EFFECT OF ACTIVITY-BASED TEACHING STRATEGY ON STUDENT'S ACADEMIC ACHIEVEMENT IN BASIC SCIENCE IN OYO STATE, NIGERIA

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Abstract

This study investigated the effects of activity-based teaching strategy as determinants of students' academic achievement in Basic science in Oyo State Nigeria. A pretest-posttest control group quasi experimental design was employed in the study. The treatments were at two levels: Activity based and Conventional strategy. The moderating effects of gender was also examined. Total number of 260 students' obtained from intact classes of the six selected schools participated in the study. Three instruments were used. The data collected were analyzed using Analysis of covariance (ANCOVA) at alpha level of $p<0.05$. Estimated Marginal Mean (EMM) of different groups were also determined and Bonferroni Post-hoc was used to obtain significant main effects. The results revealed that the treatment innovative teaching strategy found to have significant effects on students' academic achievement ($F_{(2,249)} = 20.383$; $p<0.05$, partial $\eta^2 = 0.150$). The students exposed to the treatment obtained a higher post- achievement mean score 23.40 for discovery group followed by guided enquiry strategy group 22.50, while the conventional strategy (CS) control group had the least adjusted post-achievement mean score in basic science with 12.72. It was concluded that the innovative teaching strategy enhance students' achievement. Based on the findings of this study, it was recommended that the Ministry of Education and other education stakeholders should put in place seminars and workshop for secondary school basic science teachers as yearly training programmes to introduce and demonstrate diverse innovative strategies.

Introduction

Science defined as an intellectual activities carried out by scientists designed to discover information about the natural world in which we live and to discover ways in which this information can be organized to benefit human race. In this respect, the focus of science is to collect data and the ultimate purpose is to discern order that exists in natural phenomena and happenings around us. This philosophy hinges on a perspective which portrays and projects science as a core curriculum package designed to exhibit science as a unified knowledge framework which must emphasize not only its relevance to technology and societal advancement but also capitalizes on instructional projections which need to establish it as a necessary instrument for creating a very strong basis for human development and advancement in all their ramifications (Sani 2015, Woolman, 2001).

The world is confronted daily with issues that require a scientific way of thinking for informed discussion, management and sharing of resources such as water and vegetation (Olasihinde and Olatoye 2014). Dahiru (2010) indicates that science by its nature opposes teachers' domination and cannot be taught through the chalk-and-talk method. Olatoye (2014) opined that science education lays the foundation for work in a science-related field by equipping learners with certain

knowledge, skills and attitudes. Dahiru (2010) maintained that science teaching involves various activities which includes project work, small group discussions, demonstrations, activity-based teaching methods, lectures and a host of other verbal and non-verbal activities. Science education also is an indispensable arm of general education. It is an instrument for industrialization and growth and as such should be made more functional (Ezekwe 1995). Dahiru (2010) opined that; countries with more economic and military powers are those with highly developed science and technology, while those with immense human and natural resources but without development in science and technology remain poor. This implies that science education is vital for the development of any nation, including Nigeria. To learn science, students must be self-invested in the learning process. They must be self-aware and more self-motivated; they must recognize why learning science is useful and important.

At junior secondary school level integrated science was introduced for the purpose of giving foundation skills and knowledge for subsequent science studies at the higher level (Isa, 2000). The acquisition of appropriate skills and the development of mental, physical and social abilities and competencies for the individual to live in and contribute to the development of the society in which he lives, has been a major concern of Basic science. The subject views nature in a holistic approach and this makes it a discipline in its own right. Integrated science (now Basic Science) was introduced to Nigerian secondary schools in 1972 at the junior secondary school level as a result of the outcome of Science Teachers Association of Nigeria (STAN).

Also the Primary Reference Committee of the Joint Consultative Committee (JCC) set up a panel to produce a core "core-curriculum" for integrated science and look into the three (3) sciences i.e. Biology, Chemistry and Physics. Recently, there was a trend from Integrated Science to Basic science following the Nigeria Educational Research and Development Councils (2007) decision to re-structure the Basic Education Programme to the 9-year

Basic Education Programme in order to attain the Millennium Development Goals (MDGs) by 2015. It became imperative that the existing curricula for Primary and Junior Secondary School should be reviewed, restructured and realigned to fit a 9-year basic education programme and the upper basic education curriculum is for JSS 1-3 level. Basic Science concepts is generally geared towards technological development and appropriate strategy for the acquisition of relevant skills needed for meaningful learning of science concepts.

