WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Effect of Youtube Instructional Video Package on Students' Retention in Physics

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ABSTRACT

The study aimed at investigating the effect of YouTube instructional video package on students' retention in Physics. Two research questions and two hypotheses guided the study. The population of the study comprised 7,703 SS11 physics students. The sample size for the study was 188 SS11 Physics students (male 97, female 91). Experimental and control groups were randomly assigned (experimental male 50, female 45 while control male 47 and female 46). Fifty items Physics Achievement Test (PAT) adapted from WAEC past question papers 2000 - 2022 and covered projectile, linear momentum, velocity-time graph and acceleration. PAT reliability was established using Kudar Richardson 20 (KR-20) with coefficient of 0.96. Mean and standard deviation were used to answer the research questions; while ANCOVA was used to test the hypotheses at 0.05 level of significance. The findings of the study revealed that the associated probability (.00) at F-Cal of 47.59 was less than 0.05 level of significant set as bench mark for taking decision, the null hypotheses were rejected. It implies that there is a significant difference in the mean retention scores of students taught physics using YouTube Instructional Video Package and those taught with Lecture Method. Therefore, the study revealed that the use of YouTube Instructional Video Package improved the mean retention scores of students in physics than the use of Lecture Method. Also, the results from the study showed that the associated probability (.78) at F-Cal of .07 were greater than 0.05 level of significance, the null hypotheses were accepted. Indicating that there is no significant difference in the mean retention scores of male and female students taught Physics using YouTube Instructional Video Package. Based on the findings, recommendations were made that the use of instructional videos should be incorporated into physics instruction on a regular basis and students should be encouraged to use instructional videos as a supplemental resource, in addition to traditional classroom instruction.

Keywords: YouTube Instructional Video Package, Lecture Method, and Retention

Introduction

Modern society is based on science and technology, which are essential for both national advancement and international recognition. Leveraging scientific and technological breakthroughs is essential if Nigeria is to establish its legitimate position among the nations. As scientists examine and comprehend the cosmos by delving into the underlying rules of existence, science establishes the foundation for technological innovation (Opara, 2019). Every nation acknowledges the revolutionary potential of science and technology, as Nicholas (2017) pointed out. Globally, these professions have raised living standards, stimulated economic expansion, and profoundly influenced educational institutions. In support of this argument, Giginna (2018) claimed that without giving science education top priority, no country can attain technical and developmental greatness. Additionally, Giginna (2018) highlighted that a country's scientific and technological developments have a significant impact on its progress. This is why improving science education at all levels in Nigeria, with a focus on physics in particular, is becoming a national priority. The growing interest is a reflection of the understanding of how important good science education and retention are to the advancement and development of an entire nation. One of the fundamental scientific sciences that offers vital information about matter and the physical world is physics. It is impossible to overestimate the importance of physics to the advancement of a country in the current scientific and technological period. However, there are several obstacles to overcome in the teaching and learning of physics, which frequently impair students' performance on external exams (NERDC, 2014). To maximise the potential of physics and enhance student performance, these issues must be resolved.

However, it has been suggested that in order to increase students' retention in physics, they must be appropriately guided through appropriate teaching approaches. According to studies like Njoku (2018) and Ada (2017), Nigerian teachers still use lecture methods, which are essentially talk-and-chalk presentations, to teach physics concepts. The teacher, who addresses passive students, is the main emphasis of lecture teaching approaches. According to Njoku (2018) and Ada (2017), it does not encourage critical thinking, meaningful learning, or student involvement in the teaching and learning process.

YouTube instructional video package is social networking website in which individual or organization with internet access can upload videos that can be seen by viewers. As a learning aid, the YouTube instructional video package gives students the added benefit of allowing them to further study the

subjects covered in class after class. To facilitate students' understanding and retention of Physics' concepts in which students view as difficult, YouTube instructional video package may invariable improve students'' retention in the concepts of projectile motion, linear momentum, velocity-time graph and acceleration (Effiong 2021).

