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Effectiveness of three (3) instructional methods on students' academic achievement in basic technology in Lagos State, Nigeria

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ABSTRACT: The study was designed determined investigate the effectiveness of 3 Instructional methods on students' Academic Achievement in Basic Technology in Lagos State. A guest experimental was used for the study using random sampling technique. One hundred and seventy-four (174) Basic eight (JSS II) basic technology students was used compering 86 marks and 88 females. The instrument for Data collection are pre-test (Pre BTAT) and post-test (Post BTAT). One (1) research question and one (1) hypothesis tested at 0.05 level of Signiant guided the study. The raw ability of the Basic Technology Achievement Test (BTAT) instrument using Knitter Richardson formula (KR-20) Yielded r=0.64 Data generated were analysed using mean and analysis of variance (ANOVA). The finishing shows that simulation activity and community of inquiry have significant effect in the achievement of students. The findings show that there is significant effect on the academic achievement with in basic technology with students taught using Simulation Activities (SA) and Community of Inquiry (COI) and those taught using Conventional Teaching Method (CTM). But the overall finding, revealed that SA is a viable alternative to COI and CTM of instruction basic technology.

KEYWORDS: instructional methods, technology, academic achievement.

INTRODUCTION

Instructional Methods are the tools of teachers for reaching the set goals and objectives of the subjects. The effective teacher has multiplicity methods at its disposal and must be prepared to select the ones, which will be most effective for leading the students to the desired behaviour. Instructional methods also referred, to as techniques are ways and means adopted by teachers to direct the activities toward an objective. It is therefore a process of a effective, cognitive and psych motive development whose aim is to mould the students toward a total contribution to the development of the learner and the society at large (Durosaro, 2002). In achieving this by the teacher, there is for the teacher to improve in the instructional method, in the teaching and learning process especially in teaching basic technology.

No one can deny that schools are becoming diverse in terms of students' background and abilities and teachers are being ever more challenged to find effective methods to meet the diverse needs of their students. Educators a front classroom in which students' exhibit different academic and behavioural characteristics and they are increasingly looking for successful instructional and classroom management techniques (Touraki and Criscitiello, 2003).

With many countries eagering to educate all their citizens, education professionals are seeking research supported techniques that are applicable in classrooms and that can facilitate students' access to the mastering of concepts in basic technology. Therefore, there is need to introduce an effective and innovative integrating method that do not only create cooperative pleasant atmosphere but enhance peer relation and also brings about improve academic achievement.

The study therefore investigates the effectiveness of three instructional methods in students' Academic Achievement in Basic Technology in Lagos State Nigeria.

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STATEMENT OF THE PROBLEM

Technology is a classified body of knowledge which includes applied science and technology-based subjects. Therefore, the importance of technology in the development of any nation cannot be over emphasized, apparently technology cannot thrive without using appropriate instructional teaching methods to teach students. The recent basic technology students' result at basic 9 external Basic Education Examination (BECE, 2014) shows a decline in the students' academic achievement in basic technology.

The question is that: Does the instructional method used in teaching of basic technology affects students' achievement? This is a problem which this study intends to investigate.

PURPOSE OF THE STUDY

The purpose of this study is to investigate the relative effectiveness of instructional methods in basic 8 (JSS 2) students' academic achievement in basic technology in Lagos State, Nigeria.

Specifically, the purpose of this study sought to:

1. Find out whether there is an effect in the academic achievement in basic technology of basic 8 (JSS II) students taught using simulation Activity (SA) and community of inquiry (COI) and those taught using conventional Teaching Method (CTM).
2. Ascertain if gender has effect on Basic 8 (JSS II) students' academic achievement in basic technology.

RESEARCH QUESTIONS

Based on the research purpose, the following research questions was posed:

1. What is the effect of in the academic achievement in basic technology of basic 8 (JSS II) students' taught using simulation Activity (SA) and community of inquiry (COI) and those taught using conventional Teaching method (CTM) ?
2. What effect has gender (male & female) on basic 8 (JSS II) students' academic achievement in basic technology?

