. A non-randomized pre-test, post-test control group quasi-experimental research design was adopted for the study. A sample of 315 Senior Secondary Two (SSII) physics students, drawn by both purposive and simple random sampling techniques from six co-educational schools in Educational district III was used for the study. Three research instruments: Practical Physics Achievement Test (PPAT) with reliability coefficient of 0.71; Practical Skill Rating Scale (PSRS) with reliability coefficient of an average of 0.89 were validated by experts and used to collect data for the study. Students in the experimental group followed the demonstration of the experiment using Video- based method while those in the control group followed the demonstration of the experiment using the conventional method. The data collected were analyzed using Analysis of Covariance (ANCOVA) and Estimated Marginal Means at 0.05 level of significance. The students in the experimental group (Video based) instructional strategies had a higher mean in both the achievement and acquisition of practical skills than their counterparts did in the control group (Conventional) instructional strategy. Hence, this study suggests the need for Physics teachers to lay less emphasis on Conventional laboratory method, which is expository in nature. Based on the findings, the research study recommends that physics teachers use video technology in teaching laboratory physics.

Keywords: *Video- based strategy, Practical Achievement, Practical Instructional strategy*

INTRODUCTION

Physics is the backbone of technological innovations that has empowered the 21st century students' acquisition of relevant skills such as Collaborative Learning Skills. This is in line with the submission of Adeyemo (2011) that every child should be given the opportunity to acquire at least the basic knowledge and the concept of Physics as a science subject. Physics, as a science subject, constitutes two aspects: the theoretical aspect and the practical aspect; and students are examined in both aspects at both internal and external examinations. This implies that for a student to be successful, practical aspect should be given equal importance as theoretical knowledge in Physics course. This is because practical work not only enables skills acquisition but also leads to greater conceptual understanding (Babalola, 2017). Moreover, practical work plays a positive role in science teaching and learning by making it comparatively easier to understand; and can strengthen students' content knowledge (Banu, 2011). However, WAEC Chief Examiner's Reports (2013, 2014 and 2015) asserted that students show deteriorating performances in Practical Physics at the School Certificate Examination level; and this in turn accounts for their poor performances in theoretical Physics.

In order to improve the students' performance in Practical examination, WAEC Chief Examiner's Reports (2013, 2014 and 2015) suggests that Physics teachers should endeavor to conduct regular practical classes early enough; teachers should place emphasis on measurements, plotting of graphs and making deductions from graphs; and discourage rote learning. Schools are encouraged to provide functional laboratories and engage qualified and well-trained Physics teachers who know the importance of integrating theory and practical lessons and delivering practical lessons using the appropriate instructional strategy. Therefore, the researcher believes that if the teaching of practical physics is enhanced using varied instructional strategy such as Video-based strategy, probably the performance in Physics practical will improve and this will in turn improve the students' general performance in theoretical physics.

It is for this reason that the study adopted integrated practical instructional strategy like Video-based strategy against the Conventional strategy of teaching Practical Physics in the practical physics classroom environment. During the Physics Practical sessions, the teacher demonstrates the experiment using Video-based strategy in the experimental groups. The strategy helped the students to acquire more content knowledge and knowledge retention as against the conventional method of demonstration.

The demonstration was performed by the teachers using videos of demonstration of experiments so as to teach physics topics. The students then carry out the experiment they have watched; thereby helping them to acquire the various Science process skills such as Manipulative, Measurement, Observation, Mathematical, Drawing, Graphing and Inferring and Generalization skills.

Alongside the Practical instructional strategy, the study also investigated the moderating effects of Gender on the two dependant measures (achievement and acquisition of practical skills). This is because there are inconclusive research reports on the effect of gender in practical physics.

