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EDITORIAL

Dear Readers,

We are excited to announce the launch of International Journal of Contemporary Issues in Integrated Science Education (IJCIISE). This Association Integrated Science Educators' Association of Nigeria (ISEAN) play a vital role in promoting scientific advancement, supporting science education, informing science policy, recognizing science excellence and fostering community engagement. The desire to float this journal was borne out of the passion to organize a yearly conference of Integrated Science by the Integrated Science Educators' Association of Nigeria, of which selected scholarly articles will be published after a thorough review. The journal dedicated to advancing knowledge and fostering dialogue within. Our mission is to publish high-quality research, innovative ideas, and critical analyses that contribute to the understanding and development of Integrated Science. At IJCIISE, we believe in the power of interdisciplinary collaboration and inclusivity. We welcome contributions from scholars, practitioners, and thought leaders worldwide, providing a space for diverse perspectives and groundbreaking work. As we embark on this journey, we invite you to submit your research, engage with our content, and join us in creating a vibrant academic community. Together, we can push the boundaries of knowledge and inspire future generations. Thank you for your support as we launch this exciting new endeavour.

This edition moves around issues that border on **"Enhancing Quality Assurance in Integrated Science in Nigeria."** It is believed that diverse contributions from scholars and researchers expressed in this edition will provoke the understanding of issues that could foster education for societal transformations on a global scale
We look forward to your contributions!

For further information on future conference activities, visit **http://ijciise.org/index.php/ijciise**

Warm regards,
Professor O. S. Agboola
President, Integrated Science Educators' Association of Nigeria (ISEAN)

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IMPACT OF INQUIRY DEMONSTRATION METHOD IN ENHANCING THE QUALITY OF STUDENTS' PERFORMANCE IN ALGEBRA AMONG SENIOR SECONDARY SCHOOL STUDENTS IN KADUNA STATE, NIGERIA

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Abstract
The study assessed the impact of inquiry-demonstration method on remediating errors and academic performance in algebra towards enhancing science and science education in a dwindling economy sustainable development. The research design is Quasi-experimental pre-test and posttest control groups; the experimental group was exposed to inquiry-demonstration method and control group was taught using lecture method. Two Co-educational schools were selected out of twenty senior secondary schools in the zone.186 students made up of 113 males and 73 females out of 3,606 senior secondary school students were randomly selected as sample size using simple random sampling technique. Four research questions and hypotheses were formulated and assessed using descriptive statistics of frequency and percentage to answer research questions 1, 2 and 3. Mean and Standard Deviation was used to answer research question four. Chi-square statistics was used to test null hypotheses 1, 2 and 3 and t-test statistics was used to test null hypothesis 4, ANOVA was used to test the significant difference among schools and Schaffer's test was used to find schools that were not significantly different as sample schools, at $P \leq 0.05$ *level of Significance. Three instruments were used, Quadratic Equation Error Diagnostic Test (QEDT), Quadratic Equation Performance Test, and Modified Newman Interactive Schedule (MNIS). Test retest reliability was observed. Pearson Product-Moment Correlation Coefficient (PPMCC) was used, and found to be 0.88 and 0.75 respectively. The difficulty and discriminating indices were calculated to be 0.80, and 0.71. The findings revealed that there was significant difference in the frequencies of Neman errors of experimental and control groups, and was not gender friendly on performance. It is recommended among others that the concepts of quadratic equations in algebra should be taught effectively in order to reduce the frequencies of Newman errors and improve students' performance. Professional bodies such as MAN, STAN, Mathematics educators, Text books publishers should organize training programs for teachers teaching mathematics in form of seminars, workshops and conferences focusing on the effective use of inquiry-demonstration method to enhance science and technology education in a dwindling economy.*
Keywords: Inquiry-Demonstration, Errors, Remediation, Performance.

