

CREATING ENABLING CHEMISTRY LEARNING COMMUNITY USING ACTIVITY BASED APPROACH (ABA)

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ABSTRACT

In view of the usefulness of chemistry to nearly all fields of human endeavor, the poor achievement and retention of student in chemistry in college has been a source of concern. Most of the time, poor achievement and retention are caused by poor teaching methods used by chemistry teachers, therefore this study examined possible ways of enhancing chemistry students' achievement by creating enabling learning community through activity based approach. The study employed pretest-posttest, control group quasi experimental research design. Chemistry achievement test (CAT) was developed by the researchers and administered to 150 chemistry student (boys and girls) in secondary school in SS2 from six (6) randomly selected secondary schools. Data were analyzed using descriptive statistics and the hypotheses were tested using chi-square which gave result that there is significant difference between student exposed to ABA and those exposed to conventional learning. Hypothesis one, $t_{\text{calculated}}=23.605$ and $t_{\text{critical}}=1.960$ with a significance level of $p<0.05$, hypothesis two $t_{\text{calculated}}=0.623$ and $t_{\text{critical}}=1.960$. Results obtained reviewed that students perform better in chemistry when taught using ABA as compared to conventional method. However, findings from hypothesis two reveal that gender has no significant effect on students' academic achievement. Analysis of the study also found that post-test scores shows that experimental group had a mean score of 19.25 while the control group had a mean score of 8.62, this implies that ABA had a positive effect on the student' academic achievement. It was concluded that ABA is more effective than conventional learning strategy. It was also recommended that ABA should be replicated in all science disciplines.

Keywords:

Creating Enabling, Chemistry, Learning Community, Activity-Based Approach

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INTRODUCTION

Chemistry teaching is important in high schools since it plays a significant role in understanding the daily life. Uzuntiryaki and Boz (2007) stated in their study the importance of chemistry: Chemistry develops student's way of thinking in a way that they use scientific method. Then, they can use these thinking abilities they gained in the chemistry class in any problem in their life. Also, students' critical thinking ability can be improved by chemistry. For this reason, chemistry should be taught

However, as stated by Demirciolu and Ayas (2006) have stated that chemistry is perceived as one of the difficult disciplines by students since it includes some abstract concepts. Sokmen and Bayram (1999) in their study on ninety-seven ninth graders conclude that students are not able to significantly learn various chemistry concepts such as elements, compounds, mixture, raw materials, homogenous mixture, chemical change, physical change and so on and that they have many misconceptions about chemistry. They further argued that these negative points may be as a result of an extensive school programmes and memorizing some facts. Tezcan and Uzun (2007), on the other hand, compared the high school students' achievement on the unit of "Elements and Compounds" using the cooperative learning and traditional learning approaches. It was found that those students who were taught through cooperative learning method have higher levels of achievement in contrast to those receiving traditional one.

The importance and relevance of chemistry amongst the science subjects is inestimable, hence the need for proper teaching of the subject in the secondary schools so that students score in internal and external examinations will be high, thereby making the candidates entrance into higher schools easier. Chemistry teachers are expected to make the subject more relevant, fun, enjoyable, easy and meaningful and less abstract to the students. Chemistry in particular is the central to many of the scientific fields of human endeavors; therefore, the teaching of chemistry should be given serious attention. Science teachers have always recognized the importance of practical works as a means of introducing learners to the scientific process of experimentation. To this end, the United Nations Educational Scientific and Cultural Organization (UNESCO) and the International Union of Pure and Applied Chemistry (IUPAC) have participated in numerous international meetings to promote inexpensive experimental-based teaching in chemistry.

