EFFECT OF 'CINEMATHS' ON JUNIOR SECONDARY SCHOOL STUDENTS' PERFORMANCE IN ALGEBRA IN PORT HARCOURT LOCAL GOVERNMENT AREA, RIVERS STATE

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Abstract
The study investigated the effect of 'Cinemaths' on Junior Secondary School students' performance in Algebra in Port Harcourt Local Government Area (PHALGA), Rivers State. Quasi-experimental design involving intact classes was adopted. The study examined the difference in performance of students taught Algebra using Cinemaths strategy and those taught using Lecture method; examined if gender variation had any significant moderating effect on the performance of students taught Algebra using Cinemaths strategy. Two (2) research questions were raised and answered and two (2) null hypotheses were formulated and tested at 0.05 significant level. Random sampling technique was adopted for the study; sample comprised of 87 students for the experimental group and 91 students for the control group in the sample schools. The instruments used for data collection were Pre-test and Post-test Algebraic Performance Test (APT) and their reliability coefficient were 0.74 and 0.88 respectively using Kuder – Richardson formula 20 (KR20). Mean and standard deviation were used to answer the research questions while hypotheses were tested using Analysis of Covariance (ANCOVA) at 0.05 significant level. The result of the analysis showed that students taught Algebra using Cinemaths strategy performed significantly better than their counterparts taught using Lecture method, that gender had no significant effect on the performance of students taught Algebra using Cinemaths strategy. Integration of ICT like Cinemaths is recommended as it improves the performance in Algebra without gender bias.

Keywords: Effect, Cinemaths, Junior Students, Performance, Algebra.

Introduction

The important of Mathematics, its role as foundation for nation building, utility base for daily living, agent for development of critical and disciplined mindsets in individuals and support-service to other disciplines cannot be over-emphasized. This has been highlighted by many researchers (Uwaezuoke & Ekwueme, 2013; Roohi, 2014; Uwaezuoke & Ideozu, 2014). Mathematics is indispensable for daily life. It occupies a central place in the school curriculum. It is believed that Mathematics sharpens the human mind, develops logical thinking and enhances critical reasoning ability and spatial power. Ukeje (2013), described the importance and the attention given to Mathematics as stemming from the fact that without Mathematics, there is no science, without science, there is no modern technology, and without modern technology, there is no modern society. Simeon and Francis (2012), observed that Mathematics is the

queen of science and technology and also a tool for scientific and technological development. Mathematics has been viewed as the most difficult subject in the secondary school particularly by students in the rural areas (Vundla, 2012).

Mathematics without doubt remains very important to all disciplines and field of human work and study. Hence, for any nation to survive and develop; it has to improve its teaching and learning of Mathematics which is the bases for technological development. It is as a result of this reason that the subject is made compulsory at primary and secondary levels of education and requires at least 'credit' at the ordinary level for admission into tertiary institution.

This poor knowledge, poor performance and lack of interest in Mathematics are what have aroused the interest of the researcher in a bid to discover what actually the cause is and proffer possible solutions. In this Perspective, the researcher is convinced that interest in Mathematics can be aroused with motivation and one way to motivate the students is to impact mathematical discipline alongside the spirit of the age or signs of time. A critical study of the present age brings to our consciousness that it is the age of technology. This is justified by the high degree of interest our 21st century students develop towards movies, pictures, music, phones among others. Students perform and retain knowledge better in literature both in internal and external examination with a watched literature Video Compact Disk (VCD) than the literature book taught in the classroom. Teaching methods adopted by teachers should be one that will allow students to plan and organize, monitor their work, direct their own learning and the knowledge gained from the study will be retained.

Algebra, one of the most difficult and abstract topics in Mathematics, is the most intimidating topics in Mathematics. The reason is that prior to this point students have been dealing with numbers such as 1, 2, 3, 4, 5 etcetera in other topics in Mathematics and now suddenly in algebra they begin to deal with variables such as a, b, c, x, y etcetera. This concept at first can seem a bit daunting with all of these letters here and there. Every Mathematics topic is as important as Mathematics itself because a dislike of a topic in Mathematics may lead to a dislike in the whole of Mathematics.

