



UMYU JOURNAL OF EDUCATIONAL RESEARCH



A Publication of the

Faculty of Education, Umaru Musa Yar'adua University, Katsina, Nigeria

Website: <https://www.umyujer.umyu.edu.ng/ujedur/index.php/ujer>

Volume: 12 / Issue: 1 / January 2024, - Open Access - / ISSN: 2141-7881

Effect of Instructional Videos on Academic Performance and Retention in Quadratic Equations among Senior Secondary School Students in Katsina State, Nigeria

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Abstract

This study investigated the effects of using instructional videos on students' academic performance and retention in quadratic equations among senior secondary school students in Daura Zonal Education Quality Assurance, Katsina State, Nigeria. The study was guided by four objectives, from which four research hypotheses were formulated and tested. The study adopted a pre-test, post-test, and post post-test quasi experimental and control group design. Two sets of students namely, Experimental group (EG) and Control group (CG) were used for the study. The population of this study comprised the entire public senior secondary schools in Daura zone. There were 22 senior secondary schools in Daura zone with a total of 4,175 SS II students out of which 2,190 were males and 1,985 were females. The sample of this study comprised a total of 135 students of which 75 were males and 60 were females. A validated instrument with reliability coefficient of 0.87 namely Quadratic Equation Performance Test (QEPT) was used for data collection. Independent Samples t-test statistic was used to test the hypotheses. The findings of the study show that students from experimental group performed and retained better than those in the control group. The study concluded that the use of instructional videos significantly improve academic performance of senior secondary school students in quadratic equations better than lecture method and is gender friendly. The researchers recommend the use of instructional videos in teaching students in our schools.

Keywords: Effect; Instructional Videos; Retention; Academic Performance; Quadratic Equation.

Introduction

Mathematics is one of the core subjects in both junior and senior secondary school curricula in Nigeria, which justifies its recognition as being essential in the development of technological advancement in Nigeria. From the National Curriculum for senior secondary schools, mathematics is divided into six sections which include: Number and Numeration; Algebraic Processes; Menstruation; Plane Geometry; Trigonometry, Statistics and Probability (Federal Republic of Nigeria, 2018). The focus of this study is on Algebraic processes. This is because reports have shown that Algebra occupies a major content in school mathematics and students perform poorly in Algebra (WAEC Chief Examiner Report, 2018).



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Algebra is a branch of mathematics of Arabian origin. It is a generalisation and extension of arithmetic in which symbols are employed to denote operations and letters to represent number and quantity. It is an aspect of mathematics that opens students mind to critical thinking. According to Michael (2018), Algebra is an aspect of mathematics which every individual must know, as it is a gate way to other areas of mathematics, yet many students struggle with Algebra and are left behind because they find it difficult to understand. It is the importance of Algebra that makes it to be in almost all the classes in the National Mathematics Curriculum. Algebra involves solving equations, graphing linear, simultaneous linear and quadratic equations (Federal Ministry of Education, 2019).

In this 21st century, adoption of technology-based instructional strategy that motivate, captivate and enhance students' performance and retention should be encouraged. One of such approach, according to Moreno and Mayer (2017) include technology enhanced learning such as multimedia presentation which could be either computer-based or video-based instruction. Multimedia technology today uses various forms of communication media such as computers and videos. Video instruction is a kind of multimedia that can transmit verbal and non-verbal with the combination of Audio and Visual materials.

Video-based learning has long been used as an educational tool to assist in classroom teaching, with earliest usage noted during the Second World War. A number of recent advances, most notably the rapid growth in access to high speed internet through homes, schools and personal devices such as tablets or smartphones, have had a significant impact in changing the learning environment and accelerating video use in education. Researchers note an explosion in online courses and a rapidly changing comprehension of how video can be used effectively to enhance learning (Schneps et al. 2021). Hence, this research investigated the effect of instructional videos on students' academic performance and retention in quadratic equation among senior secondary school students in Daura Zone, Katsina State, Nigeria.

To this end, poor achievement of students and lack of retention in mathematics is a known fact and of great concern to educators, researchers and mathematicians. Researchers are making great effort to see if there were improvement on students' performance and retention in mathematics by adopting various methods of teaching mathematics. Their aim of using various methods is because poor method of teaching mathematics has been identified as one of the reasons for poor achievement of students in mathematics. However the problem of not employing appropriate instructional strategies like instructional videos in most Nigerian secondary schools has made the learning of mathematics concept difficult. This worrisome state of affairs applies largely in Daura Zonal Education Quality Assurance of Katsina State, where mathematics is taught largely by traditional lecture method with no attempt at practical approach suggested by NERDC (2014). There is a need therefore to provide an alternative



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teaching strategy which will hopefully incorporate cognitive, affective and psychomotor domains of students like the use of instructional videos. It is on this basis that, the research intends to investigate the effect of instructional videos on students' academic performance and retention in senior secondary schools of Daura Zone, Katsina State in Daura Zonal Education Quality Assurance (ZEQA), Katsina State.