Activity-based Approach (ABA) as defined by Prince (2004) is a learning method in which students are engaged in the learning processes. Activity-based Approach (ABA) teaching method in the words of Harfield, Davies, Hede, Panko Kenley (2007) "students actively participate in the learning experience rather than sit as passive listeners". Learning activities if based on "real life experience" help learners to transform knowledge or information into their personal knowledge which they can apply in different situations (Edward, 2001). Harfield et al; (2007) by quoting Prince (2004) said that active learning method is different from traditional method of teaching on two points, first, active role of students and second, collaboration among students. Suydam, Marilyn and Higgins (1977) define activity -based learning as the learning process in which "student is actively involved in doing or in seeing something done." According to them Activity-based Approach (ABA) method "frequently involves the use of manipulative materials". Meaningful learning, according as Churchill (2003) quotes Jonassen and Churchill (2011) engages activity. According to Churchill (2003),it helps learners to "construct mental models that allow for 'higher-order' performance such as applied problem solving and transfer of information and skills". In Activity-based Approach the learner examines learning requirements and thinks how to solve a problem in hand. The students do not learn about the content. Rather they learn about the process to solve the problem.

STATEMENT OF THE PROBLEM

The poor performance of students in science subjects has attained a very high dangerous dimension. In the light of this, science educators need to seek for suitable ways of tackling the current mass failure if they are to stop the movement of students to art and social science subjects (WAEC Report, 2014-2018). Most chemistry students do not perform very well in some core chemistry subjects like, thermodynamics, chemical equilibrium, organic chemistry, quantitative and qualitative analysis, writing and balancing of chemical equations due to the type of teaching methodology by the chemistry teachers. The usual demonstration method that is adopted by many chemistry teachers appeared not to be student centered may be attributed to be the cause of this poor performance in Chemistry mostly on practical related content areas. In view of all these numerous challenges militating against students achievements in chemistry hence the need for creating an enabling chemistry learning community using activity-based approach on chemistry students' achievement in Lagos State.

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PURPOSE OF THE STUDY

The purpose of this study is to;

1. Find out if activity-based learning is a better method in teaching and learning chemistry in secondary schools,
2. Examine how activity-based learning improve the academic achievement of chemistry students in secondary schools
3. Find out if there will be any significant difference between the scores of students exposed to activity-based learning and those exposed to conventional learning strategy

Research Questions

This study is intended to proffer answers to the following research questions

1. How does activity-based learning strategy improve the academic achievement of chemistry students?
2. How is activity-based learning strategy better than conventional teaching techniques?
3. Will there be any difference in the academic achievement of students exposed to activity-based learning and those exposed to conventional teaching technique?
4. Will there be any gender difference in the academic achievement of chemistry students exposed to activity-based learning strategy and those exposed to conventional learning strategy?

Research hypotheses

H₀₁: there is no significant difference in the academic achievement of chemistry students exposed to activity-based learning and those exposed to conventional method.

H₀₂: there is no significant difference in the academic achievement scores of both male and female students exposed to activity-based learning approach.

SIGNIFICANCE OF THE STUDY

Chemistry has been tagged one of the most difficult subjects at any level of study.

The findings of this study will benefit the students, teachers and policy makers. The students would benefit from the outcome of the study in the sense that it will help in encouraging self-effort in learning among students, as that will make them sort solutions themselves.

The teacher would benefit from the outcome of this study in the sense that the finding would help chemistry teachers to know which teaching method would suit practical related topics in chemistry to enhance students' achievement. Education policy makers would find this study useful in the sense that they would know if they need to organize seminars or workshop in order to retrain teachers on the best way and approaches to teaching practical related topics in chemistry.

Scope of the study

Analysis of activity-based approach was studied at secondary school level using six (6) secondary schools (3 public and 3 private) in Education District IV, therefore this study is only limited to Senior Secondary SS2 chemistry students in Education District IV, Yaba Local Government area of Lagos State

METHODOLOGY

Research design

The study employed pretest-posttest, control group quasi experimental research design

Population of the study

The population of this study comprised of the total number of the chemistry students in six selected Senior Secondary Schools in Education District IV, Yaba Local Government area of Lagos State

Sample and Sampling Technique

The sample comprised of twenty five (25) SSS2 chemistry students. Purposive sampling was used to draw all the students from the six selected Secondary Schools. Simple random sampling was used to draw the control and experiment class. The assessment used one hundred and fifty (150) students.

Instruments

The following instruments were used in the study.