An object in motion like a projectile is one that is launched or projected into the air while only being accelerated by gravity. According to Anyakoha (2016), any projectile in flight is concurrently doing two tasks: (i) travelling horizontally at a steady speed and (ii) accelerating upward and downward. There are three basic components of projectile motion which are; time of flight, range and maximum height. The evidence from West African Examinations Council Chief Examiners' Report (2022) highlighted students' weaknesses at Senior Secondary School Examination (SSCE) to be failure of students to remember the component of the velocity of a projectile at its maximum height which then affect their performance in physics including linear momentum.

Linear momentum is the product of its mass and its velocity. Momentum is a vector quantity whose direction is the direction of the velocity. Anyakoha (2016) explained how Sir Isaac Newton, who proposed three significant rules of motion known as Newton's rules of Motion, became the first person to discover forces connected to motion. WAEC Chief Examiners' Report 2021 and 2022 posited that students' inability to state the principle of conservation of linear momentum and zero recognition of the relationship between impulse and change in momentum affect their performance at senior secondary school examination, as well as the velocity-time graph.

Velocity-time graph is the plotting of velocity on the vertical axis against time on the horizontal axis. The slope of velocity–time graph represents acceleration as positive slope and deceleration as negative slope. The uniform velocity is the velocity of a moving body where equal distances are covered in equal time intervals. WAEC Chief Examiners Reports for 2018 and 2019 portrayed that student inability to retain the knowledge of the interpretation and application of the concept of velocity-time graph, a clear demonstration of students' lack of understanding of this fundamental concept in Physics.

Acceleration is the rate of increase in velocity with time. That is, the speed at which velocity varies over time. A negative acceleration is the idea underlies slowing. The idea of acceleration is the basis behind the equations of motion. WAEC Chief Examiners' Report (2022) pointed out that students' weakness is the inability to recall and apply correct formulae to solve physics problems. For example, distinguishing between the general equations of uniformly accelerated linear motion and other equations in mechanics. Thus, proper understanding of the mathematical relationship of acceleration and deceleration was lacking among the Physics' students (WAEC Chief Examiners Report, 2022). The continued evidences of concepts identified by WAEC Chief Examiners Reports for several years gave rise to the choose of these topics, which led to the overall poor academic achievement in physics.

Retention, the ability to retain and recall learned information, is an essential aspect of learning, particularly in Physics. Ngwoke and Eze (2018) described retention as the process of maintaining acquired knowledge, which plays a critical role in ensuring that what is learned can be effectively applied. Effective retention strategies are vital, as students who quickly forget learned concepts are unlikely to perform well in Physics. Retention can be improved by organizing learning materials in meaningful ways, utilizing effective teaching methods, and encouraging repetitive practice and over-learning. Poor retention is often linked to rote learning, which fails to engage students meaningfully. Dalton, cited in Bawa (2019), emphasized that poor teaching techniques and failure to apply concepts to real-life situations are significant factors limiting retention in Physics. Nneji (2020) further stated that the teaching strategy adopted by the teacher greatly influences retention, while Agada-David (2018) advocated for instructional methods that promote active student involvement to enhance retention in secondary school Physics.

The gender gap in education, particularly in science classes, is a global issue. According to Fatokum and Odagboyi, some courses—such as mathematics, physics, and chemistry—are branded as male, while others—such as economics, English language, and secretarial studies—are linked to women (Alachi, Opara, and Bardi, 2021: Pg4). Social, economic, political, and academic achievement are all impacted by gender stereotyping, particularly in the fields of science and technology according to Nnorom, Alachi, and Anozie in Alachi, Ilo, Alison, and Inyama (2022). Research like Emeka (2016) demonstrated that the traditional method used to teaching physics is not gender-inclusive. Both male and female students benefited from e-learning in terms of learning outcomes and physics curiosity, according to Almasri (2022). These findings indicated that some instructional strategies close the gender gap in science retention; worthy of mention is that both male and female are attracted to digital processes. Thus, it is vital to examine the effects of YouTube instructional packages on students' retention of projectile, linear momentum, velocity time graph, and acceleration. These topics are heavily represented in WAEC test questions and are thought to be crucial to the teaching and learning of physics.