HYPOTHESIS

The following hypotheses formulated and tested at 0.05 significant level.

HO_1: There is no significant effect in the academic achievement in basic technology of basic 8 (JSS II) students involving students taught using simulation activity (SA) and community of inquiry (COI) and those taught using conventional teaching method (CTM).

HO_2: There is no significant effect on the basis of gender (male and female) on basic 8 (JSS II) students' academic achievement in basic technology.

LITERATURE REVIEW

Simulation Activity is the active involvement of the students in the learning process and facilitated their practice and mastery of concepts and principles, clearly simulation activity helped students to meet their learning objectives. Adekunle (2007) sees simulation activity as a simplified model of real-world situation which is usually used for teaching concept and principles that are not easily observable.

Wendy (2005) assented that community of inquiry is the umbrella term for a variety of educational approaches involving joint intellectual effort by students and teachers, It require a small number of students to work together on a common task, supporting and encouraging one another to improve their learning through interdependence and co-operation with one another.

Emetarom (2002) refers gender to all the characteristics and the expected behaviours and roles of men and women, which a particular society has determined and assigned each sex.

Available literature seems to confirm the fact that gender is an important variable in academic achievement of students. Olurode and Soyinbo (2001) stated that gender is significant in the understanding of development and developmental effort of a nation.

Auster and Wyler (2006) in their study find whether simulation activity method compared to traditional method of instruction can improve cognitive outcomes among students. Using a survey assessing participant perception of teaching styles, a 7 point likert scale with 50 multiple questions was then administered to 150 students. The students were group to sections. Section A: SA and section-

Traditional method. The t-test results indicate a significant difference 5.33 (D< 0.005) between classes. These results show that simulation activity method of instruction improves cognitive outcomes among students than traditional method of instruction.

In the study by Freeman, Eddy, McDanaugh, Smith, Okoroafor, Jorch and Wenderoth (2014) they reported the finding of a mean analysis of 225 studies which compared students' performance in undergraduate science technology and mathematics courses taught through traditional learning versions active learning (COI) in two outcomes variables:

1. Score on identical or equivalent exams, concepts and inventories and
2. failure rates for the purpose of analysis. The results indicate that active learning (COI) improves examination performance by approximating 6%. In addition, lecturing was found to increase failure rates by 56% (approximating 22% for active learning vs 34% for traditional sections). In conclusion community of inquiry students perform better than those in conventional teaching method students.

Ogunbiyi (2012) asserted community of inquiry strategies have been linked to open classroom situation in which each students is unique person whom is endowed with intellectual ability to think and act as both as an individual and as a group member.

Conventional Teaching Method is the commonest form of teaching used in most schools in Nigeria but the teaching is emphasized at the expense of the students as observed by Strawler and strawler (2002).

Chien (2002) also conducted an experiment on two vocational senior high classes to observe community of inquiry effect in the EFL learning group performed better than their colleagues in the traditional EFL learning group.

Chien's (2004) was in agreement to her study in 2002.

In another related study by Ying chi (2013) titled an empirical study of learning outcomes based on active (COI) versus passive (CTM) teaching styles. The aim of research was to test whether active learning method can improve cognitive outcomes of students on 300 students. The result shows mean of 2.47 and SD of 1.25 for passive/traditional teaching style whilst for the active (COI) teaching style, the results revealed mean of 2.89 and 1.04. It was concluded that active teaching (COI) approach has a greater positive influence on student learning than passive (CTM) teaching approach.

In the research work of Silmara, Fernada and Claudia (2013) which they compare a computer game based learning method with a traditional (conventional) learning method regrading learning gains and knowledge retention as a means of teaching head and neck anatomy and physiology to speech language and hearing pathology. The hypothesis is concerning the gain of knowledge. 29 students were randomized to an invention, 1 student from group 1 (GI) anatomy was excluded for not having complete the multiple choice questionnaire for the long term knowledge retention assessment; 3 students from group 11 (GII) physiology excluded for having completed the multiple choice questionnaire for the prior knowledge assessment. 13 students played the computer game and 12 students were given the traditional lecture. One-way ANOVA with two factors was used to perform between group comparisons (i.e. for the mean total scores and for the mean scores obtained in each section of questionnaire in the three moment assessment.