1.2 Statement of the Problem

The teaching of Practical Physics is the backbone of Physics as a Science subject. This is because practical work assists in arousing and sustaining the students' interest as well as cultivating scientific attitude to Physics and Physics related phenomena (Musasia, Abacha &Biyoyo, 2012; Ojediran, Oludipe& Ehindero, 2014). If this is the case, there is an urgent need to tackle the present precarious performance situation regarding the decline in students' achievement in West African Senor Secondary School Certificate Practical examination (Akani, 2015).

1.3 Purpose of the Study:

The purpose of this study is to determine the effect of Video-based instructional strategy on students' achievement and acquisition of skills in practical physics at the senior secondary school level and to find out if gender could have effect on the dependant variables.

Specifically, the purpose of this study is to:

1. Determine the effect of the treatment (Video-based instructional strategy) on students' a) achievement in Physics Practica b) acquisition of skills in practical physics.
2. Determine the effect of gender on students' (a) achievement in Physics Practical (b) acquisition of skills in practical physics.

1.4 Research Hypotheses

The following null hypotheses were tested in the study:

1. There is no significant effect of treatment (Video-based instructional strategy) on students' (a) achievement in Physics Practical (b) acquisition of skills in practical physics.
2. There is no significant effect of gender on students' (a) achievement in Physics Practical (b) acquisition of skills in practical physics.

MATERIAL AND METHODS

This study adopted a non-randomized pre-test, post-test control group of quasi-experimental research design using a 3 * 2* 2 factorial representation.The aim of the researcher is to facilitate the students in acquiring the Science process skills which would enhance a greater performance in Physics Practical examination and thereby boosting their performance in Physics. The target population of this study comprised of all the public co-educational Senior Secondary schools in six educational districts of Lagos state. Multistage sampling method was adopted to select 315 Senior Secondary Two (SSII) students (164 males and 151 females) who offer Physics from six co-educational Schools in Educational district III.There is one experimental group and one control group. The experimental group used Video-based strategy to perform the demonstration of the experiment, while the control group followed the demonstration of the experiment using the conventional method.

Data was collected using three research instruments which are classified as Stimulus and Response instrumen Instructional procedural steps (Lesson plans) is the stimulus instrument and response instruments are Practical Physics Achievement Test (PPAT) and Practical skills rating scale (PSRS). Practical Physics Achievement Test (PPAT) questions were adapted from WAEC Physics practical examination from the selected Physics unit of "Hooke's law", "Lenses" and "Electric Current" and would be used to evaluate the effect of instructional strategy on students' achievement and acquisition of Practical skills. A Practical skills rating scale (PSRS) was used by the researcher during the Practical lessons to measure the Practical skills acquired by the students. PPAT was pilot tested and Kuder Richardson formula 20 (KR20) was used to establish the reliability coefficient (r = 0.71). The reliability coefficient of PSRS was found using Scott pi for each of the skills - Manipulative skills = 0.81, Measurement skills=0.79, Observation skills=0.72, Mathematical Skills=0.76, Drawing Skills = 0.71, Graphing Skills= 1.0 and Inferring and Generalization skills= 0.83. The analysis of covariance (ANCOVA) was used to compare the pretest and posttest scores, with Video-based strategy used as the independent variable, the pretest scores as a covariate and the posttest scores as the dependent variable. ANCOVA takes into account the differences

between the pretest means of the groups to compare their post-test scores. Then Estimated Marginal Means was done gives the adjusted means (controlling for the covariate 'pretest') for each treatment group.

4. RESULTS AND DISCUSSION OF FINDINGS

4.1 Results

This chapter presents the results obtained from the analysis of data collected for the study. This presentation is done in line with the seven research questions and hypotheses earlier formulated in chapter one and duly tested in the study.

4.2 Hypothesis Testing

H01 (a): There is no significant main effect of treatment on Students' Achievements in Physics Practical.