Statement of the Problem

Studies have shown that Nigerian teachers persistently use traditional teaching method basically lecture of talk and chalk in presenting Physics concepts. Other studies argue that traditional teaching method does not promote meaningful learning nor students' participation in the learning process. However, the emerging trend in education are changing the setting of teaching and learning with new tools such as YouTube instructional video package. YouTube instructional video package is a social networking website in which individual or organization with internet access can upload videos which can be seen by viewers. Studies on poor performance of students' in Physics have shown that students have difficulties in the subject especially topics under mechanics. Several studies which attempted to address the difficulties of secondary school students' in selected topics in mechanics (projectile motion, linear momentum, velocity-time graph and acceleration) used other approaches except YouTube instructional video package. The study aimed at investigating the effect of YouTube instructional video package on secondary school students' retention in Physics.

Research Questions

The study was designed to seek answers to the following research questions:

1. What is the mean retention score of students taught Physics using YouTube instructional video package and those taught with lecture method?
2. What is the influence of gender on the mean retention score of male and female students taught Physics using YouTube instructional video package?

Research Hypotheses

The following null hypotheses were tested in this study at .05 level of significance:

HO_1: There is no significant difference in the mean retention scores of students taught Physics using YouTube instructional video package and those taught with lecture method.

HO_2: There is no significant difference in the influence of gender on the mean retention scores of male and female students taught Physics using YouTube instructional video package.

Methodology

The study is quasi-experimental research design. Specifically, pre-test post-test control group design since intact classes were used.

Area of the Study

This study was conducted in Nigeria's Imo State. Imo State is located in the country's southeast (Nigeria). Geographically, it is situated in Nigeria's eastern region. With an estimated 98% of the state's population speaking Igbo, Imo State is a largely Igbo-speaking state. Their main religion is Christianity.

Sample and Sampling Technique

The sample size consisted of 188 SS11 physics students who were randomly drawn from four coeducation secondary school in the study area. The choice of SS11 was due to the fact that the topics covered were in SS11 scheme of work. This was done using multi-stage sampling technique. Using basic random sampling (balloting without replacement), one Education Zone had been selected from Imo State's six Education Zones. The selection of only co-educational schools was purposive. This is to provide classes where boys and girls work side by side under the same teacher, with the same classroom condition. For an in-depth study and to avoid interclass discussion, 4 out of the 66 co-educational schools were selected from different LGAs in the Zone using simple random sampling techniques in each case. The sample was drawn to provide bases for choosing only one school from each local government area. Two entire classes were chosen from each of the four schools that were sampled. Additionally, basic random sampling (balloting without replacement) was used to choose the intact classes A control group B (traditional lecture group: 47 males and 46 females) received one intact class, whereas experimental group A (YouTube group: 50 males and 45 females) received another intact lesson.

Instrument for Data Collection

The Physics Achievement Test (PAT) was employed as a data collection tool. To ascertain whether the items in the PAT were appropriate, content validity was applied using the test blueprint. Each of the validators was given the topic of the research, purpose of the study, research question hypotheses for the face validity. Projectile, linear momentum, velocity-time graph, and acceleration were all covered in the 50-item, multi-choice, objective Physics Achievement Test, which was created by researchers using West African Examination Council (WAEC) historical questions from 2000 to 2019. The reason for the these topics was based on Reports by WAEC Chief Examiners on students' weakness in mechanics such as linear momentum, projectile motion, velocity-time graph and acceleration which invariably affect their overall results in SSCE.