Introduction

Mathematics is the bedrock of all sciences; hence, recognition attached to mathematics cannot be over emphasized. Mathematics is the basic knowledge required by students to extend their learning to a higher level. Not only that, it is also required for our daily lives, irrespective of educational background and social life. The benefit derived from mathematics is not only restricted to knowledge acquired in computations, but more importantly, when each individual can master it very well. It is then that the pattern of reasoning will be more rational and critical. Principle of mathematics enables people to see the problems as facts but not as a fiction Hudoyo and Itanku, (2005).

National Council of Teachers of Mathematics NCTM (2006) has emphasized that mathematics is a science of size and numbers, logical reasoning and model thinking that constitutes everyday activities. This is due to the fact that mathematics provides the laws, the formulae and the theorems that empower the scientific and technological developments (Musa, 2006). However, mathematics became a major area of concern over the years, because large number of students failed their final examinations. Mathematics as a subject has occupied a sensitive place in school curriculum and plays a vital role in the development of any nation (Odili, 2006). Mathematical concepts are interrelated with one another. This is because learning process in mathematics is categorized as hierarchical. The mastery of basic mathematical knowledge is very essential in concept development. Mathematics has played fundamental role in the economic development of many countries of the world (Popoola, 2007).

Lecture Method is the method of transmission of knowledge to learners characterized as a one-way passive. The method is the most frequently used method of instruction (Suleiman, 2011). It is a traditional method of teaching, defined as a teaching technique in which one person, usually the teacher, presents a spoken discourse on a particular subject (Aminu, 2011). It emphasizes "Talk and Chalk" in the teaching of Mathematics it is indeed an oral presentation intended to present information or teach people about a particular subject. It conveyed critical information, historical background, theories and equations Donald (2011). According to Okeke, (2011) mastery of basic Mathematical knowledge is essential in concept development.

Inquiry-demonstration method was defined as a method of presenting a problem to students. The demonstration is not designed to illustrate a concept or principle of science it is instead designed to present a discrepancy or problem for the students to explore (Suchman in Mujibul, 2008). An inquiry session is designed to engage the class in an exploration of a problem staged by means of the discrepant event. An inquiry session begins with the presentation of a problem through demonstration. Musa (2010) defined performance as the quality of results produced by students as reflected in the quality of their examination score.

Remediation refers to an attempt by a teacher to address any deficiencies in students learning to prevent students from falling behind in their education. If a

student does not know how to multiply numbers then he cannot solve equation in a later unit. In addition before a student reaches this point of failure, the teacher must identify the problem and help the students to master the problems (Reccomini, 2006). James (2015) declared that academic performance really involved knowing how much a student has learned. Annemie and Martin (2011) stated that the term performance is used in parallel to other concepts, such as achievement, outcome, result, output, productivity and many others.

Statement of the Problem

The study seeks to find the impact of inquiry-demonstration method on remediating errors and academic performance in algebra towards enhancing science and science education in a dwindling economy. Research findings in secondary schools have shown that algebra is one of the difficult areas in mathematics which has become a major area of concern over the years. This was as a result of different types of error students commit which led to poor performance. They include Newman errors, procedural errors, fact errors, basic errors, conceptual errors, Aslock errors, Suydam errors among others. However, the researcher used Newman errors.

Objectives of the Study

The specific objectives of the study are to:

1. determine the difference in frequencies of Newman Errors committed by students in the solution process of quadratic equation among senior secondary schools;
2. examine the difference in frequency of Newman errors committed by students in the solution process of Quadratic equations exposed to inquiry-demonstration method and those exposed to lecture method;
3. assess the difference in frequency of Newman errors committed by male and female students in the solution process of quadratic equations exposed to inquiry-demonstration method;
4. determine the impact of inquiry-demonstration on students' performance in quadratic equations among senior secondary students;

Research Questions

The study is set to answer the following research questions:

1. What is the difference in the frequencies of Newman errors committed by students in the solution process of quadratic equation among senior secondary schools?
2. What is the difference in the frequency of Newman errors committed by students in the solution process of quadratic equations exposed to inquiry-demonstration method and those exposed to lecture method?
3. What is the difference in the frequency of Newman errors committed by male and female students in the solution process of quadratic equations exposed to inquiry-demonstration method?

