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EFFECT OF ACTIVITY BASED TEACHING STRATEGY ON STUDENTS' ACHIEVEMENT OF SECONDARY SCHOOL STUDENTS' IN CHEMISTRY

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Abstract: *The high rates of failure recorded by students in public schools have been a major concern to researchers. Consequently, the poor achievement in chemistry had been traced to conventional strategy that did not put into consideration the students' activity in teaching and learning process. The research concerns itself with the effect of activity based teaching strategy on students 'achievement of secondary school students' in chemistry.. The moderating effects of gender were also being examined. The study adopted a pretest, posttest, control group, quasi-experimental research design. Five instruments used in the study were: Students Chemistry Achievement Test (SCAT). Instructional guide on Activity based teaching (IGABT). Instructional Guide on Conventional Strategy in Chemistry (IGACSC). Evaluation sheets for assessing teacher performance on the strategies (ESATPS) on Activity based Strategy, and ESAT on Modified Conventional Strategy. Two null hypotheses were tested at 0.05 alpha levels. Data was analysed using ANCOVA Treatment had significant effect on subjects' post-test achievement scores (F(2,369)=35.248; partial squared =.160). Activity based teaching Strategy was significantly difference from Modified Conventional Strategy in their achievement scores. It was recommended that teachers should facilitate the use of Activity based teaching strategy in schools to improve their achievement in the subject.*

Keywords: Activity Based Strategy, Conventional Strategy, Achievement and Chemistry

Introduction

Chemistry is one of the basic science subjects needed for sustainable development. Its knowledge is important in the manufacturing of fertilizer, insecticides, food processing and storage, management of our natural resources, provision of food and health facilities as well as favorable living environment. And it provides a natural link between home and school and the means through which student understand the world around them and explore the wider implications of science in relation to man. The specific objectives to be achieved for chemistry in the curriculum as stated in the Nigerian Educational Research and Development Council, (NERDC 2007) includes; provide students with the basic knowledge in chemical concepts and principles through efficient selection of content and sequential; show chemistry and its inter-relationship with other subjects; provide a course which is complete for students not to proceeding to higher education while at the same time provides a reasonable adequate foundation for a post secondary school chemistry course. Literature is however replete with evidence that Nigerian students do not only find science subjects very difficult but uninteresting and that the few students that enroll

for science, sometimes perform poorly as exemplified in their consistent poor performance in school certificate examinations. The factors that hindered Chemistry achievement include students' background problems, students' lack of interest and/or negative attitude towards Chemistry, teacher related factors like poor teacher preparation, inadequate qualified Chemistry teachers, inadequate instructional materials and poor teaching methods (Usman and Memeh, 2007). Nigeria efforts are being made by researchers, government and nongovernmental organisations to improve cognitive, affective and psychomotor learning outcomes in Chemistry. For instance, a good number of research efforts have been made to diagnose the problem associated with the teaching and learning of Chemistry in order to proffer solution that leads to better achievement. Chemistry as a core science subject is needed as a pre-requisite to study any science or technological related discipline such as medicine, pharmacy, engineering, agriculture and all other science professions. To this end, the importance of improving on the teaching strategy of Chemistry in senior secondary schools towards students' achievement in and attitude to Chemistry cannot be over-emphasized. Chemistry is introduced into the curriculum content of secondary schools because of its educational value and relevance to the needs of the individual learner and society as a whole. Literature is however replete with evidence that Nigerian students do find science subjects (especially Chemistry) very difficult and uninteresting, hence the few students that enroll for science, sometimes perform poorly in Secondary School Certificate Examinations (SSCE).

Table 1: Statistics of Senior Secondary Chemistry Results by Grades for all Senior Secondary Certificate Examinations (2000-2013).

Year	Number of Candidates registered	% credit (1-6)	% Pass (7-8)	% Fail
2000	160953	24.52	30.23	45.25
2001	301740	23.42	29.82	46.76
2002	262824	20.94	25.61	53.45
2003	282120	24.62	28.54	46.84
2004	269774	38.94	28.30	32.76
2005	349996	50.91	21.81	27.28
2006	308104	55.34	14.55	30.11
2007	424747	46.16	24.81	26.49
2008	456980	44.37	27.13	26.10
2009	467612	43.49	26.65	22.82
2010	465643	50.80	24.11	22.14
2011	565668	48.95	26.94	24.11
2012	627025	44.36	31.52	24.11
2013	639104	74.34	15.20	9.78

Source: Department of Statistics West African Examination Council (WAEC), Lagos.