Table 1: Five Years Analysis of SSCE Mathematics Examination Result (May/ June 2018-2022)

Year	No. of Candidates Sat for the Exam	No. of Pass	% of Pass	No. of Fail	% of Fail
2018	375,825	218,199	58.05	149,144	39.68
2019	463,755	207,133	44.67	273,765	51.27
2020	415,113	200,345	48.26	207,892	50.07
2021	465,636	222,722	47.82	221,514	47.57
2022	418,593	180,797	43.19	228,652	54.61

Source: WAEC (2022)

Thus, the selection of video as a learning resource in the form of learning media for mathematics subjects is considered highly relevant and effective in stimulating students' critical thinking (cognitive) as well as student motivation (affective), since the subject requires sufficient concentration from students as it relates to numbers, symbols and formulas. All this is intended to assist in the effort to achieve mathematics learning goals.

This study investigated the effects of using instructional videos on students' academic performance and retention in quadratic equations among senior secondary school students in Daura Zonal Education Quality Assurance, Katsina State Nigeria.

Objectives of the Study

The research has the following objectives:

1. To determine the effect of using instructional videos on students' performance in quadratic equations among senior secondary students in Daura ZEQA.
2. To find out the effect of using instructional videos on students' retention in quadratic equations among senior secondary students in Daura ZEQA.
3. To determine the effect of using instructional videos on male and female students' performance in quadratic equations in senior secondary schools in Daura ZEQA.
4. To ascertain the effect of using instructional videos on male and female students' retention in quadratic equations in senior secondary schools in Daura ZEQA.



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Hypotheses

The following hypotheses were analysed in the study;

- Ho1.** There is no significant difference in the mean academic performance scores of senior secondary school students taught quadratic equations using instructional videos and those exposed to lecture method.
- Ho2.** There is no significant difference in the mean retention scores of senior secondary school students taught quadratic equations using instructional videos and those exposed to lecture method.
- Ho3.** There is no significant difference in the mean academic performance scores of male and female senior secondary school students taught quadratic equations using instructional videos.
- Ho4.** There is no significant difference in the mean retention scores of male and female senior secondary school students taught quadratic equations using instructional videos.

Methodology

The design of the study was quasi experimental design. Specifically it is non-equivalent control group design involving two groups: Experimental and Control. The population of the study comprised the entire public senior secondary schools in Daura zone. There were 22 senior secondary schools in Daura zone with a total number of 4,175 SS II students, out of which 2,190 were males and 1,985 were female.

The sample of the study comprised a total of 135 students, of which 75 were males and 60 were females. Two schools were selected to serve as experimental and control groups namely; Government Senior Secondary School Dan-Nakola was selected to serve as experimental group and Government Senior Secondary School Koza was selected to serve as control group.

The instrument used for data collection was the Quadratic Equation Performance Test (QEPT). It was drawn from SS II secondary school syllabus. The selected methods used were factorization method, completing the square method, the use of general formula and graphical method. These methods measure objectives in the Bloom's cognitive domain of educational objectives. The QEPT was used for both pre-test and post-test. It consist of 30 items of multiple choice objective test. Each objective question has 4 options A, B, C, and D, scored 3.33 mark each with a total of 100 marks. This test was designed to measure students' cognitive achievement in quadratic equations. The QEPT was used to determine the extent to which the



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experimental groups differed in remembering the contents taught and it was administered two weeks after the Performance Test in order to determine the extent to which the instrument can measure the students' performance and retention in quadratic equation. The test items were scrutinised by three lecturers in the Department of Science and Vocational Education, Umaru Musa Yar'adua University, Katsina. The same instrument was also given to three lectures in the Department of Mathematics Umaru Musa Yar'adua University, Katsina for validation and after necessary corrections it was adjusted suitable for this research.

The instrument was subjected to a test of reliability using test-retest method. To achieve this, the scores obtained by the subjects from the pilot testing was analysed using Pearson Product Moment Correlation (PPMC) where the common inter-item correlation coefficient (r) was obtained at 0.87 indicating that the instrument has high consistency of the items, thus the instrument was said to be reliable and suitable for the data collection. The hypotheses were tested using Independent Samples t-test at 0.05 level of significance with the help of Statistical Package in Social Sciences (SPSS) version 23.

Results

Ho1. There is no significant difference in the mean academic performance scores of senior secondary school students taught quadratic equations using instructional videos and those exposed to lecture method.

Table 6: Independent Samples t-test of Academic Performance Scores of Experimental and Control Groups

Grouping	N	Mean	Std. Dev.	t- value	df	p-value	Remark
Experimental	59	59.00	11.05	12.034	133.	.000	Significant
Control	76	36.57	10.48				

Table 6 presented Independent Samples t-test of performance scores of Experimental and Control Group. From the result, t-value recorded was 12.034 while p-value observed at degree of freedom of 133 was 0.00. The observed p-value is less than alpha value and the hypothesis was rejected. This shows that there was significant difference in the mean academic performance scores of senior secondary school students taught quadratic equations using instructional videos and those exposed to lecture method, in favour of those students in the experimental group.

