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EFFECTS OF COMPUTER-BASED SIMULATIONS AND VIDEO INSTRUCTIONAL PACKAGES ON THE ATTITUDE OF SENIOR SECONDARY SCHOOL PHYSICS STUDENTS IN OSUN STATE, NIGERIA

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Abstract:
The study examined the effect of Computer-Based Simulations (CBSs) or Video Instructional Package (VIP) on secondary school students' attitude towards Physics in Osun State, Nigeria. It also determined if there are interactions between student's sex and the effects of CBSs or VIP on the students' attitude towards Physics. The study adopted pretest, posttest, control group quasi-experimental design. One hundred and thirteen senior secondary school Physics students were selected from all the Physics students in the senior secondary schools in Osun State using a multistage sampling procedure. The students were grouped into two experimental groups and one control. Physics Students' Attitude Questionnaire (PSAQ) was used for data gathering. The content validity ratio (α = 1) was obtained for the instrument and Split half method was used to determine the reliability of the instrument and Spearman-Brown coefficient r = 0.86 was obtained for its reliability. Analysis of data showed no significant difference in the attitude of the students irrespective of the method of instruction ($F_{(2,110)} = 1.17$; $p > 0.05$). The finding also showed no significant interaction between sex and the effects of CBSs or VIP on the students' attitude towards Physics ($F_{(2,112)} = 0.25$; $p > 0.05$). The study concluded both Computer Based Simulations and Video Instructional Package had the same effects on secondary school students' attitude towards Physics and also sex did not significantly intervene on the effects of CBSs or VIP on secondary school students' attitude towards Physics.

Keywords: attitude; computer-based simulations; sex; video instructional package

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1. Introduction

Physics serves as the foundation upon which the technological structure of all nations rests and the pillar that strengthens all sectors of a country. It is based on this fact that developed nations of the world are engaging in required efforts to advance the teaching and learning of Physics at all levels of education. Physics is relevant in providing solutions to numerous challenges facing humanity. The fact remains that any country trying to own a key position at the global ranking must not joke with Physics since it serves as a source for scientific discoveries. The events of man happening towards a better way of life and wealth advancement could be traced to the impact of Physics on man's existence.

The continuous decline in students' academic performance in Physics together with a negative attitude to Physics are identified in Bunkure (2008) as the major problems facing Physics, especially at the secondary school level in Nigeria. These problems had become a clog in the wheel of economic growth of the nation. Poor methods of teaching used by the teachers, lack of standard Physics laboratories for conducting experiments in Physics due to the high-cost implication of setting up a standard Physics laboratory, wrong perception by students of the subject as being abstract and difficult, inadequate qualified teachers to teach Physics are some of the identified causes (Bajah, 1998; Ariyo, 2006; Kuti, 2012; Oteyola, 2010; 2015). Others are the concentration of the teachers on the theoretical aspects than the practical aspects of Physics due to a lack of self-confidence and fear of handling Physics apparatus, safety concerns in form of laboratory hazards (on the part of teachers and students), and the amount of time and effort required to conduct experiments (Oyeniran, Oteyola, Adelokun & Ireh, 2004).

The advent and adoption of technology into teaching have brought transformation to the delivery system of instructional content and thereby furnishing teachers and learners with opportunities to access information and ideas that could be explored in the teaching-learning process (Smetana & Bell, 2012). Physics educators over the past decades have made significant advances and innovations as a means of solving these problems. These innovations are in the form of technology-based interactive and internet-driven instructional strategies such as the design of Computer-Based Simulations and Video Instructional Packages for teaching Physics.

Computer simulations provide opportunities for students to learn with an approximation of practice. It also helps students to overcome the limitations of learning in real-life situations to be overcome. It helps learners to develop complex skills (Chernikova, Heitzmann, Stadler, Holzberger, Seidel & Fischer, 2020). Cook et al. (2013) in Chernikova et al. (2020) defined simulation as an educational tool or device with which the learner physically interacts to mimic real life and which they emphasize the necessity of interacting with authentic objects. Computer simulations provide virtual imitations of instructional settings that offer users the chance to watch occurrences in conditions where it is hard to do due to time challenges, safety concerns, or the absence of proper instruments and thus extending the space between the physical and theoretical concepts.

Learners can explore and review phenomena by manipulating variables and spotting changes as they happen in a simulated environment (Eysink, de Jong, Berthold, Kolloffel, Opfermann & Wouters, 2009). In a simulated instructional environment, the teacher can control the pace of the process of a physical phenomenon. This process can be shown repeatedly to students and they can observe its effect as it is treated. Computer simulations of Physics experiments as indicated by Azar and Şengülec (2011) can be used in getting rid of the negative impact of the poorly equipped laboratory on students' academic performance in Physics. Students are permitted to have direct contact with the replicated real laboratory setup. As verified by Chukwunenye (2011), computer simulations like Physics Education Technology (Ph.ET) Interactive Simulations, Interactive Physics, Edison 4.0, Crocodile Physics, and Virtual Labs, were designed to reproduce Physics Practical performed in the laboratory in a virtual form on the computer. Simulations of Physics experiments are in various forms ranging from computer representation of three-dimensional geometric shapes to highly interactive computerized laboratory experiments which can be online or offline. Through computer-based simulations, learners are enabled to visualize the features of experiments that by their nature cannot be easily seen (Kukkonen, Kärkkäinen, Dillon & Keinonen, 2014).