Bonferroni correction for multiple comparison was used to ensure 0.05 level of significance and to vary where the significant difference occurred.

The study revealed that there is no significant differences between computer based learning method and traditional (conventional) learning method.

In correlated study by Goldberg and Mckhann (2000) investigating the performance of students in a virtual learning environment to learning topics in Neuroscience and compared with that of students in conventional lecture.

The results consistently demonstrated higher test scores in the virtual learning environment as opposed to the conventional lecture, regardless of the time of the semester at which the knowledge tests were given.

Ekanem (2005) investigated students' academic achievement in business studies. She used a total of 600 Junior secondary school students (300 male and 300 female). The findings indicated that achievement mean score for the males are 25.07 as against female of 25.87. The t-calculated value shows no significant different in the mean scores. The result revealed that there is no significant difference in the academic achievement in business studies based on gender.

In another study by Joshua and Asim (2007) an average gender differences and mathematics achievement in rural senior secondary school students in Cross River state. Using stratified random sampling. Sample of 2000 students (50% male and 50% female was selected and a 30- item four option multiple difficulty was administered to the students. From option multiple difficulty was administered to the students). The result shows $0.40 < p < 0.82$. From their findings, the achievement of rural male and female students differ only for those in low socio-economic bracket and for public schools. The result also revealed that there is a significant difference between mathematics achievement of the rural male and female because t-cal value 5.43 is greater than t-value 1.645 at 0.05 level of significance at 1998 df.

Therefore, this study will investigate further if instructional method use gender has moderated variable basic 8 (JSS II) students' academic achievement in basic technology.

METHODS

An experimental method was used in the study in which 2 groups (SA & COI) received treatment while the other group (CTM) did not (control).

RESEARCH DESIGN

The research was carried out using a quasi- experimental design with two experimental groups and one control group from 3 co-educational basic secondary school in Lagos state. It made use of 3x2x2 non -randomized pre -test post- test factorial design.

The population of the study consists of 108,509 basic secondary school 8 (JSS II) basic technology students in Lagos state; which comprises 52931 boys and 55,578 girls. The sample consisted 174 (86 males and 88 females) students' in basic technology class in basic secondary schools. The sample was selected based on their school's geographical locations and 3 intact classes (8A, 8B, 8C) were purposely selected from the schools respectively.

The instrument for data collection are pre-test (PBTAT) and post-test (BTAT). A pre-test of 35 with multiple consisting of 35 choice item A-D.

INSTRUMENT

In the study, Basic technology Achievement test (BTAT) was used to measure the student's achievement. And the test was constructed based on the content of the syllabus taught the students.

VALIDITY

For the content validity of the basic technology achievement test (BTAT), the instrument is match up initial 50 questions and later adjusted to 35 questions.

RELIABILITY

Reliability on BTAT was formed using kuder Richardson 2020 and it yielded co-efficient reliability of r = 0.64.

DATA ANALYSIS

Pre-test and post-test data analysis was conducted on 174 (86 males and 88 females) with aid of statistical package for social science (SPSS). The data collected were analysed using the mean and Analysis of Variance (ANOVA). These analysis was used to determine whether there is significant effect of instructional methods on students' academic achievement in basic technology.

RESULT

Research Question 1: What effect exist in the academic achievement in basic technology of basic 8 (JSS II) students involving students taught using simulation Activity (SA) and community of inquiry (COI) and those taught using conventional Teaching Method (CTM) ? Data presented in Table 1 provide answer to research question 1.

