EFFECT OF YOUTUBE-ENHANCED INSTRUCTIONAL STRATEGY ON SECONDARY SCHOOL STUDENTS' ACHIEVEMENT IN MATHEMATICS

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Abstract
The study investigated the effect of YouTube-enhanced instructional strategy on students' achievement in mathematics among senior secondary schools in Bomadi Local Government Area of Delta State, Nigeria. A pretest-posttest, quasi-experimental design with a non-equivalent control group was adopted. A total of eighty-eight (88) SS2 students were involved in the study. Two schools were purposively selected and randomly assigned to experimental and control groups. Also, one intact class was selected for treatment and control groups. The study lasted for five weeks. Three instruments were used for the study. There were two Instructional Guides and Mathematics Achievement Test (MAT). MAT had a reliability of 0.82 using Kuder-Richardson Formula 21(KR-21). One research question was answered and ***one null hypothesis was tested at 0.05 level of significance. Mean and the standard deviation were used to analyse the research question and Analysis of Covariance (ANCOVA) for the hypothesis. Treatment had significant effect on students' achievement in mathematics*** *($F_{1,85}$ = 582.529; p(0.000) < 0.05; partial eta squared = 0.873), which gives an effect size of 87.3 percent. The findings showed that YouTube-enhanced instructional strategy improved students' achievement in mathematics more than the modified lecture instructional strategy. It was recommended, among others, that teachers should adopt a YouTube-enhanced instructional strategy to improve students' achievement in mathematics among secondary school students.*

Keywords: YouTube, Modified Lecture, Instructional Strategy, Mathematics, Achievement

Introduction

Worldwide, mathematics is one of the most important school subjects in the curriculum. Mathematics is especially useful for technical and science subjects. In every nation of the world, the subject is considered a bedrock and an indispensable tool for scientific, technological, and economic

advancement (Umameh, cited in Tshabalala & Ncube, 2013). It could be said that without mathematics there is no real scientific study that will take place.

In Nigeria, mathematics is made a compulsory school subject for both pupils and students in Primary and Secondary Schools (Federal Republic of Nigeria, 2013). Proficiency in mathematics knowledge is essential to any human being and nation, in household and business deals, technological advancement, scientific discoveries, investigation, problem-solving, and decision making in different situations of life. Despite its great importance, mathematics is one of the most dreaded subjects to learners in schools (Akinoso, 2011).

There is ample evidence of continued low interest in the subject by Nigerian students (Okigbo & Okeke, 2011), which also results in poor achievement in mathematics. The West African Examinations Council (WAEC, 2012, 2013 & 2014) lamented over the low achievement and interest in mathematics by Nigerian candidates. Igbojinwaekwu and Nneji (2012) attributed the high failure rate of students in mathematics in the Senior School Certificate Examination to the structure of questions in the examination while (Ali, 2010) also viewed teachers' incompetence as a contributing factor. Many teachers in schools use only lecture and questioning techniques even if such techniques are not relevant to the concept under discussion (Akinsola & Popoola, 2004). Also, shortage of qualified Mathematics teachers, poor facilities, inadequate instructional materials, method of teaching such as the use of traditional chalk and talk methods, large class size, limited background preparation in mathematics, undue distraction from unproductive use of a social network like Facebook, twitters, etc., lack of problem-solving skills, poor self-concept, motivation, and some government policies are responsible for poor achievement in mathematics (Odogwu, 2014; Abimbade, 2015; James 2012; Salman, Mohammed, Ogunlade & Ayinla, 2012; Etuk, Etudor, Nwaoku & Etuk, 2016).