From Table 1, the number of percentage credit passes and above in Chemistry continues to fall below 50% for the period of fourteen years reviewed, although grade 7 and 8 are considered to be Pass but these are not good enough for candidates securing admission into tertiary institutions.

Figure Below shows the interpretation of Table 1.1 in which grades 7 and 8 are considered as failure.

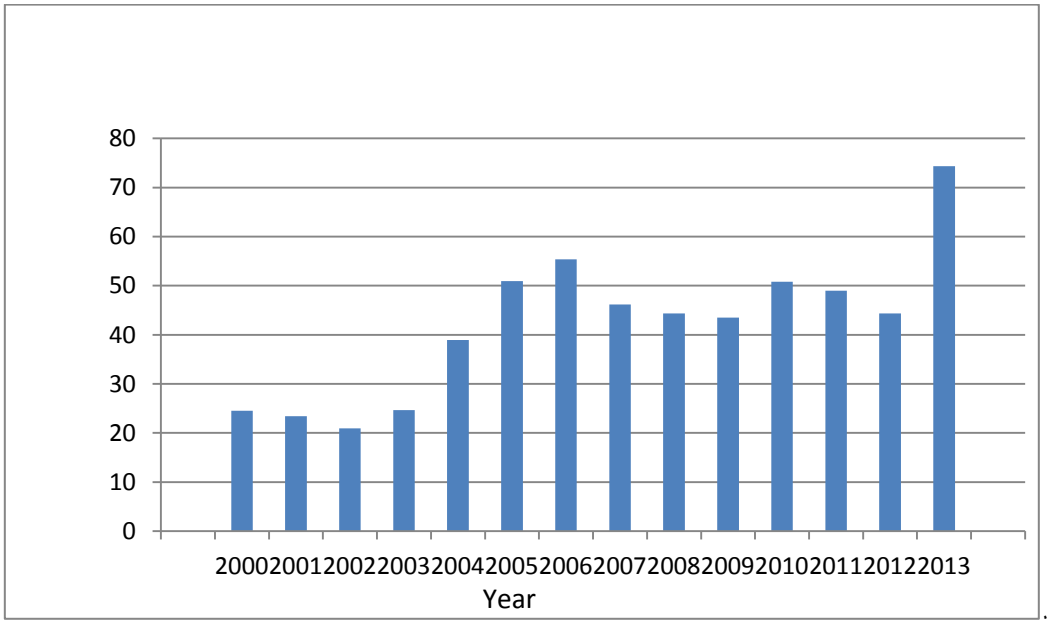

Figure 1: Percentage Passes in Chemistry SSCE May/June 2000 to 2013

These percentage passes for the year 2000 to 2013 apart from 2005, 2006, 2010 and 2013 are not good enough especially for candidates that want to study Chemistry and Chemistry-based courses or for any candidate that may include Chemistry as one of the relevant five subject passed at credit level in order to be admitted into any higher institution in Nigeria. Consequently, the high percentage of the candidates who failed SSCE in 2000 to 2013 is becoming worrisome. The fluctuation in achievement of learners in Chemistry has been variously explained. Abimbola (2013) concluded that the percentage of candidates' admitted for science and science-based courses did not reach 20 percent during this period (2000-2013), except 1998/1999 academic session when it was 23.09 percent. However, there has been concern about the fallen standard of science education at the secondary schools in Nigeria. Jegede (2009) have reported on the fallen standard of science teaching in Nigeria. He identified some factors hindering students understanding and achievement in science subject. Among these factors is the use of inappropriate and non-effective teaching methodology. The major opposition in the system of education is that science is presented dogmatically in most schools as series of disjoint facts and concepts which students find difficult to relate to real world (Oludipe,