Table 1. Mean and Standard Deviation Scores of students using Simulation Activity (SA), community of inquiry (COI) and conventional Teaching method (CTM)

Source of variation	Methods	N	Pre-test Mean	SD	Post-test Mean	SD	Mean gain	Remarks
Experimental Groups	Simulation Activity (SA)	58	20.87	5.10	28.83	4.35	7.96	
	Community of Inquiry (COI)	58	19.76	4.90	27.69	4.26	7.93	Positive effect
Control Group	Conventional Teaching Method (CTM)	58	16.00	4.13	17.26	3.87	1.26	

HYPOTHESIS I:

There is no significant effect in the Academic Achievement in Basic Technology of Basic 8 (JSS II) students taught using simulation Activity, community of inquiry and those taught using conventional Teaching method. Data presented in Table 2 provide result for hypothesis I.

Data in Table 1 shows the pre-test mean score of 2.87 and post-test mean score of 28.83 with mean gain 7.96 for SA, pre-test mean score of 19.76 and post-test mean score of 27.69 with mean gain 7.93 for COI (both experimental groups) and pre-test mean score 16.00 and post- test mean score of 17.26 with mean gain 1.26 for student taught in the control group with CTM. The results show that both simulation activity (SA) and community of inquiry (COI) have effect on the academic achievement in basic technology of Basic 8 (JSS II) students. The results reveals that both simulation activity and community of inquiry has more effect on student's academic achievement in basic technology.

Table 2. ANOVA Test of significant effect in Academic Achievement in Basic Technology of Basic 8 (JSS II) Students taught using simulation Activity (SA), community of inquiry (COI) and those taught using conventional Teaching Method (CTM).

Description Of variation	DF	Sum of squares	Mean Square	F CAL	F TAB	SIG Level	Decision
SA and COI between Treatment (Numerator)	2	2891.36	137.68				
Residual (within) Denominator	171	4225.86	27.80	4.95	3.06	0.05	Hypothesis 1 rejected
Total	173	7117.22					

Table 2 shows that the F-calculated (4.95) is greater than the f- tabulated (3.06) at 0.05 sig. level. Thus, hypothesis 1 which says there is no significant effect in academic achievement in basic technology of Basic 8 (JSS II) student involving students taught using simulation Activity, community of Inquiry and conventional teaching method is hereby rejected. This result implies that there is significant effect on the academic achievement of Basic 8 (JSS II) amongst students taught basic technology using simulation Activity, community of inquiry and those taught with conventional teaching method.

Table 3. Pre-test and Post-test Mean and Standard Deviation scores of students

Source of variation	N	Pre-test Mean	SD	Post-test Mean	SD	Mean Gain	Remarks
Male Students	86	19.40	6.41	24.08	6.91	4.68	
Female Students	88	19.83	4.85	24.99	5.90	5.16	Positive effect
Mean Difference						0.48	
Total	174						

Data in Table 3 shows that pre-test mean score of 19.40 and post-test mean score of 24.08 with mean gain 4.68 were obtained for male students with the methods while pre- test mean score of 19.83 and post- test mean score of 24.99 with mean gain of 5.16 were obtained for female students. The difference in mean gain value reveals positive effect of gender on the academic achievement in basic technology of Basic 8 (JSS II) students. The result implies that female students perform better than the counterparts in basic technology.

Table 4. ANOVA Result Test of significant effect in the basis of gender on Basic 8 (JSS II) Students Academic Achievement in Basic Technology

Modal	Sum of squares	DF	Mean Square	F	SIG	Decision
Regression	39.308	2	13.103	0.693	0.623	Ho_2 rejected
Residual	795.092	171	22.086			
Total	834.400	173				

a: predictors: (constant) Respondents' gender in SA, COI and CTM.

b. Dependent variable: Students' Academic Achievement in basic technology form the test of significance using ANOVA (Table 4), the F value 0.693 at DF 2/171 where significant value of 0.623 were calculated and found to be significant at 0.05 probability level. Thus, hypothesis 2 which says there is no significant effect on the basis of gender (male and female) on Basic 8 (JSS II) students' academic achievement in basic technology is rejected. This result implies that there is significant effect on the basis of gender (male and female) on Basic 8 (JSS II) students' academic achievement in basic technology.