1. Chemistry Achievement Test (CAT)
2. Instructional Guide on Activity-Based Approach (IGABA)
3. Instructional Guide on Conventional Teaching Strategy (IGCTS)
4. Evaluation Sheet for Assessing Teachers' Performance on Activity-Based Approach
5. Evaluation Sheet for Assessing Teachers' Performance on Conventional Teaching Strategy

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Validity of the instruments

The instruments for the data collection were validated by Science Education experts and the Chemistry Lecturers in the School of Science Education, Federal College of Education (Technical), Akoka. Their observations and recommendations were used to improve the instruments before administration.

Reliability of the instrument

A drafted copy of the achievement test was pilot-test on some set of SS2 students in a school different from the school used for the study. The data resulting from the pilot-test was analyzed using Kinder Richardson method to determine the correlation coefficient $r = 0.81$

Method of data collection

The instruments were administered by the researcher. Two groups were selected and labeled as follows: Experimental Group (Group A) and Control Group (Group B). Both the experimental and control group wrote a pre-test with the instrument to determine their entry behavior. The two groups were then taught using the conventional method. Later, the experimental group was exposed to activity-based learning. At the end of the instruction, the post-test prepared based on the instructional contents was administered on the two groups. To avoid interaction between the two groups, strict supervision was carried out so that the result would not be affected in anyway. The teaching, administration and supervision were done by the researcher with the help of the subject teachers from the selected schools.

Method of data analysis

The data collected was analyzed using statistical tools like frequency count, percentage mean and t-test.

Achievement Test (Section A) Respondents' Bio-data

Table 1.1: Students' Gender

Students' Gender	Frequency	Percent
Male	62	41.3
Female	88	58.6
Total	150	99.9

Analysis of Students' Gender

The result in Table 1.1 below shows the gender of students who responded to the achievement test, 41.3% respondents are male while 58.6% are female, the margin in percentage variation shows that data gotten is not gender biased as there is only a little variation in respondents' gender.

Achievement Test (Section B) Analysis Test Items

Analysis of Achievement Test Scores of both Experimental and Control Group The tables above show test scores of the two groups, the control group which conventional method of teaching was adopted has a range of score 3-13 i.e the lowest score is 3 and highest score is 13. However, for the experimental group had a better performance compared to control group. Its score range is 12-29 i.e the minimum score is 12 while maximum score is 19.

Research Question 1:

How does activity-based improve the academic of chemistry students?

Table 1.2: Mean and Standard Deviation of Mean Performance of Students' taught Chemistry using Activity-based and Conventional Method of Teaching

Group	N	Mean	Std. Deviation
Activity-based (experimental)	150	19.25	4.88
Conventional (Control)	150	8.62	2.57

Analysis of Mean and Standard Deviation of Mean Performance

The data presented in Table 1.2 shows that the experimental group had a mean score of 19.25 while control group had a mean score of 8.62 with standard deviation of 2.57. With this result, the students in the experimental group performed better in the achievement test than the students in the control group. Hence, activity-based instructional strategy improved students' achievement in learning chemistry.

Research Question 2:

How is activity-based instructional strategy better than other teaching techniques?

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To answer this research question 2, many other teaching methods should be used alongside activity-based strategy so as to have a justifiable result. But since it was only two teaching methods that were adopted in this research (activity-based and conventional method) thus, the researcher compares both means (x) by using paired samples T-test.

Table 1.3 Paired samples statistics and correlation

	N	mean	Std. Deviation	correlation	significant
Activity-based	150	19.25	4.88		
				-0.78	0.343
Convectional method	150	8.62	2.75		

Analysis of paired samples statistics and correlation

The correlation between the experimental group and control group is -0.7, this shows that the relationship (r) between these two methods of teaching is negatively high. It therefore means that activity-based learning strategy is better than convectional teaching method with a low significant value of 0.343.

Research Question 3

Will there be any difference in the academic achievement of students exposed to activity-based and those exposed to conventional teaching techniques?