2009). According to Chief Examiners report of 2008-2012 on Chemistry result which indicates that students are weak in observation, identification of problems, lack recording and mathematical skills with poor practical/experimental exposure, also, due to abstractness in some physical Chemistry concepts in the SSCE Chemistry syllabus such as chemical reactions, ionic equations, redox reactions (Oxidation-Reduction) and ionic theory. The report confirmed that there was no improvement of candidates when compared to previous year. This situation of fluctuation in performance in Chemistry has affected the education pursuits and aborted the ambition of many candidates who aspired to study professional courses like Medicine, Pharmacy Chemistry, and Chemistry education and so on. Several studies have been conducted in and outside of Nigeria to investigate the causes of students under-achievement in Chemistry and other science subjects (Adegoke, 2002) and the most recurring factor in all the reports is the inefficient teaching strategy employed by secondary school teachers, which is the conventional teaching strategy (lecture method). The achievement of students in Chemistry is also reported to be casually influenced by the previous experience of the students in basic science. A student cannot learn Chemistry effectively without going through some experiences in basic science (Adeosji,2002). Chemistry teaching can only be result oriented when students are willing and the teachers are favourably disposed, using appropriate methods and resources in teaching the students with the current increase in scientific knowledge the world over, much demand is placed, and emphasis is laid on the teacher, the learner, the curriculum and the environment in the whole process of teaching and learning of science. Despite the importance of Chemistry to mankind and the efforts of the researchers to improve on its teaching and learning, the achievement of students in the subject remains low in Nigeria. Among the factors that have been identified as students learning outcomes in Chemistry are; poor methods of instructions (Adeyegbe, 2005).There are varieties of methods and materials that can be employed to educate secondary schools students in Chemistry, such as Demonstration, Guided Discovery, to mention a few. Activity based method guides learners to discover facts for them selves. Abah (2006) advised that for effective teaching to occur, the teacher should get the learners involved as much as possible in activities that will enable them to develop that needed process skills and attitudes relevant to scientific life.

Active learning techniques are being used with increasing frequency as a means to engage students in their own learning. The use of active learning in the classroom spans a continuum, ranging from the occasional use of problems for students to solve, to the extensive use of discussions, problems, or other activities in a class. The instructor's role is to guide the students, walking around the room and probing them with questions to check their understanding (Hanson 2005). This approach replaces a traditional teacher-centered model with a new student-centered model. A Meta analysis of the effectiveness of activity based strategy by Abah (2006) suggested that students may acquire more knowledge in short term when taught conventionally but are likely to retain knowledge longer when taught with Activity based method. Gallagher (2003) concluded in his study that activity based method is more effective than traditional instruction that its result in

better long-term retention than traditional strategies of teaching. Teachers roles in constructivist teaching is to serve as facilitator of learning in which students are encouraged to be responsible, autonomous and construct their own understanding of each of the scientific concept. Hence, the activities are learner-centered, democratic and interactive. In constructivist classroom, the teacher facilitates and provides students with experiences that allow them to use the science process skills such as observing, measuring, classifying, communicating, inferring, using number, using space/time relationship, questioning, controlling and manipulating variable, hypothesizing, defining operationally, formulating models, designing experiment and interpreting data. Concerning gender effect, Dios (2009) revealed that there was no significant difference between girls and boys with respect to achievement in life sciences. Moreover, Westwood (2008) reported that no significant gender difference in Jamaican eighth-grade students' performance. Furthermore, Yenilmez, (2006) reported that boys and girls achieve equally on this standardized measure until the middle school years, when boys begin to have an advantage that lasts through high school. On the other hand, other studies reported that there was a significant gender difference regarding science achievement (Young and Fraser, 2006). For example, Young and Fraser (2006) revealed significant gender differences in chemistry achievement in favor of the boys. Soyibo, (2004) reported that girls performed at significantly higher levels on tasks where the content was drawn from the biological sciences and those written tasks assessing science skills. Boys, however, were found to have greater success in the physical sciences. Girls had significantly higher achievement than boys, regarding students' achievement.

Statement of the Problem

Poor approach to teaching which invariably translates to students' poor performance and inability to put practice what is learnt in reality has become a hydra-headed problem. In most cases what is taught in classroom cannot be transferred to real life situation by students. Hence the need to find pedagogical approaches that promotes active learning. Therefore, there is need to conduct a study to examine the effect of activity based teaching strategy on secondary school students' achievement in chemistry.

Hypotheses

The following null hypotheses are formulated and will be tested at 0.05 level of significant:

HO_1: There is no significant main effect of treatment on students' Achievement in chemistry.

HO_2: There is no significant main effect of gender on students' Achievement in chemistry

Methodology

In this study, a pretest, posttest, control group quasi-experimental design was adopted using a 2x3x2 factorial matrix. The target population for the study includes the entire senior secondary school class two chemistry students in two local governments in Lagos

state. Six schools are randomly selected from all the schools in the local government. The criteria for selections were based on :

1. Chemistry laboratory: School chosen must have functional chemistry laboratory and at least a laboratory attendant.
2. Age of the school: All school above 30years of existence will be considered.
3. Co-Educational: Mixed schools were included in the sample.