Reliability of the Instrument

A pilot study was conducted to test the research instruments' dependability. Kuder Richardson 20 (k-20) reliability testing was used to assess internal consistency. Hence, the Physics Achievement Test which is 50 item multiple-choice objective test with four options each were administered and the KR-20 gave a reliability of 0.96..

Method of Data Analysis

Mean and standard deviation were used to answer the two research questions. For the two null hypotheses, Analysis of Covariance (ANCOVA) was used to test each of them at p =<0.05 (5%) level of significance. Hence, hypothesis that is greater than 5% or P=>0.05 was accepted and hypothesis that is less than 5% that is P=<0.05% will be rejected

Research Question 1

What is the mean retention score of students taught Physics using YouTube instructional video package and those taught with lecture method?

Table 7: Mean retention scores of students taught Physics using YouTube instructional video package and those taught with lecture method.

Group	N	Test Type	Mean	SD	Gain	Mean Diff
Experimental	95	**ReT-test**	63.81	7.67	0.36	
		Post-test	63.45	6.91		3.59
Control	93	**ReT-test**	36.54	7.92	-3.23	
		Post-test	39.77	8.72		

***N = Number of students, $\overline{X}$ = Mean, SD = Standard Deviation**

The result presented on Table 7 showed that the experimental group had a posttest mean achievement score of 63.45 with a standard deviation score of 6.91 and a retention test score of 63.81 with a standard deviation score of 7.67. The difference between (gain scores) the posttest and retention for the experimental group was 0.36. The control group had a posttest mean retention score of 39.77 with a standard deviation score of 8.72 and a retention test mean retention score of 36.54 with a standard deviation of 7.92. The difference between (gain scores) the posttest and retention test mean score for the control group was -3.23. The difference in both group gain scores was 3.59. This result reveals that, the students taught Physics using YouTube Instructional Video Package had higher retention mean score than those group taught the same course with lecture method.

H_{01}: There is no significant difference in the mean retention scores of students taught Physics using YouTube Instructional Video Package and those taught with Lecture Method.

Table 8: ANCOVA result on the significant difference in the mean retention scores of experimental and control groups

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	43488.138[a]	4	10872.034	694.029	.000	.938
Intercept	145.269	1	145.269	9.273	.003	.048
Pretest	8508.635	1	8508.635	543.159	.000	.748
Method	745.588	1	745.588	47.596	.000	.206
Gender	1.174	1	1.174	.075	.785	.000
Method * Gender	9.333E-5	1	9.333E-5	.000	.998	.000
Error	2866.713	183	15.665			
Total	522374.000	188				
Corrected Total	46354.851	187				

a. R Squared = .938 (Adjusted R Squared = .937)

The result on Table 8 also showed that an F-cal of 47.59 with associated probability value of .00 was obtained with respect to the difference in the mean retention scores of students` taught Physics using YouTube Instructional Video Package and those taught with Lecture Method. Since the associated probability (.00) was less than 0.05 level of significance set as the criterion for taking a decision, the null hypothesis (H_{07}) was rejected. It was therefore concluded that there is a significant difference in the mean retention scores of students taught Physics using YouTube Instructional Video Package and those taught with Lecture Method.

Research Question 2

What is the influence of gender on the mean retention score of male and female students taught Physics using YouTube instructional video package?

Table 9: Mean retention score of male and female students taught Physics using YouTube instructional video package.

Group	N	Mean Ret-test	Mean Post-test	Mean Gain Score	SD Ret-test	SD Post-test
Male	50	63.48	62.98	0.50	7.71	6.46
Female	45	64.18	63.98	0.20	7.69	7.41

The result presented on Table 9 showed that the male gender had a posttest mean retention score of 62.98 with a standard deviation score of 6.46 and a retention test mean retention score of 63.48 with a standard deviation score of 7.71. The difference between (gain scores) the posttest and retention for the male group taught Physics using YouTube Instructional Video Package was 0.50. The female gender had a posttest mean retention score of 63.98

with a standard deviation score of 7.41 and a retention test mean retention score of 64.18 with a standard deviation of 7.69. The difference between (gain scores) the posttest and retention test mean score for the female group taught Physics using YouTube Instructional Video Package was 0.20. The difference in both gender gain scores was 0.30. For each of the two genders, the retention test mean scores were greater than the posttest retention mean score with the male gender having a slight higher mean gain score than the male gender. This indicated that YouTube Instructional Video Package appears to have increased slightly both the male and the female students` retention scores in Physics.