4. What is the difference in the performance of students in quadratic equations exposed to inquiry-demonstration strategy and those exposed to lecture method?

Null Hypotheses

To guide the study the following null hypotheses were formulated and tested at $P \leq 0.05$.

H_o1: There is no significant difference in the frequencies of Newman errors committed by students in the solution process of quadratic equations among senior secondary schools.

H_o2: There is no significant difference in the frequency of Newman errors committed by students in the solution process of quadratic equations exposed to inquiry-demonstration method and those exposed to lecture method.

H_o3: There is no significant difference in the frequency of Newman errors committed by male and female students in the solution process of quadratic equations exposed to inquiry-demonstration method.

H_o4: There is no significant difference in the performance of students exposed to inquiry-demonstration strategy and those exposed to lecture method.

Methodology

The research design used was pretest posttest quasi-experimental design. The study used two groups; Experimental and Control groups. Experimental group (EG) was exposed to Inquiry-Demonstration Method as a treatment (x_1). While, Control group (CG) was taught using lecture method (x_0). The two groups were pretested (0_1) on errors and performance before treatment, to ensure selection of samples that are not significantly different in abilities in terms of performance before treatment.

The design was recommended by Kerlinger, (1973) and Tuckman, (1975) the research design was represented in Figure 1

CG $\longrightarrow$ O_1 $\longrightarrow$ X_0 $\longrightarrow$ O_2

EG $\longrightarrow$ O_1 $\longrightarrow$ X_1 $\longrightarrow$ O_2

Figure 1 Research Design

Source: Adopted from Kerlinger, (1973) and Tuckman, (1975)

Where;

EG = Experimental group

CG = Control group

X_0 = Lecture Method of teaching

X_1 = Inquiry-demonstration method of teaching

O_1 = Pretest

O_2 = Posttest

The population of this study covered all public Senior Secondary Schools II (SSII) students in Zaria Education zone of Kaduna State. The available data from the zone as at 2015 revealed that there were three thousand six hundred and nine 3,609 SSII students with 1,953 male and 1,656 female. There are ten (10) Co-educational schools, six boys' schools and four girls' schools totaling twenty senior secondary schools in the zone.

Table 1: Population of the Study

S/No	School	Types of school	Number SS II Students		Total
			Male	Female	
1	Alhuda Huda College	Boys	296	-	296
2	Barewa College Zaria	Boys	198	-	198
3	GGSS Dogon Bauchi	Girls	-	205	205
4	GGSS Kofan Gayan	Boys	-	200	200
5	GSS Zaria	Boy	105	-	105
6	GSS Muchia	Coeducation	100	167	267
7	GSS Aminu	Coeducation	130	78	208
8	GSS Magajiya	Coeducation	104	43	147
9	GGSS Fada	Girls	-	249	249
10	GSS Kaura	Coeducation	265	136	401
11	GSS Tudun Jukun	Coeducation	278	128	406
12	GSS Kofan Gayan	Coeducation	124	76	200
13	SIASS Karau Karau	Boys	188	-	188
14	GSS Chindit Barracks	Boys	-	89	89
15	GSS Dakace	Coeducation	45	32	77
16	GSS Kugu	Coeducation	36	25	71
17	GSS Tudun Saibu	Coeducation	48	32	80
18	GGSS Chin-Barracks	Girls	-	82	82
19	GSS Likoro	Coeducation	36	25	61
20	GGSS Zaria	Girls	-	89	89
	T0TAL		**1,953**	**1,656**	**3,609**

Source: (Zaria Education Zone, 2015)

Five schools were selected using stratified random sampling technique from the folded papers containing the names of the schools, to form the study team. The schools were GSS Kaura, GSS Tudun Saibu, GSS KofarKuyanbana, GSS Magajiya and GSS Aminu. The schools were selected based on their status as well as schools location. The selected schools are more than 10% minimum sample size recommended by Wallen (2000). One intact class from each school was used. G.S.S kaura had 50 male and 35 female totaling 85 students while G.S.S Tudun-Jukun had 63 male students and 38 females totaling 101were selected, in line with Karlinger,

(1973), Tuchkman (1975) and Franklin and Wallen, (2000). Pretest was administered to the selected schools to determine which of the schools were comparable in their ability levels using analysis of variance (ANOVA) statistical tool at $p \leq 0.05$. After the pretest the result showed that there was significant difference in which Schaffer's test was used to determine the schools that were not significantly different. G.S.S Kaura and G.S.S Tudun Jukun showed no significant difference and were picked for the study.