The importance of introducing learners to different interactive learning experiences based on diverse methodologies is to maximize the achievement of knowledge and afford learners the opportunities to explore their environment. Bada (2004) believes that if instructors could enhance courses with interactive content, learning would become promising, easily accessible, and individualized. These interactive contents may be in the form of video instruction. The advancement of Technology and its adoption of the teaching-learning process has made the application of video-based instruction approach in the teaching of Physics a point of focus. Bada (2006) and Egbowon (2006) in Oyeniran et al. (2022) affirm that video instruction is capable of improving students' readiness to learn more and retain better, thereby enhancing academic performance.

Admas and Adane (2011) opine that the adoption of video for classroom instruction promotes genuineness and enlivens students' interest by reducing pressure in the classroom. In other words, it enhances students' development of a positive attitude towards Physics. Daniel and Lasisi (2009) as cited in Oyeniran et al. (2022) also asserts that video is a medium that creates a safe environment to observe and test phenomena that might be dangerous to carry out in the laboratory. Cecen and Tuluce (2018) argue that through video, students could learn on their own without the constraint of time. Through the use of video instruction, students can watch and learn the occurrences of phenomena that are considered risky and complex. Videos provide opportunities for self-pacing and self-regulated learning.

Students' attitude plays a paramount role in measuring academic achievement in a particular discipline. The attitude which can be positive or negative is associated with the management of emotions which directs learners' behavior during the teaching-learning process. Kaya and Buyuk (2012) opine that the role of attitude in an instructional

system is to create values that affects learning process and also influences future lives of learners. Learners may form attitude based on the learning experiences they are exposed to. Orunaboka (2011) posits that if learners are introduced to favorable learning experiences, learners will develop a positive attitude, and if negative, the reverse is the case. Syyeda (2016) in Manzana, Montero and Casmir (2019) posit that attitudes can change and develop with time. It thus implied that attitude can be influenced either positively or negatively.

In Physics, studies have discovered several factors affecting students' attitude which has metamorphosized to the development of the notion that physics is an abstract subject which is very difficult to understand. Some of the resultant effects of this conception are the development of a negative attitude towards Physics and the belief that Physics is a very difficult subject. According to Erdemir (2009) in Oteyola (2015), Physics as a discipline is considered the most problematic subject which attracts fewer students compared to other science subjects. Belay and Kumneger (2016) opine that students develop a positive attitude towards Physics when methods that will build permanent learning, boost mental activities and permit students to work individually or in groups are adopted. Therefore, teaching Physics lessons on a sole theoretical basis may influence the attitude of the students in a negative manner. A study conducted by Gambari and Mogbo (2005) and cited in Falode, Usman, Ilobeneke, Mohammed, Godwin and Jimoh (2016) reported that sex had no significant influence on secondary school students' attitude towards Physics when subjected to computer-assisted instruction software.

2. Objectives of the Study

1) Examine the effect of Computer-Based Simulations (CBSs) or Video Instructional Package (VIP) on students' attitude towards Physics;
2) Determine the interaction between sex and the effects of CBSs or VIP on the students' attitude towards Physics.

3. Research Hypotheses

Ho_1: CBSs or VIP has no significant effect on students' attitude towards Physics; and
Ho_2: Sex has no significant influence on the effects of CBSs or VIP on students' attitude towards Physics.

4. Methodology

The study adopted the 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 of 113 SS2 students selected across the three senatorial districts in Osun State. The multistage sampling procedure was adopted for the study. Three Local Government Areas (one from each senatorial

district) were selected using a simple random sampling technique. Three schools were purposively selected from each of the selected Local Government Area based on the availability of ICT facilities, Physics laboratory, access to the alternative power supply and proximity. The selected schools were randomly assigned to one control and two experimental groups. An intact class of SS2 Physics students were selected from each of the selected schools. Students in one of the experimental groups were exposed to the computer-based Simulations while those in the other experimental group were exposed to the Video Instructional Package. The placebo was taught using the teacher expository method. The students were taught using various modes for six weeks. Concepts in the determination of acceleration of free-falling objects, electricity in a metallic conductor and frictional force were taught to the students. Ph.ET was adapted in preparing the simulation. The multi-mediated video was locally produced and the traditional lesson was prepared for those in the control group. The Physics Students' Attitude Questionnaire (PSAQ) was used in data gathering. PSAQ is a 20-item Likert-type questionnaire. It was adapted from the attitudes of students towards Physics lessons and experiments questionnaire developed by Kaya and Bayuk (2012). PSAQ was administered to all the participants by the end of the sixth week. Split half method was used to determine the reliability of the instrument and Spearman-Brown coefficient r = 0.86 was obtained. Thus, the instrument was considered reliable. The data were analyzed using mean, standard deviation, and analysis of variance (ANOVA).