Ho2. There is no significant difference in the mean retention scores of senior secondary school students taught quadratic equations using instructional videos and those exposed to lecture method.



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Table 7: Independent Samples t-test of Retention Scores of Experimental and Control Groups

Grouping	N	Mean	Std. Dev.	t- value	df	p-value	Remark
Experimental	59	58.08	11.09	8.577	133.	.000	Significant
Control	76	36.18	10.56				

Table 7 presented Independent Samples t-test of retention scores of Experimental and Control Group. From the result, t-value recorded was 8.577 while p-value observed at degree of freedom of 133 was 0.00. The observed p-value is less than alpha value and the hypothesis was rejected. This shows that there was significant difference in the mean retention scores of senior secondary students taught quadratic equations using instructional videos and those exposed to lecture method, in favour of those students in the experimental group.

Ho3. There is no significant difference in the mean academic performance scores of male and female senior secondary school students taught quadratic equations using instructional videos.

Table 8: Independent Samples t-test of Academic Performance Scores of Male and Female Senior Secondary School Students in Experimental Group

Grouping	N	Mean	Std. Dev.	t- value	df	p-value	Remark
Male	32	58.31	9.52	- .520	57	.610	Not Significant
Female	27	59.81	12.77				

Table 8 presented Independent Samples t-test of academic performance scores of male and female senior secondary school students in Experimental Group. From the result, t-value recorded was - 0.520 while p-value observed at degree of freedom of 57 was 0.610. The observed p-value is greater than alpha value and the hypothesis was retained. This shows that there was no significant difference in the mean academic performance scores of male and female senior secondary school students taught quadratic equations using instructional videos.

Ho4. There is no significant difference in the mean retention scores of male and female senior secondary school students taught quadratic equations using instructional videos.

Table 9: Independent Samples t-test of Retention Scores of Male and Female Senior Secondary School Students in Experimental Group

Grouping	N	Mean	Std. Dev.	t- value	df	p-value	Remark
Male	32	57.21	7.99	- .714	57	.478	Not Significant
Female	27	59.11	12.21				



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Table 9 presented Independent Samples t-test of retention scores of male and female senior secondary school students in Experimental Group. From the result, t-value recorded was -0.714 while p-value observed at degree of freedom of 57 was 0.478. The observed p-value is greater than alpha value and the hypothesis was retained. This shows that there was no significant difference in the mean retention scores of male and female senior secondary school students taught quadratic equations using instructional videos.

Discussion

From the first findings of the study, it was discovered that there was significant difference in the mean academic performance scores of senior secondary school students taught quadratic equations using instructional videos and those exposed to lecture method. This means that students in the experimental group performed better than control groups. Julius, Nicholas, John and Maundu (2018) found a significant difference in academic achievement in Chemistry between the CAI and CIM groups, with students of CAI group obtaining higher Chemistry scores than students of CIM group.

Significant difference exists in the mean retention scores of senior secondary students taught quadratic equations using instructional videos and those exposed to lecture method. This finding is in concurrence with that of Lin and Diana (2021) who in their studies reveals that use of media such as cartoons lead to greater long term memory retention of learned materials. This finding is also in agreement with that of Lawal (2019), who work on the effectiveness of conceptual change instructional strategy and traditional instructional strategy in remediating the misconceptions in genetic concept of senior secondary school. The result of finding confirmed that students exposed to conceptual change instructional strategy retained more knowledge of genetic than the subject exposed to traditional instructional strategy. Mangal (2020) ascertained that retention of learned material can be improve through association of ideas, connection, and systematic thinking in the task of recall.

Also, it was found that no significant difference exist between the mean academic performance score and retention of male and female students exposed to using instructional videos. This is in agreement with that of Musa (2020), Haruna (2020), and Usman, (2022), who in their various studies showed that innovative strategies enhances skills development of students when compared to Conventional method regardless of gender. However, the finding contradicts that of Ibrahim (2021), and Amasun (2019), who stated that use of constructivism favour female students than males. The findings further contradicts that of Isah (2021), and Muhammad (2021), who found that use of media improved female students' performance better than males. Also, Usman (2022) found that senior secondary male and female biology students differ significantly in their performance when exposed to innovative strategies.



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Conclusion

Based on the results of this study, the researchers concluded that the use of instructional videos significantly improves academic performance and retention ability of senior secondary school students in quadratic equations better than lecture method, and that using instructional videos improve academic performance and retention score of male and female students alike, and in consequence, it was described as gender friendly.

Recommendations

Based on the findings of this study, the researchers recommend that:

1. The use of instructional videos in teaching should be encouraged in our schools by stake holders in the education industries such as Federal Ministry of Education, State Ministries of Education through periodic seminars and workshops to teachers.
2. There is a need for Katsina state ministry of education to make adequate provision for computers, projectors and other facilities that supports instructional videos in our schools to enhance cognitive attainment of students.
3. Teachers in Katsina state should be encouraged to use instructional videos in their teaching to demonstrate abstract concept of mathematics so as to improve students' retention.
4. Teachers should be trained on how to develop simple video cliffs that can be used in teaching difficult concept of mathematics and across gender.

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