Table 4.1 : Summary of 3 X 2X 2 Analysis of Covariance (ANCOVA) on the Posttest Achievement Scores of Students' achievements in Physics Practical According to Treatment and Gender.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	9779.244[a]	4	2444.811	32.121	.000
Intercept	294660.937	1	294660.937	3871.435	.000
pretestachievement	39.862	1	39.862	.524	.470
TREATMENT	8939.849	1	8939.849	117.457	.000*
Gender	102.253	1	102.253	1.343	.248
TREATMENT * Gender	49.080	1	49.080	.645	.423
Error	14765.640	194	76.112		
Total	1306639.000	199			
Corrected Total	24544.884	198			

*Significant at $P < 0.05$.

The table 4.1 shows significant main effects of treatment on students' achievements in Physics practical, [$F_{(2, 314)} = 8939.849$; $P < 0.05$]. Hence, H01 (a) was not accepted. This implies that the achievement in Physics Practical was associated with the instructional strategy used by teacher.

Table 4.2 Estimated Marginal Means of Achievements in Physics Practical by Treatment.

Estimates				
			95% Confidence Interval	
TREATMENT	Mean	Std. Error	Lower Bound	Upper Bound
Video-based strategy(VBS)	87.61	.918	85.809	89.429
Conventional strategy(CM)	73.41	.885	71.670	75.160

Table 4.2 indicated that students who were subjected to VBS method (M=87.61) while the CM method obtained the lowest achievement score (M=71.67).This explains that VBS was more effective than VBS and CM.

$H_0$1 (b): There is no significant main effect of treatment on students' acquisition of practical skills.

Table 4.3: Summary of 3 X 2 X 2 Analysis of Covariance (ANCOVA) on the Posttest Acquisition of skills in Physics Practical According to Treatment, Gender, and Attitude.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	682.372[a]	4	170.593	2.899	.023
Intercept	1989.188	1	1989.188	33.807	.000
pretestacquisitionskills	442.484	1	442.484	7.520	.007
TREATMENT	112.282	1	112.282	1.908	.169
Gender	32.506	1	32.506	.552	.458
TREATMENT * Gender	13.652	1	13.652	.232	.631
Error	11414.964	194	58.840		
Total	1187814.000	199			
Corrected Total	12097.337	198			

*Significant at P < 0.05.

The table 4.3 shows there is no significant main effects of treatment on students' acquisition of practical skills in Physics, [$F_{(1,314)}$ = 1.908; P > 0.05]. Hence, H01 (b) was accepted. Further, Estimated Marginal Means (Table 4.4) of the output gives the adjusted means (controlling for the covariate 'pretest') for each treatment group.

H02 (a): There is no significant main effect of gender on students' achievements in Physics Practical

Table 4.1 shows there is no significant main effect of gender on students' achievements in Physics Practical, [$F_{(1, 314)} = 0.118$; $P > 0.05$]. Hence, H02 (a) was not rejected.

H02 (b): There is no significant main effect of gender on students' acquisition of practical skills.

Table 4.3 shows there is no significant main effect of gender on students' acquisition of practical skills in Physics Practical.[$F_{(1, 314)} = 0.673$; $P > 0.05$]. Hence, H02 (b) was not rejected.

4.3 DISCUSSION OF FINDINGS

Students in Video-based practical instructional method scored the highest mean because this strategy helps the learners to watch the video in their own pace, perform practical on their own, and so understand the practical in a better way. Furthermore, Tamunoiyowuna and James (2016) supported this method when they observed that it helps the students to learn more, retain better and thus improve performance. This study also showed that VBS is an effective teaching tool in laboratory to enhance students achievement which is in line with several studies (Rodrigues, Pearce & Livett,2001; Hucke & Fischer,2002; Hans Niedderer, Aufschnaiter, Tiberghien, Buty, Haller, Hucke, Sander &Fischer,2002; Koleza & Pappas ,2008; Skingsley, Merry, Mitchell, & Orsmond,2015; Tamunoiyowuna & James,2016). This is in line with the finding of this study that videos enabled students to become more autonomous and efficient learners in the laboratory and allowed more time during the practical for higher-level interaction with demonstrators, including time to pool and analyse group data (Croker, Andersson, Lush, Prince & Gomez, 2010) comparatively to conventional method.