Lack of interest in Mathematics especially difficult and abstract topic like algebra, leading to phobia and eventually poor performance, is the undoing of many students. This discovery stimulated the researcher into searching for solutions. To arouse and maintain students' interest in Mathematics is a major problem for the teacher who knows that loss of interest is one of the principal causes of students' failure. A strong interest of students should be aroused and their wholehearted attention to the extent of concentration should be secured. The use of instructional materials or resources has an important role to play in Mathematics instruction as it allows teachers to model or demonstrate representations of Mathematical ideas and in supporting learners to develop Mathematical understanding and thinking (Drew & Hansen, 2013). An innovative and resourceful Mathematics teacher will focus on using all available resources to reduce abstraction in the Mathematics classroom, hence increasing learner's interest, concentration, confidence and performance in the subject.

Information and Communication Technology (ICT) today offer a handful of useful resources which can be harnessed in a Mathematics classroom to improve students' interest and learning. African Virtual University, AVU (2012) established that Information and Communication Technology has become

one of the fundamental building blocks of modern society. Today's learners on another hand, being born into this technological age (digital natives) are showing great affinity to technological devices and application (Prensky, 2001; Digital Minds, 2013). To this end, various new models of education are evolving in response to the new opportunities that are becoming available by integrating Information and Communication Technology and particularly web-based technologies into the teaching and learning environment (AVU, 2012). The implication of this development on Mathematics education as an option is, the development, mastering and integration of appropriate modern technological teaching tools in the Mathematics classroom with the overall aim of arousing learners' interest, increasing the effectiveness of teaching and improving students' learning, hence performance. Mathematics teachers (digital immigrant) can take advantage of learners' obvious interest in technology to make changes and improvements in the Mathematics classroom. Thus, adding Cinemaths as an ICT tools in improving interest, concentration, performance and achievement of teaching and learning of Mathematics.

To limit learning difficulties experienced by students in Mathematics especially difficult and abstract topic like algebra, one instructional strategy which probably has the potential to offer opportunities to address the issue of effective teaching and learning of Mathematics, one that will arouse students' interest, concentrate, reason, creative and consider students cognitive style which will influence their problem solving ability by way of simplifying the concepts, help students organize and structure their thoughts to further understand information and discover new relationships is the Cinemaths strategy, which is an operation that associates or calibrates Mathematics into movies. It is a teaching strategy that integrates Mathematics into movies to step by step simplify Mathematics to the easy understanding of the students through television. Television is a very powerful medium for teaching and learning, it is the medium that involves the use of our two senses, sight and hearing. It is therefore referred to as an audio-visual resource to educate, to inform and to entertain. The tripartite role of the television makes it popular as a means of communication. For a long time, television was only use for entertainment and information. Today the use of television as a medium of academic learning and instruction is an innovation in the educational system. This research work sought to offer teachers measures to combat problems of lack of interest and poor performance of students. On the other hand, visual thinking becomes more important as watching films is one of the favourite hobbies to young people. Education community should learn to use it, as well as other audiovisual Medias, ICT, social network in order to adapt their methodology to the changing times. In view of this situation the study of "Cinemaths" arises, as effective strategy in the teaching of Mathematics. This tool was used to help stimulate students' interest in algebra and investigate its influence on junior secondary school students' performance.

Statement of the Problem

Irrespective of all this importance accorded to Mathematics at presents, the performance is still not encouraging. Digital tools like laptops, phones, et cetera have had a tremendous impact on everyday human behaviour; it even has an impact on vocational training of the adolescents. The technological digital tools are widespread, higher percentage of populace indulge in the digital tools and watching of the television which

influences change of attitude towards their background, interactions and affects their study habit. This performance increased with the innovation of technologies as television and other digital tools like laptops, phones, et cetera are available and mobile. It is pertinent for the researcher to think towards a strategy that will involve technological digital tools, television and movies in the learning and teaching of Mathematics. Thus, Cinemaths strategy which is the "Cinema in Mathematics" should be adopted as the likely strategy that can arouse the interest and concentration in the teaching and learning of Mathematics even in difficult and abstract topics like algebra for better understanding of junior secondary students in Port Harcourt Local Government Area of Rivers State.

Aim and Objectives of the Study

This study aimed at investigating the effect of Cinemaths strategy on junior secondary school students' performance in Algebra. The specific objectives were to:

1. examine the difference in performance between students taught algebra using Cinemaths strategy and those taught using Lecture method.
2. compare the performance of male and female students taught algebra using Cinemaths strategy.