Instruments

The following instruments will be used in the study.

1. Students chemistry Achievement Test (STAT)
2. Instructional Guide on Activity-Based Strategy in Chemistry (IGABSC)
3. Instructional Guide on conventional Teaching Strategy (IGCTS)
4. Evaluation Sheet for Assessing Teachers Performance on Activity-Based Strategy
5. Evaluation Sheet for Assessing Teachers Performance on Conventional Teaching Strategy

Students Chemistry Achievement Test (SCAT)

The researcher constructed Student Chemistry Achievement Test (SCAT) based on electrolysis. It consists of two sections, A and B. section A seeks for personal information on the students with respect to name of the school, gender, and age while Section B consists of the achievement test made up of 30 items. Each of the items was followed by (4) option (A-D) from which the students select the correct alternative. The scoring criteria of the pre test and post test was one mark for each question got right.

Table 2: Specification for SCAT

Concepts	Knowledge	Comprehension	Thinking	Total
Electrolysis	5, 9	15, 18	16, 3	6
Ionic theory	6, 7	19	10	4
Electrolytes &non electrolytes	2, 8, 14	1, 13	17, 20	7
Laws of electrolysis	11		4, 12	3
Total	**8**	**5**	**7**	**20**

Validation of SCAT

The test was given to four experience chemistry secondary school teachers and one expert in the area of measurement and evaluation and necessary amendments made according to their suggestion. The questions were reduced to 20. This was administered to 20 students in the area that was not part of the study. This was analyzed using Kuder Richardson formula (KR21) and the reliability index was 0.86.

Teachers Instructional Guide on Activity-based Strategy (TIGABS)

The instrument consists of lesson guide on electrolysis in chemistry, using the following procedure:

1. A specific plan outlining the necessary instructional procedures for the effective implementation of each lesson of the series,
2. Supportive background information to assist teachers in their own understanding of the physical concepts,
3. Questions to explore common applications of the concepts, and
4. Test questions for the assessment of student understanding.

Validation of Teacher's Instructional Guides (TIG)

The draft of the instructional was sent to five experience chemistry teachers who were seasoned on WAEC and NECO examiner, based on their comments and suggestions, necessary amendments were made.

Teachers Instructional Guide on Conventional Teaching Strategy (TIGCTS)

The instrument consisted of lesson guides on the topic on electrolysis in Chemistry, using the following procedure:

(i) Teacher introduces the lesson by asking questions based on their previous knowledge.
(ii) Teacher presents the instructional aids and explains the contents of the lesson.
(iii) Teacher asks some question to evaluate the students.
(iv) Teacher asks students to write the chalkboard summary on their notebooks.
(v) Teacher gives assignments

Evaluation Sheet for Assessing Teachers Performance (ESATP)

The researcher requested the teachers to give demonstration lesson which was assessed by the researcher using the evaluation sheet for assessing teachers' performance (ESATP), to ensure teachers strict compliance to the guide.

Procedure for Data Collection

The researcher first administers pre-attitudinal test to the students and score were recorded. The researcher then exposes the Experimental Group to Electrolysis in chemistry using Activity-based strategy for four weeks. The control group was also subjected to conventional lecture strategy for four weeks.

Schedule of Work

The study schedule of work was as follows:

1. Training of Teachers- 1 week
2. Pretest of all instruments- 1 week
3. Treatment- 4 weeks
4. Post test- 1 week.

Pre Test

The researcher administered the pre test to the students:, the pretest on students' chemistry achievement test, SCAT was later used in comparison with the post test.

Treatment

Experimental Group one (Activity-Based)

The student carefully read to discover what they are asked to do. By this they discover what facts are given to them. They then develop appropriate plan to solve the problem. The student carefully write down the steps involve (comprehension, analysis, and demonstration), make classification, manipulate data. They recheck each step and make sure that correct reactions are used and correct figures were substituted.

Control Group

The control group was taught using conventional strategy, that is the usual classroom teaching based on electrolysis. The treatment for both experimental and control group lasted for 4 weeks in each of the school.

Post Test

After the treatment SCAT was again administered after it has been re-arranged to the students as post test and scores recorded

Data Analysis

Data were analyzed using ANCOVA (Analysis of Covariance), Multiple Classification Analysis and Post-hoc test. ANCOVA will be used to determine significant main effect and interaction effects. Multiple Classification Analysis was used to find out the magnitude of the difference among groups,

Result

HO_1: There is no significant main effect of treatment on students' achievement in chemistry.