Moreover, the result of hypothesis H01 (a) showed that there is significant main effect of treatment on students' achievement in Physics Practical. This might be due to the effect of laboratory strategies leading to permanence of students' knowledge (Azar & Sengüleç, 2011). As in previous studies, it is also the finding of this research that instructional strategies also help in the development of the students scientific and practical skills (El-Rabadi, 2013). This finding is also in line with previous studies Babajide (2010) and Raimi & Adeoye (2004), whose result showed that there is significant main effect of treatment on students' achievement and acquisition of practical skills in Practical Physics. However, the treatment used by the researcher was different from the study conducted by Babajide (2010) and Raimi & Adeoye, (2004).

Moreover, the result of hypothesis $H_0$1 (b) showed that there is no significant main effect of treatment on students' acquisition of Practical skills. This finding is in contrary with Nwagbo and Uzoamaka (2011) who indicated that the active involvement of students in practical activities might have given rise to efficient learning, which accounted for the reported significant effect in acquisition of science process skills. Moreover, the gained process skills allow development of social skills of collaboration, sharing, debating and extending ideas in the group (Musasia, Abacha & Biyoyo, 2012). There are no significant main effects of gender on Senior Secondary students' achievement and acquisition of skill in Practical Physics Which is in line with the studies, which showed that gender has no significant effect on students' practical skills in Physics (Huppert, Lomask & Lazarowitz, 2002; Ogunleye & Babajide, 2011; Nwagbo & Uzoamaka, 2011; Babajide, 2010).

5.2 Conclusion

This study has found out that Video-based strategy proved superior to conventional strategy in enhancing the students 'achievement in physics practical. It has shown that there is no main effect of treatment on acquisition of skills. Gender has no significant on students' achievement and acquisition of skills in practical physics.

5.3 Recommendations

Based on the findings, the following recommendations is being rendered -

1. Since this research demonstrated the importance of Video-based strategy, it is therefore necessary for teachers to include Video technology into teaching laboratory physics.

2. The curriculum developers need to incorporate VBS into the Physics curriculum to ensure that schools support integrating technology into practical work.

3. The government should provide appropriate infrastructure to incorporate technology into laboratory teaching. Government should prepare teacher educators should introduce Video-based practical method as Laboratory teaching strategy at colleges of education and faculties of education in the Universities.

5.4 Contributions to knowledge

1. The study developed and validated a laboratory instructional strategy package.
2. The study established a practical solution to students' decline in performance in external practical examination by using laboratory instructional strategy like Video-based strategy to perform demonstration of practical work. This would allow students to develop interest in the subject as well as trigger their enthusiasm by creating a game-like environment. This might be a modernist contribution in the field of teaching and learning physics.
3. The strategy adopted and investigated would promote a better understanding of the concepts and hence improve students' achievement in practical physics examination.
4. The strategy would assist the learners to overcome distractions in demonstration lessons and so grasp the methodology to conduct experiments and hence develop their creative and thinking skills.

5.5 Implications of findings

The result of this study has some apparent educational implications for teachers, students, Curriculum planners and Ministry of Education.

1. The study has provided pragmatic evidence in respect of the efficacy of the Computer Video-based instructional strategy on Senior Secondary Students' Achievements in Practical Physics. Hence, an obvious implication is the need for Physics teachers to lay less emphasis on Conventional laboratory method, which is expository in nature and does not encourage the students to give adequate attention to demonstration of experiments.
2. The finding of this study shows that VBS have implication for physics students. Students can collect the Videos related to their practical work on a CD-ROM and watch it during their leisure time.
3. The study has proved the impact of VBS on teaching and learning area by promoting active learning and being students centered activity. Curriculum planners should focus on activity oriented pupils activity and student centered teachers' activity to make learning a source of enjoyment and satisfaction using VBS strategy.

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