Research Questions

Two research questions were raised and answered in this study;

1. What is the difference in performance between students taught algebra using Cinemaths strategy and those taught using Lecture method?
2. How does the mean score performance of male differ from female students when taught algebra using Cinemaths strategy?

Hypotheses

Two null hypotheses were formulated and were tested at 0.05 level of significance;

H_{01} There is no significant difference in the performance mean scores of students taught algebra with Cinemaths strategy and those taught using Lecture method.

H_{02} There is no significant difference in performance mean scores of male and female students taught algebra using Cinemaths strategy.

Methodology

The research design adopted in this study was Quasi-experimental design whereby the students receive treatment in their various classes without disorganizing their class setting. The experiments were carried out in intact classes. Quasi-experimental design is an empirical study used to estimate the causal impact of an intervention on its target population without random assignment. It has the attribute of true experimental studies apart from randomization and its usual association with social factors or human behaviour. This design aims at demonstrating the effect of an independent variable on the dependent variable and does not involve randomization. The study area is PHALGA, one of the twenty-three (23) local government areas in the state with headquarter at Mosco road Port Harcourt. The population of the study consisted of all Junior Secondary One (JS1) students in the fifteen (15) functional public junior secondary schools in Port Harcourt local Government Area (PHALGA) of Rivers State. Three thousand one hundred and twenty-six 3,126 Junior Secondary One (JS1) students were on enrolment as at March 2019 in the 15 schools, these constituted the population for the study. Random sampling technique was adopted to select two functional co-educational public

junior secondary schools from the target population to obtain eighty-seven (87) students (52 males and 35 females) in school A as Experimental group and ninety-one (91) students (42 males and 49 females) in school B as Control group, making a total of one hundred and seventy-eight (178) JS1 students (94 males and 84 females). The pre-test APT was administered to the students in their respective schools before the commencement of the instruction. The students in the control group were taught using Lecture method only, while the students in the experimental group were taught through viewing a Cinemaths Video. The treatment and teaching were done two days in a week for two weeks, after which the post-test APT was administered to check the students' level of performance in algebra. Two Researcher-made instruments; Pre-test/Post-test Algebraic Performance Test (APT), were used to gather data for the study. The APTs consist of ten (10) theory questions each specifically testing the students' ability to solve problems and answer questions on algebra in line with the current JS1 syllabus. APTs were trial tested on 25 students and data generated were used to determine the reliability coefficient of 0.74 and 0.88 for Pre-test and Post-test APTs respectively using Kuder – Richardson formula 20 (KR20). The pre-test and post-test scores of APTs of the students were analyzed. Mean and standard deviation were used to answer the research questions while analysis of co-variance (ANCOVA) was used to test the hypotheses at 0.05 level of significance. Statistical Package for Social Sciences (SPSS version 23.0) was used for data analysis

Results

Research Questions 1: What is the difference in performance between students taught algebra using Cinemaths strategy and those taught using lecture method?

Table 1: Mean, Standard Deviation Pre-test, Post-test and Mean Gain of students taught algebra using Cinemaths strategy and those taught using lecture method.

Group	n	Pre-test		Post-test		Mean
		Mean	SD	Mean	SD	Gain
Experimental	87	29.66	17.12	59.21	16.58	29.55
Control	91	28.00	13.35	36.55	13.71	8.55

Table1 shows that the Pre-test mean scores of the students taught using Cinemaths strategy was 29.66 ± 17.12 whereas that of their counterparts taught using the lecture method was 28.00 ± 13.35. The Post-test mean scores of the students taught using Cinemaths strategy were 59.21 ± 16.58 whereas that of their counterparts taught using the lecture method was found to be 36.55 ± 13.71. The students who were taught using Cinemaths strategy had mean gain of 29.55 and those taught using Lecture method had mean gain of 8.55

H_{01} There is no significant difference in the performance mean scores of students taught algebra with Cinemaths strategy and those taught using lecture method.