Table 3 represent the summary of ANCOVA results on subjects' post test achievement scores

Table 3: 2x3x2 ANCOVA Post-Test Achievement Scores of Students by Treatment, Parent Educational Qualification and Gender

Source	Sum of Squares	DF	Mean Square	F	Sig.	Eta Square
Main Effect:	1315.969	18	73.109	20.066	.000	.494
Pretest Achievement in Chemistry	1000.392	1	1000.392	274.574	.000	.426
Treatment groups	256.850	2	128.425	35.248	.000	.160
Gender	11.738	2	5.869	1.611	.201	.009
Parent education	20.656	1	20.656	5.669	.180	.015
Explained	1315.969	18	3.643			
Residual	1348.073	370				.
Total	2664.041	388				

Table 3 revealed that treatment had significant effect on subjects' post-test achievement scores (F(2,369)=35.248; partial squared =.160). The effect size of 16% was fair. The hypothesis was therefore rejected. On the basis of these findings, hypothesis 1a was rejected. To find out the magnitude of the mean scores of the groups performance. Table 3 is represented as follows.

Table 4: Estimated Marginal Mean Scores of the Treatment Groups' Performance.

	Mean	Std. Error	Upper Bound	Lower Bound
Activity- based strategy	14.62	0.62	16.89	12.35
Modified Conventional	13.08	0.72	14.08	12.08

Table 4: Revealed that students in the Active based strategy group had the highest adjusted posttest mean achievement scores ($\bar{X}$=14.62) while students in the modified conventional strategy group had the lower adjusted mean achievement scores ($\bar{X}$=13.08).

HO_2: There is no significant main effect of gender on students' achievement in chemistry.

Table 5 revealed that Parent Educational qualification had no significant effect on the students achievement ($F_{(2,369)}$=1.611) Partial et squared .009) the effect size of 00.9% was negligible. Therefore, hypothesis 2 was not rejected.

Table 5: Estimated Marginal means of post test Achievement score by gender group.

	Mean	Std. Error	Upper Bound	Lower Bound
Male	13.96	0.54	15.02	12.90
Female	14.23	0.44	15.18	13.28

From table 5 Female group had higher mean of 14.23 while lower mean of 13.96 which comes from male group, but the difference in their means scores was not significant.

Discussion, Educational Implications, Recommandations And Conclusion

Discussion

The result obtained has shown that students learn better when they are consciously involved in the teaching and learning process rather than a situation whereby the teacher is more active in the teaching and learning process than the students. Activity based strategy has proved to be better in enhancing students' achievement in Chemistry possibly due to the nature of the strategy whereby the teacher first explains the concept before the students carry out other processes in the teaching and learning situation. Just as an apprentice first takes instruction from his teacher and follows such in the execution of an assignment, so also in this situation. The strategy is found to be better than Practice invention whereby students first think about the concept on their own before the teacher finally gives them the correct feedback. Nevertheless, this study has proved that the treatment strategy is better than conventional strategy .This result corroborated the findings of Gurung (2005) that well-designed activity based session help students organized the materials to be studied. Studies show, that, perhaps emphasis should be on total study time but not on the way students study. Much stronger relationship has been found between test scores and time spent organizing the course content than with total study time (Dickson and O'Connell 2005).The finding is however opposed to Brenda and Robert (2003) who found and argued that the conventional lecture method could not be totally ignored.

Educational Implications

-The findings have therefore revealed importance of using teaching strategies that are participatory and learner centered where learners are trained to take control and direct their learning processes for effective learning.The study also revealed that there is need to incorporate in our educational system the Activity based strategy as one that could help in providing chemistry achievement needed to bring about necessary performance.

Recommendations

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

- In order to improve students' performance in Chemistry, Activity- based teaching strategy is recommended to secondary school Chemistry teachers.
- Teachers should facilitate the use of Activity based teaching strategy in schools to improve their achievement in the subject.
- There is need for training of pre-service Chemistry teachers on the effective use of Activity- based teaching strategy.
- Government and professional bodies such as STAN, NTI, NUT, etc. should organize in-service and re-training programmed for teachers on the effective use of Activity- based teaching strategy in the teaching of Chemistry.

Conclusion

The right selection and appropriate use of instructional strategies may result into better achievement on the part of the learners. The study had shown that Activity- based teaching strategy was more effective in improving the students' achievement in chemistry than conventional teaching strategy. The study found that However, Activity based teaching strategy can be used to foster the learning of selected concepts in Basic science irrespective of gender.

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