Table 2: Sample for the Study

Group	No of Males	No of Females	Total
Experimental	50	35	85
Control	63	38	101
	113	73	186

For the purpose of data collection three instruments were used for the study. The instruments were Quadratic Equation Performance Test (QEPT), Quadratic Equation Newman Error Diagnostic Test (QNEDT), and Modified Newman Interactive schedule (MNIS). The instruments were validated by experts in Science Education Department of Amadu Bello University Zaria. The instruments were pretested and Post-tested.

Results

The data collected from the test administered to the students were analyzed using descriptive and t-test statistics at $p \leq 0.05$ level of significance.

H_o1: Null Hypothesis One

There is no significant difference in the frequency of Newman Errors Committed by the Students in quadratic equations.

Table 5: Chi-Square results on Frequencies of Different Newman Error Types

S/N	Variable	N	F	Chi-cal	Df	P	Remark
1	Reading		11.76				
2	Comprehension		14.08				
3	Transformation		24.42				
4	Process Skill	186	25.70	16.28	5	0.01	*
5	Encoding		13.70				
6	Carelessness		10.34				

*Significant at $p \leq 0.05$

The result in Table 5, the number of Newman Error types were six, and the degree of freedom for a 6 cell data correspond to 5 which was equivalent to (N-1), where N represent the total number of error, Chi-cal was 16.28. The P value obtained was

0.010 which was less than the significant level set at p $\leq$ 0.05. The null hypothesis was therefore rejected.

H_o2: Null Hypothesis Two

There is no significant difference in the frequency of Newman errors committed by students in the solution process of quadratic equations exposed to inquiry-demonstration and lecture method.

Table 6: Chi-Square test Result on Frequencies of Newman Error Types Committed by the students in Posttest

Group	N	F	Chi-cal	Df	P	Remark
Experiment	85	33.23				
			1	17.27	0.03	*
Control	101	66.77				

*Significant at p $\leq$ 0.05

The result in Table 6: indicated that the mean frequency for experimental and control groups were 33.23 and 66.77 respectively. The p value of 0.03 was obtained less than the level of significant at p $\leq$ 0.05. Therefore, the null hypothesis three is rejected, which indicated a significant different

H_o3: Null Hypothesis Three

There is no significant difference in the frequency of Newman errors committed by male and female students in quadratic equations exposed to inquiry-demonstration method.

Table 7: Chi-Square test Result of Newman Error Types and Gender in Experimental group.

Group	N	Mean Frequency	Df	Chi-cal	P	Remark
Male	50	73.26				
			1	19.86	0.31	**
Female	35	33.23				

**Significant at p $\leq$ 0.05

The result in Table 7 shows that the mean frequencies for male and female students were 73.26 and 73.23 respectively. The calculated P value was 0.31. The result indicated p $\leq$ 0.05. Therefore; null hypothesis was retained.

H_o4: Null Hypothesis Four

There is no significant difference in the Performance among senior secondary students exposed to inquiry-demonstration and those exposed to lecture method.

Table 8: t-test Results on Student's Performance Score in Experimental and Control Groups.

Group	N	Mean	Std	df	t-cal	P-value	Remark
Experiment	85	55.93					
			238	238	-24.76	0.038	*
Control	101	20.26					

*Significant at $p \leq 0.05$

The result presented in Table 8 showed that there was no significant difference in the performance of the experimental group and control group as supported by t-cal = -24.76 at def = 238 and p-value = 0.038 less than level of significance $\alpha = 0.05$. The results indicated that there was no significant difference in the mean performance by the two groups in quadratic equation; hence null hypothesis one was reject.