To answer research question three (3), the mean score between the groups was determined using descriptive statistics and the result is presented in Table 4.8

Table 1.4 Descriptive Statistics Results of Difference Between academic achievements of activity-based and conventional method

To answer research question three (3), the mean score between the groups was determined using descriptive statistics and the result is presented in Table 4.8

Table 1.4 Descriptive Statistics Results of Difference
Between academic achievements of activity-based and conventional method

Group	N	Mean	S.D	Mean score difference
Activity-based	150	19.25	4.88	
Conventional method	150	8.62	2.57	

Analysis of Descriptive Statistics Results of Difference between Academic Achievement of Activity-based and Conventional Method

The result in Table 1.4 showed that activity-based has a mean of 19.25 while the mean of conventional method is 8.62; the difference in mean was observed to be 2.31 and t test whether the mean score difference is significant or not, null hypothesis (H_0) was formulated and tested using independent t-test statistics, the Hypothesis reads:

Research Question 4:

Will there be any gender difference in the academic achievement of chemistry students exposed to activity-based instructional strategy?

To answer the research question 4, the mean score between both gender was determined using descriptive statistic and the result is presented in Table 4.10

Table 1.5: Descriptive Statistics Results of Difference between Academic Achievement and Students' Gender taught with Activity-based Strategy

Gender	N	Mean	S.D	Mean score difference
Male	62	20.21	5.02	1.63
Female	88	18.58	4.68	

Analysis of Description Statistics Result

The result presented in table 1.5 showed that chemistry male students exposed to activity-based strategy has a mean score of 18.58 while their female counterparts has a mean score of 20.21, and to test whether the

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difference is significant or not, null hypothesis (H_0) was formulated and tested using independent t-test statistic, the null Hypothesis reads:

Research Hypothesis One:

H_0 1: There is no significant difference in the academic achievement of chemistry students exposed to activity-based and those exposed to conventional teaching method.

Table 1.6: Comparison of the Academic Achievement between the Activity- based and Conventional Group

Group	N	Mean	S.D	df	t-eal	t-crit	Sig	Decision
Activity-based	150	19.25	4.88	298	23.605	1.960	Significant	Ho1 Rejected
Conventional method	150	8.62	2.57					

$P \leq 0.05$

Analysis of Academic Achievement between the Activity-based and Conventional Method

To test null hypothesis, T-test statistic was used in the table 1.6 above. The t- calculated for the null hypothesis is 23.605 the t-critical is t-crit = 1.960 at degree of freedom (df) of 298, $P \sim 0.05$ level of significance. The null hypothesis (H_0) was therefore rejected since t-crit value is less than t-eal value it then means that there is a significant difference between the chemistry students exposed to activity-based instructional strategy and those exposed to conventional method of teaching.

Research Hypothesis 2

H_0 2: There is no Significant Gender difference the Academic Achievement Scores of Chemistry Students exposed to Activity-based Instruction Strategy.

Table 1.7: Comparison of the Academic Achievement between the Activity-based and Conventional Method

Group	N	Mean	S.D	df	t-cal	t-crit	Sig	Decision
Activity-based	62	20.21	5.02	148	0.623	1.960	NotS	H02 Accepted
Conventional method	88	18.58	4.68					

$P < 0.05$

Analysis of Comparison of the Academic Achievement

To test the null hypothesis 2, T-test statistic was used in Table 1.7 above. The t-Cal for the hypothesis is 0.623 and the t-crit is 1.960 at degree of freedom (df) of 148, $P < 0.05$ the null hypothesis (H02) was therefore accepted since t-crit is greater than t-Cal, it then means that there is no significant gender difference on their academic achievement using activity-based instructional strategy.

Discussion of findings

From the results shown above it was concluded that there was a positive impact of activity-based teaching in developing cognitive skills in the students of chemistry at secondary school level. ABLS is more effective for the development of higher order thinking skills in the students. These results are supported by the findings of Hung, Jonassen and Liu (2008), Suydam, Marilyn and Higgins (2000).

SUMMARY

The study found that there was a significant difference in performance between the students who were exposed to activity based learning and those who were not. There was a significant difference between post-test score of experimental and control groups. The post-test showed that the experimental group has a mean score of 8.62. from the findings, the experimental group mean score is higher than that of control groups mean score implying that activity-based learning strategy had a positive effect on the students' academic achievement. This shows that the use of activity-based learning strategy had a significant improvement in the

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performance of chemistry student in thermodynamics and so it is a better method of teaching and learning chemistry. The finding of this study is also consistent with Daluba, (2013) who carried out an experiment on activity-based learning. The finding of this study showed that there was no significant difference between the post-test mean achievement of male and female student.