The lecture instructional strategy is a verbal presentation of ideas, concepts, generalisations, and facts. It is a teacher-centred strategy, a one-way communication channel from the teacher to students. The students are mostly passive listeners. They do not ask questions or make comments until the teacher has completed the work for the day (Davids, 2012). However, as a result of research in education, no trained mathematics teacher uses the traditional lecture strategy at the primary and secondary school levels for teaching. This study will use the modified lecture strategy as control. The activities within the modified lecture strategy include teacher-student interaction in the form of asking and answering questions. Students come to the chalkboard to solve mathematics problems and explain to the class, giving room for student-student interaction.

YouTube is a website that caters for high volumes of traffic, a platform for broadcasting, a media archive, and social network (Jones & Cutlrell, 2011). A wide variety of YouTube videos hosted online allow sharing and uploading because it is a social network. These videos can be accessed via blogs, handheld devices, and websites (Hansen & Erdley, 2009). Using YouTube in the classroom is an innovative and cost-effective way to bridge the gap between students from the wet generation and their teachers (Abell, 2011).

YouTube could have a high potential for improving the learning of mathematics skills and concepts. It exposes learners to multiple instructors (the instructors while watching the videos and the class teacher). Thus, students experience different strategies, ways of explanation of mathematical concepts, skills, and procedures of solving problems. Rice, Snelson and Wyzard (2012) state that YouTube videos for teaching and learning display explanations and clarifications about the concepts in mathematics. Fathallah (2015) also states that YouTube videos allow active, constructive, and interactive learning opportunities. Learning through YouTube videos achieve enhanced learning outcomes of mathematical skills because YouTube makes videos available anytime and anywhere, with high quality, and the possibility of video repeat or stop and complete later. It contributes to

developing visual education skills, read images and graphics faster and easier without conceptual errors.

Educational application of e-learning is in the form of constructivism known as social constructivism. Bandura (1977) states that people learn from one another, via observation, imitation, and modeling. Learning is influenced by not only the instructional delivery but also the interactions between the students and the teacher (Kahrmann, 2016) and from other visual sources made available in the mathematics classroom. Social constructivism emphasises that the learner is an active contributor, who should be involved in structuring his/her understanding based on his earlier knowledge, and that learning is best done in a collaborative or joint setting with the teacher as a facilitator. Thus, in this study, the students watch YouTube videos at home before the normal class period. They discuss all that they understand from the videos during the class and the teacher's role is that of a facilitator.

Statement of the Problem

Mathematical knowledge is needed by all in our society, especially in this modern age of science and technology. Yet students' achievement in the subject at all levels of education is still poor. The available literature shows that students' poor achievement in mathematics is due to several factors, especially on the strategies used for teaching mathematics. The traditional strategies mostly used by teachers may have contributed too many problems in mathematics at various levels of education. The era of modern technology enhances social network platforms such as YouTube videos in which mathematics can be learned. The use of YouTube in the teaching and learning of mathematics in the formal classroom is relatively carried out in the Delta State of Nigeria. Therefore, this study determines the effects of YouTube-enhanced instructional strategy on students' achievement in simultaneous linear equations and algebraic fractions among SS2 students in Bomadi Local Government Area of Delta State, Nigeria.

Research Question

The study was guided by this research question: What is the mean difference that exists in students' achievement in mathematics when taught with YouTube-enhanced and modified lecture instructional strategies respectively?

Research Hypothesis

A null hypothesis was formulated and tested at 0.05 level of significance to guide the study. There is no statistically significant difference in students' achievement in mathematics when taught with YouTube-enhanced and those taught with the modified lecture instructional strategies respectively.

Methodology

The study adopted a pretest-posttest, quasi-experimental design with non-equivalent control groups. Two schools were purposively selected after satisfying the following criteria. The schools must be public and teachers must be specialists in mathematics education and are willing to be involved in the experiment. One intact class was randomly assigned to the treatment and control groups from the two schools. **A total of 88 students (males=54, females=34) were involved in the study.** The instrument used in this study is the Mathematics Achievement Test (MAT). There were two instructional guides, namely: Instructional Guide on YouTube-Enhanced Instructional Strategy (IGYEIS) and Instructional Guide on Modified Lecture Instructional Strategy (IGMLIS). IGYEIS and IGMLIS were used as teaching guides for the experimental and control groups respectively. The Mathematics Achievement Test (MAT) had a reliability of 0.82 using Kuder-Richardson Formula 21 (KR-21). All the instruments were duly validated by expert review.