H_{02}: There is no significant difference in the influence of gender on the mean retention scores of male and female students taught Physics using YouTube instructional video package.

The result in Table 8 shows that an F-cal of .07 with associated probability value of .78 was obtained with respect to the difference in the mean retention scores of male and female students taught Physics using YouTube Instructional Video Package. Since the associated probability (.78) was greater than 0.05 set as the level of significance and criterion for taking a decision, the null hypothesis (H_{08}) was accepted. Based on this, it was therefore concluded that there is no significant difference in the influence of gender on the mean retention scores of male and female students taught Physics using YouTube Instructional Video Package. This result also shows that YouTube Instructional Video Package did not discriminate between male and female students when it comes to students` retention of what is taught in Physics classroom.

Discussion of results

The finding from the study shows that students that were taught physics using YouTube instructional video package retain more knowledge than their counter part who were taught with lecture method. Therefore, the study reveals that there is a significant difference in the mean retention scores of students taught physics using YouTube instructional video package and those taught with lecture method. This implies that YouTube instructional video package had effectively enhanced the memory of the experimental group more than the control group as much that had caused a significant different. This higher mean retention score by the treatment group could be as a result of the YouTube instructional video package was able to have enhanced the brain cells of the experimental group. This result is in line Onyema and Olele (2020) who reported that blended learning increased the retention of physics students. Also, the study was in agreement with DanjumaBeji and Abdullabi (2021) who reported that students taught with YouTube based instruction obtained higher retention mean score than the students taught with lecture method. Also, their finding reveals that there is significant difference in the retention mean scores of students taught using YouTube based instruction and those taught with lecture method. By implication, the finding of this study shows that YouTube instructional video package can promote students' retention in physics if adopted.

Also, the finding from the study shows that both male and female students taught physics using YouTube instructional video package, the retention test mean were greater than the posttest mean with the male students having a higher mean gain. The results revealed that there was no significant difference in the mean retention scores of male and female students taught physics using YouTube instructional video package. This implies that YouTube instructional video package had effectively enhanced the memory of the experimental group more than the control group as much that had caused a significant different. This higher mean retention score by the treatment group could be as a result of the YouTube instructional video package was able to have enhanced the brain cells of the experimental group. Furthermore the gender inclusive instructional technique of YouTube instructional video package made it possible for the experimental group to obtain higher mean retention score than the control group. These results are in agreement with Onyema and Olele (2020) and Chianson (2018) who reported that YouTube and cooperative learning has no effect on gender on students' retention. This implies that YouTube instructional video package has no effect on male and female students' retention in physics. This is an indication that students' gender group memory was greatly enhanced as a result of gender inclusive YouTube instructional video package. Therefore gender influence on the mean retention score of students taught using YouTube instructional video package was not significant.

Conclusion

Based on the result of the data analysis using the ANCOVA, The mean retention scores of students who received physics teaching via the lecture technique and those who received instruction via the YouTube instructional video package were found to differ considerably, supporting the hypothesis.

There was no discernible difference in the mean retention scores of male and female students who received physics instruction via the YouTube Instructional Video Package.

Recommendation

Based on the research findings, the following recommendation are made

1. Use of lecture method of teaching among Physics teacher should be de-emphasized in secondary schools as that does not contribute much in students' achievement in physics'
2. Physics teachers should be sent on refresher course as well as seminars and workshops periodically to update their knowledge and be exposed to techniques in teaching the subject – physics, YouTube instructional video package.

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