CONCLUSION

The study confirmed that the use of Activity-Based Approach (ABA) is an effective method in improving students' academic achievement in chemistry in secondary schools. ABA increase students' interest and abilities in science subjects as well as their performance in chemistry. From the findings, it was concluded that students achievement to a great extent rely on the strategy used by the teacher in teaching thermodynamics concepts particularly when exposed to ABA. Chemistry teachers should therefore employ ABA to improve students' achievement in difficult and abstract concepts like thermodynamics.

Contributions of the Study to Knowledge

This study has contributed to knowledge in the following ways:

1. The study would help to improve learners' achievement in Chemistry
2. The findings would serve as a basic foundation for future studies in the area of Activity-Based Approach and is proper utilization for effective teaching and learning of Chemistry in secondary schools.
3. The approach is active learning based because it encouraged team work and interactions among the students and all categories of learners were helped to acquire more knowledge.
4. It would help to contribute significantly towards curriculum planning, development and training of Chemistry teachers for better classroom management.
5. It would as well help Curriculum planners, educational administrators and government in providing a better programme of teacher training course for would-be Chemistry teachers, which might invariably enhance the attainment of the goals of education.

RECOMMENDATIONS

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

- 1 Activity-Based Approach should be adapted as viable strategy for learning concepts in Chemistry since they involve students' participation in their learning process.
- 2 Government should organise an in-service and retraining programmes for teachers for the effective use of innovative strategies such as Activity-Based Approach through seminars, workshops, and conferences.
- 3 Government should ensure that there are not more than 30 students in a class so that class management would not be difficult for teachers.
- 4 These strategy is viable for improving achievement needed by students in secondary schools.
- 5 Government and other employers of labour should ensure that professionally qualified and competent teachers are engaged in teaching Chemistry.
- 6 There is need to integrate into the school Chemistry curriculum, systematic ways in which practicing teachers and would - be teachers can be trained in the use of Activity-Based Approach.
- 7 In order to improve students' achievement in Chemistry Activity-Based Approach is particularly recommended to secondary school Chemistry teachers.

Suggestion for further studies

This study was carried out in Lagos state (Yaba Local Government) Education District IV, s further research can be carried out in other states or different Education Districts in Lagos State and in other areas of science subjects

REFERENCES

- Churchill, D. (2011). Effective Design Principles for Activity Based Learning.
- Daluba, N. E. (2013). Effect of Demonstration Method of Teaching on Students Achievement in Agricultural Science. *International Journal of Modern Social Science*.
- Harfield, T., Davies, K., Hede, J., Panko, M., & Kenley, R. (2007). Activity Based Teaching For Unitee New Zealand Construction Students. *Emirates Journal for Engineering Research*, 57-63.

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Panko, M., Kenley, R., Davies, K., Piggot-Irvine, E., Allen, B., Hede, J., & Harfield, T. (2005). Report for Building Research. Auckland: Unitec New Zealand.

Prince. (2004). Learners Performance of Physical Science Using Laboratories. Limpopo: University of Limpopo.

Suydam, Marilyn, N., Higgins, & Jon, L. (1999). Activity-Based Learning in Elementary School Mathematics. Ohio State University Press.

Tezcan, & Uzun. (2007). A Critical Appraisal of The Role of Laboratory Chemistry Practical in Science Teaching In Nigeria. *Journal of Curriculum And Instruction*, 59-65.

Uzuntiryaki, & Boz. (2008). Guided Inquiry Teaching Method. Nsukka: University of Nsukka.

WAEC West African Examination Council, Chief Examiners Report. (2014). Lagos.

WAEC West African Examination Council, Chief Examiners Report. (2015). Lagos.

WAEC West African Examination Council, Chief Examiners Report. (2016). Lagos.

WAEC West African Examination Council, Chief Examiners Report. (2017). Lagos.

WAEC West African Examination Council, Chief Examiners Report. (2018). Lagos.

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