The first week was used for the training of the participating teachers in each of the schools by the researchers on the use of IGYEIS and IGMLIS. The second week was used for the administration of pre-test by the teachers and researchers on MAT. The next two weeks (3-4) were used for the administration of treatment to

the experimental group; YouTube-Enhanced Instructional Strategy (YEIS) and control group: Modified Lecture Instructional Strategy (MLIS) and week five was used for the administration of posttest on MAT by the teachers and researchers.

Method of Data Analysis

The data collected were analysed using Analysis of Covariance (ANCOVA). This was adopted to test the hypothesis using pre-test scores as covariates. The research question was analysed using mean and standard deviation.

Results

Research Question

What difference exists in students' achievement in mathematics when taught with YouTube-enhanced and modified lecture instructional strategies respectively?

Table 1: Summary of the mean and standard deviation of pretest and posttest scores on the effect of instructional strategies on students' achievement in mathematics

Instructional Strategies	N	Pretest scores		Posttest Scores		Mean gain scores
		X	SD	X	SD	
YouTube-enhanced	42	19.10	6.16	75.00	4.92	55.90
Modified lecture	46	20.04	7.32	42.91	7.15	22.87
Total	88	19.59	6.77	58.23	17.25	38.64

The data presented in Table 1 shows that the post-test mean score of students taught with YouTube-enhanced 75.00 is greater than the post-test mean score of students taught with modified lecture strategy 42.91. The data further indicates that the mean gain score of students taught with YouTube-enhanced 55.90 is greater than the mean gain score of students taught with modified lecture strategy 22.87. This implies that students taught with a YouTube-enhanced instructional strategy achieved better than their counterparts taught with a modified lecture instructional strategy.

Hypothesis

There is no statistically significant difference in students' achievement in mathematics when taught with YouTube-enhanced and modified lecture instructional strategies respectively.

Table 2: One-way Analysis of Covariance (ANCOVA) of post-test scores of students' achievement in mathematics when taught with YouTube-enhanced and modified lecture instructional strategies.

Source of Variation	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared	Decision p < 0.05
Corrected Model	22607.566	2	11303.783	292.231	.000	.873	
Intercept	31541.005	1	31541.005	815.413	.000	.906	
Pretest Scores	3.764	1	3.764	.097	.756	.001	
Instructional	22532.812	1	22532.812	582.529	.000*	.873	*

Strategies			
Error	3287.888	85	38.681
Total	324252.000	88	
Corrected Total	25895.455	87	

*R Squared = .873 (Adjusted R Squared = .870) *= Significant at p < 0.05 alpha level*

The data on Table 2 shows that the main effect was not significant on students' achievement in mathematics ($F_{1,85}$ = 582.529; p (000) < 0.05; partial eta squared = 0.873), which gives an effect size of 87.3 percent. Therefore, the null hypothesis, which states that "there is no statistically significant difference in students' achievement in mathematics when taught with YouTube-enhanced and modified lecture instructional strategies" was not accepted.

Discussion of Findings

The findings from the study revealed that there is a statistically significant difference in students' achievement in mathematics when taught with YouTube-enhanced and modified lecture instructional strategies. **Students exposed to** YouTube-enhanced **instructional strategy had a higher mean** achievement score in mathematics than those taught using a modified lecture instructional strategy. The finding of this study is consistent with that of Harris (2011) that YouTube videos inspire learning, engagement, excitement, and fuels additional discussion amongst students in the classroom. In essence, these are necessary characteristics that can enhance students' academic achievement in mathematics. Also, Hansen and Erdley (2009) aver that educational videos can heighten the students' interest in a subject and may motivate them to learn more. These are some of the observations found among the students in the YouTube video group that must have improved their achievement in mathematics more than the students in the control group.