Various studies such as those of Akale (1992) and Usman, (2007) have shown that teachers of Basic Science are not qualified and this in turn affects academic performance. One major problem of the teachers is their inability to use appropriate activity based teaching strategy. They often resort to traditional, lecture method that has been shown to lead to poor academic performance in Junior Secondary Schools, (Maduabun 1990, Akale 1992, Usman 2007). Despite of the Federal Government of Nigeria's encouragement in the teaching of Basic science in Nigerian schools by providing both moral and financial support, e.g. the establishment of National Science and Technology Fund (1998). National Policy on Education Federal Republic of Nigeria (FRN, 2008). Science is still presented to pupils as facts that young people are expected to memorize, thus less emphasis is placed on science processes and practical application of science which makes science more relevant to the needs and aspiration of the society]. Fisher (2001) feels that science suffers from pedagogical deficiency as a result of which most people cannot see the connection between the scientific knowledge they learn and daily life.

This study is therefore an attempt to fill the foregoing gaps mentioned above in the use of traditional methods in science teaching. In other words, the paradigm shift away from teaching to an emphasis on learning is to encourage power to be moved from the teacher to the student (Mokiwa 2014). This development is in contrast to traditional forms of teaching in which an educator lectures, or otherwise relays information to students who are expected to

absorb what they are told. In activity-based learning, an educator serves the function of a facilitator, assisting students through the learning process, and providing them with guidance. Various actions and tasks can be used in this type of programme, allowing students to become directly involved in the learning process rather than remaining passive. This is often accomplished through the creation of different activities and projects that students work on as they learn.

Garba (2012) reveals that group work is quite common during activity-based learning, since it allows students to take on the role of educator and work together to better understand different subjects. Under these circumstances, students work together in small groups to accomplish particular project tasks. Each group presents information learned after performing the tasks assigned to it to the rest of the class. Garba (2012) advances the view that the activity-based learning pedagogy aims to enrich students with practice and concepts with methods, using data and insight they have obtained through engagement with the larger world.

Apart from exploring the assets of effective instructional strategies that are rooted in the activity-based learning approach, science educators are also faced with the problem of attracting girls to science (Bichi 2008). The issue of gender differences and achievements, particularly in schools, is far from being resolved. This frame of thought has led to the emergence of such innovative projects as "GIST" (Girls Into Science and Technology) and WISE (Women in Science and Education) that have been designed to examine ways of making science more girl-friendly. Researchers on differential gender achievements in science (Muhammed 2007) have attempted to link this predicament to a number of factors such as, (a) gender role model orientation and educational background of parents; (b) peer group expectations; and (c) extracurricular class activities. One of the major objectives of this study is to find out whether the use of activity-based instructional methods would enhance and improve students' academic performance in science. The study is also aimed at finding out whether the activity-based method of teaching Science produces differential effects amongst male and female students.

Statement of the problem

Low performance ranges from inability of teachers to use students-center method, lack of instructional materials to teach science and the teachers inability to achieve effectiveness in curriculum delivery as a result of a lack of in-depth knowledge of science in totality. Thus, it is apparent that the problem exists in the teaching and learning of science. The concern of this study therefore is to investigate whether the use of an activity-based instructional method could enhance students' academic performance in science at the junior secondary school level, and also to determine the effects of gender in academic performance of students taught science concepts through the use of an activity-based method. Considering the slow progress and low status of technological development in Oyo State of Nigeria, it has become necessary to re-assess the status of the strategies employed in teaching science and technology to future generations to determine their efficacy and worthwhileness. The current rate of failure, especially in science subjects, shows a serious and fundamental flaw in the background knowledge amongst students in the sciences.

Hypotheses

The following research hypothesis were formulated to guide the study:

1. Ho_1: There is no significant main effect of treatment on students' on academic achievement in Basic Science?
2. Ho_2: There is no significant main effect on activity-based mean achievement of male and female students in Basic Science?