Discussion of Findings

The data collected from the test administered to the students were analyzed using descriptive and t-test statistics at $p \leq 0.05$ level of significance. The results in tables 6, 7, 8 and 9 represented the results of pretest and posttest of experimental and control groups. The research questions were answered using frequency and percentage. Table 6 identified Newman errors committed by the students. Table 7 represent frequencies and percentages of Newman errors types committed by the students, process skill error recorded the highest with 25.70%, followed by Transformation errors with 24.42% while the least errors occurred in reading with 11.76% and errors committed as a result of carelessness 10.34%. Table 8 answered research question 3, where the frequency and percentage errors based on gender was presented with high errors committed by the female students. Table 9 was the results of research question 4, on the pretest and posttest experimental groups. Table 9 is the hypothesis 4 tested at 0.05 level of significant of the frequency of Newman errors using chi-square and the results indicated that there is significant difference with 0.010 probability value. The result was supported by the findings of Usman (2005) in his study on "the relationship between students' performance in practical activities and their academic achievements in integrated science using NISTEP mode of teaching" who observed that senior secondary male and female biology students will not differ significantly in their performance when exposed to innovative strategies. The findings also supported the previous studies such as that of Musa (2000), Azuka (2006), Tiawo (2007), Amoo (2010) and Martin (2011) who in their separate studies found that, the effect of laboratory teaching method for enhancing academic performance in chemistry among senior secondary school students was irrespective of gender.

Table 6 using the same technique of analysis to test for the difference in the frequency and percentage the result showed that there is significant difference

since the probability value of 0.03 was less than 0.05 level of significance. The findings supported the study of Sello (2006) who observed that students performed better when they are exposed to teaching strategies than those exposed to lecture method. Table 7 represents the results of male and female students' analyzed using chi-square test, with mean difference of 40.03. The probability value of 0.31 obtained was greater than 0.05 level of significant, which showed no significant difference on gender. Table 8 indicated a significant difference with 0.038 probability values and mean difference of 2.61, using t-test analysis on performance of students exposed to remediating package and those students taught using lecture method.

The results were in favour of experimental group, and were found to be significant at $p \leqq 0.05$. The results of table 9 identified Newman errors committed by the students in experimental and control groups. The findings were in conformity with those previous researches on Newman Errors such as the one by Effandi. Ibrahim & Sitti (2014) in their studies on analysis of students errors in the learning process of quadratic equations observed that the used of teaching strategy, inquiry-demonstration method in identifying Newman errors minimized the errors committed by the students in the learning process of quadratic equation.

Summary of Findings

The findings of the study revealed that:

1. There was a significant difference in the frequency of Newman errors committed by the students in the solution process of quadratic equations among senior secondary schools students.
2. There was a significant difference in the frequency of Newman errors committed by the students in the solution process of quadratic equations taught using inquiry-demonstration method compared to those taught using lecture method.
3. The instructional strategy inquiry-demonstration method was not gender friendly in the frequency of Newman errors committed by male and female students.
4. Inquiry-demonstration method as teaching strategy has enhances student's performance in the solution process of quadratic equation.

Conclusion

Based on the findings of the study, it was concluded that inquiry-demonstration method minimized the frequency of Newman errors and improve students' performance in Algebra among senior secondary school students in Kaduna State and Nigeria in general, that will invariably go along ways enhancing science and technology education in a dwindling economy like Nigeria.

Recommendations

Based on the findings of this study, the following recommends were made

1. The use of Inquiry-demonstration method as a teaching strategy should be encouraged in our secondary schools in order to reduce the Newman errors, improve students' performance and help in enhancing science and science education in a dwindling economy.
2. Equal opportunity should be given to both male and female students' in the used of this strategy in enhancing science and technology education in a dwindling economy.
3. Government should encouraged Professional bodies such as MAN, STAN through state ministries of education to organized training programs for teachers teaching mathematics in form of seminars, workshops and conferences focusing on the use of inquiry demonstration method. That will enhance science and technology in a dwindling economy.

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