These findings point out the fact that using YouTube videos in mathematics lessons or classes has a great possibility of enhancing and increasing their understanding and their achievement in the subject. Students consider YouTube video classes as fun, entertaining, beneficial for learning, and engaging (Fleck, Beckman, Sterns & Hussey, 2014). There is no doubt, students in the experimental group achieved significantly better in mathematics than students in the control group.

Conclusion

The YouTube-enhanced instructional strategy is a good instructional strategy, highly suitable for enhancing students' achievement in Mathematics because it is blended in nature. It allows students to learn mathematics at home and while in school. If this strategy is adopted in the teaching of mathematics, the subject will be better understood and students will lose their fear of mathematics and improve in their academic achievement.

Recommendations

Based on the findings of this study, the following recommendations are made:

Mathematics teachers and educators should be motivated to adopt learner-centred strategies of teaching mathematics such as the YouTube-enhanced instructional strategy.

The Federal and State Governments should organise workshops and in-service training programmes aimed at equipping teachers with the basic skills of YouTube-enhanced instructional strategy in lesson delivery in mathematics regularly.

Also, the federal, states and local governments, with private owners of schools, should build and equip schools with internet facilities to benefit maximally in using this innovative strategy in the teaching and

learning of mathematics and other science subjects.

References

Abell, C. H. (2011). Using YouTube to bridge the gap between baby boomers and millennials. *Journal of Nursing Education, 50*(5), 299. Available at https://pdfs.semanticscholar.org/0e0b/5f63a8a13360fa93ab8d611d882388b28cc5.pdf

Abimbade, A. (2015). Mathematics methods 2. Centre for External Studies, faculty of education, University of Ibadan (TEE 333). Available at https://www.icidr.org/jres-vol6no2-aug2015/Trend%20on%20Students-Performance%20in%2

Akinoso, S.O. (2011). Correlation of some factors affecting students' achievement in secondary school Mathematics in Osun State. In International (I JESMES), University of Abuja 3(10), 83-95.

Akinsola, M.K & Popoola, A.A. (2004). A Comparative Study of the Effectiveness of Two Strategies of Solving Mathematics Problems on the Academic Achievement of Secondary School Student, Abacus: *Journal of the Mathematical Association of Nigeria (JMAN)*, 29 (1). Available at http://www.eajournals.org/wp-content/uploads/Igbo-Language-as-Medium-of-Instruction-and-Enhancement-of-Retention-Level-of-Pupils-in-Primary-School-Mathematics.pdf

Akuezuilo, E.O. & Chinweoke, F.U. (2009). Effectiveness of Prior Knowledge of Behavioural Objectives and Study Questions on Female Students' Mathematics Achievement. *UNIZIK Journal of STM Education*: 1, (1) 1-7. Available at http://www.eajournals.org/wp-content/uploads/Igbo-Language-as-Medium-of-Instruction-and-Enhancement-of-Retention-Level-of-Pupils-in-Primary-School-Mathematics.pdf

Ali, A (2010). Content competence in mathematics attained by Grade II Teachers for teaching primary school mathematics. *Journal of Educational Studies, Institute of Education, University of Jos, Nigeria.* 1 (2), 28-43. Available at http://www.eajournals.org/wp-content/uploads/Igbo-Language-as-Medium-of-Instruction-and-Enhancement-of-Retention-Level-of-Pupils-in-Primary-School-Mathematics.pdf

Bandura, A. (1977). Social learning theory. Englewood Cliffs, N.J: Prentice-Hall. Available at http://www.asecib.ase.ro/mps/Bandura_SocialLearningTheory.pdf

Davids .I. (2012). Skills in effective teaching. Port-Harcourt: Minson Publishers Ltd.