Methodology

The adopted quasi experimental with pretest, posttest experimental and control groups. In the design, both the experimental and the control groups were pre-tested to ensure group equivalence, thereafter exposed to treatment for 2 weeks and at the end of

which post-test was administered to determine students' achievement.

Sample Selection and Sampling Techniques
The population for this study comprised all JSS2 Basic Science Oyo State. A simple random sampling was used to select three Local Government Area from the thirty three Local Government Areas of Oyo State. Two schools were purposively selected from each of the local government area understudy, three schools for the experimental groups and three schools for the control group. Intact classes were used for this study in which all classes were randomly selected this study adopted a pretest-posttest control group quasi-experimental design.
The following criteria were used in selecting two (2) schools used for this study:
-   The schools should be a co-educational school.
-   Accessibility of the school.
-   Evidence of presenting students for Basic Education Certificate Examination (BECE) in Basic Science for at least ten (10) years.

Research Instruments
The following instruments were used in this study:
-   Basic Science Achievement Test (BSAT)
-   Teacher's Instructional Guide on Activity Based Instructional Strategy (TIGABIS)S

-   Teacher's Instructional Guide on Conventional Strategy (TIGCS)

Validation of BSAT
The BSAT was given to three experienced science education lecturers for scrutiny and their suggestions, were used to modify the final version of the instrument. The reliability coefficient of the instrument was determined using Kuder-Richardson 20 and the reliability coefficient of 0.77 was obtained.

Research Procedure
BSAT was administered to participants as pre-test on the first day of the study. Treatment condition for each groups took place for four weeks. The two groups of students were taught the same topics, different instructional strategies by the research assistants. The experimental group was taught with activity based instructional strategy while the control group was taught using conventional method. At the end of the research exercise, students in the experimental and control groups were all subjected to BSAT.

Data Analysis
The data collected were analyzed using Analysis of covariance (ANCOVA) to determine the significant main effects, Estimated Marginal Mean (EMM) to different groups was used to detect the magnitude and the direction of difference and Bonferroni Post-hoc was used where significant main effects were obtained.

Results
Ho_1: There is no significant main effect of treatment on students' achievement in Basic science.

Table 1. Analysis of Covariance (ANCOVA) of Post-Achievement by Treatment and Gender

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	500.379a	6	100.063	8.186	.000	.160
Intercept	1235.679	1	2347.669	192.059	.000	.546
Pretest Achievement	3.272	1	3.272	.260	.605	.021
Treatment	476.309	2	238.155	20.383	.000*	.150
Gender	29.573	1	29.573	2.419	.121	.010
Treatment Gender	54.109	2	28.054	2.213	.112	.018
Error	2921.462	239	13.224			
Total	31277.000	260				
Corrected Total	3521.841	259				

R Squared = .160 (Adjusted R Squared = .150)

Table 1 shows that there is a significant main effect of treatment on students' achievement in Basic Science ($F_{(2,249)}$ =20.383; $p<0.05$, partial $\eta^2 = 0.150$). The effect is 15.0%. This implies that 14.0% variation in students' achievement in Basic Science is accounted for by the treatment. Thus, hypothesis 1 was rejected. In order to determine the magnitude of the significant main effect across treatment groups, the estimated marginal means of the treatment groups was carried out and the result is presented in Table 2.

Table 2: Estimated Marginal Means for Post-Achievement by Treatment, Gender and Control group

Treatment	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Activity Based Teaching Strategy(ABTS)	29.50	.359	18.897	21.311
Conventional Strategy (CS)	13.82	.367	10.098	12.544

Table 2 reveals that students in Activity Based Teaching Strategy (ABTS) treatment Group had the highest adjusted post-achievement mean score in Basic Science (29.50) while the Conventional Strategy (CS) control Group had the least adjusted post-achievement mean scores in Basic Science (13.82). This order can be represented as ABTS> CS.

Table 3: Bonferroni Post-hoc Analysis of Post-Achievement by Treatment and Control Group

Treatment	Mean	ABTS	CS
Activity Based Teaching Strategy(ABTS)	29.50		*
Conventional Strategy (CS)	13.82	*	

Table 3 reveals that, students exposed to Activity Based Teaching Strategy (ABTS) were significantly different from those taught using conventional strategy. This implies that the significant difference is as a result of difference between the treatment and the control group but not between the two treatment groups as far as post-achievement is concerned.