Table 2: Summary of analysis of covariance on thedifference in the performance mean scores of students taught algebra with Cinemaths strategy and those taught using lecture method.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	31159.134[a]	2	15579.567	84.591	.000	.534
Intercept	47358.939	1	47358.939	257.141	.000	.547
Pretest	8326.156	1	8326.156	45.208	.000	.336
Group	21285.401	1	21285.401	115.572	.000	.292
Error	32230.647	175	184.175			
Total	467095.000	178				
Corrected Total	63389.781	177				

a. R Squared = .492 (Adjusted R Squared = .486)

Table 2 shows that there is significant mean difference in the performance mean scores of students taught algebra with Cinemaths strategy and those taught using Lecture method (F1, 175 = 115.572, $p<.05$). The null hypothesis one (H_{01}) was rejected at 0.05 alpha level.

Research Questions 2: What is the difference in performance between male and female students taught algebra using Cinemaths strategy?

Table 3: Mean, Standard Deviation Pre-test, Post-test and Mean Gain of male and female students taught algebra using Cinemaths strategy.

Group	Gender	n	Pre-test		Post-test		Mean
			Mean	SD	Mean	SD	Gain
Experimental	Male	52	28.15	15.35	59.04	16.42	30.89
Experimental	Female	35	31.89	19.47	59.46	17.06	27.57

Table 3 shows that the Pre-test mean scores of the male students taught using Cinemaths strategy was 28.15 ± 15.35 whereas that of their female counterparts taught using the same strategy was 31.89 ± 19.47. The Post-test mean scores of the male students taught using Cinemaths strategy was 59.04 ± 16.42 whereas that of their female counterparts taught using the same method was found to be 59.46 ± 17.06. The male students who were taught using Cinemaths strategy had mean gain of 30.89 and their female counterparts taught using the same strategy had mean gain of 27.57

H_{02} There is no significant difference in performance mean scores of male and female students taught algebra using Cinemaths strategy.

Table 4: Summary of analysis of covariance on thedifference in performance meanscores of male and female students taught algebra using Cinemaths strategy

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	5599.450a	2	2799.725	13.029	.000	.294
Intercept	42104.995	1	42104.995	195.937	.000	.640
Pretest	5595.783	1	5595.78326	.040	.000	.294
Gender	37.697	1	37.697	.175	.676	.007
Error	18050.826	84	214.891			
Total	328625.000	87				
Corrected Total	23650.276	86				

a R Squared = .237 (Adjusted R Squared = .219)

Table 4 shows that there is no significant difference in performance mean scores of male and female students taught algebra using Cinemaths strategy (F1, 84 = .175, p>.05). The null hypothesis two (H_{02}) was accepted at 0.05 alpha level.

Discussion of Findings

Table 1 showed that the students who were taught using Cinemaths strategy had mean gain of 29.55 which is greater than the mean gain of those taught using lecture method which is 8.55. Table 2 however showed that the difference was significant; thus, students taught Algebra using the Cinemaths strategy performed significantly better than those taught using the Lecture method. This finding was in line with those of Uwaezuoke and Ekwueme (2013), Rankowski and Galey (2014), Davis (2014) and Ukah (2016). Table 3 showed that male students who were taught using Cinemaths strategy had mean gain of 30.87 which is slightly greater than that of their female counterpart which had main gain of 27.57. Table 4 showed that there was no significant difference, hence the integration of an appropriate instructional strategy like the Cinemas, highly reduced the effect of gender as a moderating variable. This finding was in line with those of Santos et al (2006) in Uwaezuoke and Ekwueme (2013), Adaramola and Onwioduokit (2010) cited in Ukah (2016) and the Uwaezuoke and Ekwueme (2015).

Conclusion

Based on the findings of this study, it was concluded that the integration of innovative digital technologies like Cinemaths enhanced and improved performance in the teaching and learning of Algebra one of the difficult topics in Mathematics in junior secondary school students. It reduced the influence of gender bias on students' performance.

Recommendations

Based on the findings of this research work, the researchers proffered the following recommendations

1. The use of Cinemaths strategy and its likes as an educational resource for Mathematics teaching and learning in schools should be seen as an issue of importance to all educational stakeholders
2. The integration of the Cinemaths strategy to support and simplify the teaching and learning of Mathematics in schools should be inculcated into Mathematics teacher-education programmes in the country and in-

service training should be granted to serving teachers to acquaint them with the innovation.

3. Mathematics curriculum planners should recommend the use of Cinemaths strategy and its likes as a Mathematics learning resource in the secondary school Mathematics curriculum.
4. The government and other stake-holders should ensure that laboratory and other facilities that will encourage Cinemaths strategy and it's likes are built in schools to facilitate optimal Mathematics learning

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