Etuk, K.G, Etudor, E.E, Nwaoku, A.N & Etuk, U.R (2016). Teaching staff quality and teaching effectiveness: A Panacea for quality assurance in Akwa Ibom State Higher Institutions. *Nigeria Journal of Educational Administration and Planning*, 6(2), 107-119.

F.R.N (2013). National policy on education. Lagos, NERDC. Available at https://www.mcser.org/journal/index.php/jesr/article/download/9164/8850

Fathallah, M.A (2015). The Effectiveness of PowerPoint only and with educational videos via closed-circuit television in the development of students/ teachers achievement and their skills and attitudes towards the use of educational technology in teaching. Education Science.

Fleck, B.K.B., Beckman, L.M, Stern, J.L, & Hussey, H. (2014). YouTube in the Classroom: Helpful tips and students' perceptions. *The Journal of Effective Teaching.*

Hansen, M. & Erdley, S. (2009). YouTube and other Web 2.0 Applications for nursing education. *Online Journal of Nursing*

Informatics (OJNI), 13(3). Available at http://ojni.org/13_3/Hansen_Erdley.pdf

Harris, M. (2011). Using YouTube to enhance student engagement. Faculty Focus. Available at http://proceedings.e-skillsconference.org/2014/e-skills389-399Roodt763.pdf

Igbojinweakwu, P.C. & Nneji, N.L. (2012). Restricted Mathematics question and academic achievement of students in senior school mathematics. African indices, British University in Egypt (BUE), Etsharonk City, Cario, 4(1), 12-13. Available at https://www.mcser.org/journal/index.php/jesr/article/download/9164/8850

James, O.A. (2012). Effect of formative testing on students' achievement in junior secondary school Mathematics. *European Scientific Journal*, April Edition 8 (8). (online) Retrieved at http://www.eujournal.org/index.php/esj/article/view/134.

Jones, T., & Cuthrell, K. (2011). YouTube: Educational potentials and pitfalls. Computers in the Schools, *28*(1), 75-85. Available at http://proceedings.e-skillsconference.org/2014/e-skills389-399Roodt763.pdf

Kahrmann, C. R.. (2016). Efficacy of Math video tutorials on student perception and achievement. *Doctor of Education in Teacher Leadership Dissertations.* Paper 9.

Odogwu, H.N. (2014). The Mathematics teachers' factors in the achievement of goals of the Universal Basic Education (UBE). *Journal of Mathematics Association of Nigeria,* 27(1), 72-78.

Okigbo, E.C. & Okeke, M.C. (2011). Availability and use of improvised visual aids for teaching solid geometry in secondary schools. *UNIZIK Journal of Science Technology and Mathematics (STM) Education,* 1(2), 55-60. Available at https://www.mcser.org/journal/index.php/jesr/article/download/9164/8850

Rice, K., Snelson, C. & Wyzard, C. (2012). Research priorities for YouTube and Video-sharing technologies. A Delphi Study. *British Journal of Educational Technology*, 43(1) Jan, 119-129. Available at http://proceedings.e-skillsconference.org/2014/e-skills389-399Roodt763.pdf

Salman, M.F., Mohammed, A.S., Ogunlade, A.A & Ayinla, J.O. (2012). Causes of mass failure in senior school certificate Mathematics Examination as viewed by secondary school teachers and students in Ondo, Nigeria. *Journal of Education and practice, 3(8). (online),* Available at www.iiste.org.

Tshabalala, T. & Ncube, A. C. (2013). Causes of the poor performance of ordinary level pupils in Mathematics in rural secondary schools in Nkayi District: Learner's Attritions.

WAEC (2012). Chief examiner's report. Lagos Nigeria, West African Examination Council

WAEC (2013). Chief examiner's report. Lagos Nigeria, West African Examination Council

WAEC (2014). Chief examiner's report. Lagos Nigeria, West African Examination Council