SUMMARY OF FINDINGS

From the analyses of data presented, the following major findings were made:

1. The academic achievement of basic technology students taught using simulation activity and community of inquiry are greater those taught using conventional teaching method by 7.96 and 7.93 mean gain as against 1.26 mean gain of the control group (Table 1)
2. There was significant effect in the achievement in basic technology of basic 8 (JSS II) between students taught using simulation activity, community of inquiry and those taught using conventional Teaching Method. Simulation Activity (SA) proved superior to community of inquiry (CI) and conventional Teaching Method (CTM). This is indicative from its achievement mean scores showing F - cal (4.95) is greater that F- tab (3.06) at significant level of 0.05 (Table 2).
3. There is effect on the basis of gender on the students' academic achievement in basic technology, with male students having 4.68 mean gain as against 5.16 for female students resulting in mean difference of 0.48, in favour of the female students (Table 3).
4. There was significant effect on the basis gender (male and female) on Basic 8 (JSS II) students' academic achievement in basic technology using ANOVA (Table 4) which reveals F.cal value of 0.693 at DF = 2/171 where significant value of 0.623 were calculated and found out to be significant difference on the basis of gender (male and female) on students' academic achievement in basic technology with female students performing better than their male counterpart (gender performance was sex influenced).

DISCUSSION OF THE RESULTS

The data presented in Table 1 and 2 provide answers to research question one and result to hypothesis one and it shows that the null hypothesis was rejected. This means that there is significant effect on the academic achievement in basic technology of basic 8 (JSS II) amongst students taught using simulation activity, community of inquiry and those taught with conventional Teaching Method. The findings revealed that students taught basic technology with simulation Activity (SA) outperformed students taught with the community of inquiry (COI) and conventional Teaching method (CTM).

The result of this study was in line with Auster and Wyler (2006) in which they compared simulation activity method of instruction to traditional teaching method of instruction improves cognitive outcomes among students. The result was also in line with that of Donald (2004) and Anikweze (2002).

The effect of community of inquiry cannot be overlooked because it has a close link with simulation activity. In a study by Freeman, Eddy, MCdanaugh, Smith, Okoroafor, Jorch, and Wenderoth (2014) they stated that community of inquiry method of instruction improves examination performance as it helps the students to develop logic reasoning irrespective of their ages. This is also in line with Brad (2006), Ogunbiyi (2012) and Ying chi (2013).

This data presented in Table 3 and 4 provided answers to research question 2 and result to hypothesis 3 and shows that the null hypothesis that states there is no significant effect on the basis of gender on basic 8 (JSS II) students' academic achievement in basic technology was rejected. The findings of this study is in line with Ekemem (2008) which shows sex effect in business studies academic achievement. The study findings differ from Joshua and Asim (2007) in which they found no gender difference between mathematics achievement of the rural male and female.

CONCLUSION

The study was to investigate the effect of instructional methods (SA, COI AND CTM) on students' academic achievement in basic technology in Lagos state, Nigeria. In the conduct of the study, the researcher took into consideration gender (male and female) as a moderator variable which could influence the dependent variables.

Based on the findings, it was concluded that there is significant effect of instructional methods on students' academic achievement in basic technology. The results show that simulation Activity is a viable alternative to community of inquiry and conventional teaching method of instruction in basic technology. Simulation activity method of instruction gives basic technology teachers opportunity to engage students in real world of classroom exercise.

In addition, there are gender differences in students' academic achievement when the students are taught with the instructional methods.

RECOMMENDATIONS

Further research work and more empirical studies could be beneficial to obtain a compete vision of simulation activity and community of inquiry method of instruction. Moreover, it is substantial for basic technology teachers to use new and innovative learning strategies and methodologies which can create an avenue to teaching and learning of basic technology to more convenient for the students which can reduce the poor achievement in basic technology in basic secondary schools.

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