Ho$_2$: There is no significant main effect on activity-based mean achievement of Male and Female students in Basic Science?

Result of Analysis of Covariance of Male and Female Basic Science Students' Achievement Exposed to Activity Based Teaching Strategy

Source of Variation	Sum of Square	Df	Mean Square	F	Sig
Corrected Model	3589.121	2	1710.210	50.009	.000
Intercept	5310.090	1	5310.090	97.107	.000
Pretest	3201.002	1	3201.002	69.083	.000
Group*Gender	697.341	1	697.341	41.011	.000
Error	2411.001	60			
Total	20365.484	65			

Ho$_2$: There is no significant main effects of treatment on gender in basic science Table 4 shows that the ANCOVA test is $F = 41.011$, $p <0.05$. This implies that there is a significant difference in the achievement of male and female Basic Science students exposed to Activity based instructional strategy. Therefore, the hypothesis was rejected.

Discussion of Findings

The findings of the study revealed significant difference in the achievement score of the students' in selected Basic science concepts across the two level of experimental groups. Students' exposed to the Activity based learning strategy had higher achievement scores than their counterparts in the control group.

The findings showed that the experimental strategies are more viable than conventional method in improving students' achievement in Basic science in junior secondary school.

The result is in support of the findings Dawaki, (2012), conducted research on the effects of an activity-based instructional strategy and the traditional method on the academic performance of students in Integrated Science in junior secondary schools in Kaduna North Local Government Area, Kaduna State, Nigeria. As in this current study, Dawaki employed a quasi-experimental research design, where pre-tests and post-test were administered to the population. His finding revealed that students who were exposed to an activity-based learning design performed better than their counterparts who were taught through the use of expository methods.

This finding agrees with that of Abdullahi (2005) and Usman (2000) who reported that the conventional lecture method used by most teachers is inferior in promoting effective learning. Teachers use it only for easy coverage of the school syllabus, teacher being active while students are always passive learners. It is further characterized by one – way flow of information and encourages rote learning and yields little retention. Meaningful and concretely learned concepts by students are always retained and even coded in the memory for easy recall when the need arises. Similarly, in line with the finding Ahmed & Oyasola, (2018) study on effect of concept mapping on students' academic achievement with 246 students, the study reveals that concept mapping has a positive and greater effect on students' achievement in Basic science.

The finding support with Nzewi, (2008) submits that the use of an activity-based teaching strategy (ABTS) for Biology courses is associated with students' improvements in their academic achievement. On the issue of gender in relation to academic in disagreement with Saleh (2017), in his research on the impact of an activity-based teaching strategy on students' academic achievement and anxiety in physics at senior secondary schools in Katsina Metropolis revealed that female students who were exposed to an activity-based teaching method (ABTM), like their male counterparts, performed better than these males academically.

Also this finding agrees with that of Abimbola in Stanley (2008) who observed that the type of instructional strategy used does not discriminate between male or female. Therefore, the Activity-Based teaching strategy is gender friendly as far as this study is concerned. Concrete and meaningful learning appears to be gender-friendly.

Conclusion

The result of the study have shown that activity-based teaching strategies are more effective in enhancing students' level of achievement in Basic science than that the conventional strategy. The aim of teaching is not only to transmit information but also to transform passive students into active receptors of knowledge and constructor of their own knowledge. The use of activity-based teaching and learning strategies in educational institutions has the potential to improve achievement, empower students and galvanize the effort to achieve the human development goals for the country. There are no gender and location disparity in the student responses to activity –based teaching in Basic science concept.

Recommendations

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

1. Teacher should be discouraged from using teacher-center instructional strategy in Basic science but rather, activity-based teaching strategy where students' would be actively involved in the art teaching and learning.

2. Students' should be encouraged to cooperate with their teachers when this strategies is being used.
3. The Ministry of Education, Federal Republic of Nigeria should put in place seminars and workshop for secondary school basic science teachers as yearly training programmes to introduce and demonstrate diverse innovative strategies.

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