5. Results and Discussion

Ho_1: CBSs or VIP has no significant effect on students' attitude towards Physics.

Table 1: Mean and standard deviation of the attitudinal scores of students in the groups

Group	N	Mean	Std. Deviation
Computer-Based Simulation	34	63.62	3.87
Video Instructional Package	39	61.87	5.11
Control	40	62.63	5.38

Table 2: Analysis of variance of attitudinal scores of students in the experimental and control groups

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	55.458	2	27.73	1.17	.32
Within Groups	2611.763	110	23.74		
Total	2667.221	112			

Table 1 showed that the mean score of the attitude of the students exposed to Computer-based simulation was 63.62, while those exposed to the Video Instructional Package was 61.87. those in the control group had a mean of 62.63. The Analysis of variance of the mean scores showed that there is no significant difference in the attitude of the students exposed to CBSs or VIP and those taught with the traditional talk and chalk method

($F_{(2,110)} = 1.17$; $p > 0.05$). The finding is not in congruence with the findings of Oteyola (2015) that both the adapted and the locally developed intelligent tutoring packages influenced students' attitude towards Physics. It also disagrees with the findings of Ojo (2015) that students in the three experimental groups that were exposed to Instructional Mobile Technology Packages of Audio, Video and Text formats had a better attitude towards Computer Science than those taught with the traditional chalk and talk method. This could be because Oteyola (2015) and Ojo (2015) involved students in colleges of education while the study is on public secondary school students. Similarly, Akerele and Afolabi (2012) findings on the effect of video on the teaching of Library Studies among undergraduates in Adeyemi College of Education, Ondo disagree with the finding. Findings from Akerele and Afolabi (2012) revealed a significant improvement in learners' attitude towards Library Studies. However, the findings of this study agreed with the findings of Shegog, Lazarus, Murray, Diamond, Sessions and Zsigmond (2012), and Zoubeir (2000). Shegog et al. (2012) and Zoubeir (2000) both conducted their studies on secondary school students. It can therefore be inferred that while IT-driven platforms influence students' attitude in higher institutions of learning, it does not affect secondary school students' attitude.

Ho_2: The interaction between sex and the effects of CBSs or VIP on the students' attitude towards Physics is not significant.

Table 3: Univariate analysis of variance of the interaction between sex and the effects of CBSs or VIP on students' attitude towards Physics

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	67.509[a]	5	13.50	.56	.734
Intercept	389430.548	1	389430.55	16028.34	.000
Sex	.002	1	.002	.00	.992
Group * Sex	11.896	2	5.95	.25	.783
Error	2599.712	107	24.30		
Total	446389.000	113			
Corrected Total	2667.221	112			
a. R Squared = .025 (Adjusted R Squared = -.020)					

Table 3 revealed that there is no significant difference between sex on the students' attitude towards Physics ($F_{(1,112)} = 0.00$; $p = 0.99$). Mode of teaching also has no significant influence. It thus implies that students' attitude towards Physics is not influenced by sex irrespective of the mode of teaching ($F_{(2,112)} = 0.25$; $p > 0.05$). The hypothesis that states that the interaction between sex and the effects of CBSs or VIP on the students' attitude towards Physics is not significant is not rejected. The findings agreed with Kaya and Buyuk (2012) that no significant variation was found in students' attitude towards Physics practical with respect to gender. This finding also agreed Shegog et al. (2012) and Zoubeir (2000). Public secondary school students have a positive attitude to Physics probably because of its prospects. The modes of instruction are not contributing

significantly to the students' attitude. Good students' attitude is expected to translate to good learning outcomes (Kaya & Buyuk, 2012). Bunkure (2008) observed students' negative attitude to Physics but findings of the study showed that students irrespective of the mode of instruction had a good attitude towards the subject. It can therefore be inferred that teachers over the years have been able to find a way to improve upon students' attitude to Physics since attitude can change with time as stated in Manzana, Montero and Casmir (2019). Teachers in public secondary schools are expected to leverage on this opportunity and ensure that methodologies that arouse students' interest in the subject are employed in teaching. Actions that may inhibit the students' attitude should be discouraged by the teachers.

6. Conclusion

The findings of this study revealed that both the computer-based simulations and the video instructional package did not significantly influence students' attitude towards Physics. Also, the student's sex intervention on both computer-based simulations and video instructional package was not significant.

Conflict of Interest Statement
The authors declare no conflicts of interest.

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