

**Article Citation Format**

J.E. Ntibi & H.A. Neji (2018): Improving Students Achievement in Chemistry and Physics Classes Using Activity-Based Approach. Journal of Digital Innovations & Contemp Res. In Sc., Eng & Tech. Vol. 6, No. 1. Pp 67-74

**Article Progress Time Stamps**

**Article Type:** Research Article  
**Manuscript Received:** 23<sup>rd</sup> January, 2018  
**Review Type:** Blind  
**Final Acceptance:** 3<sup>rd</sup> march, 2018  
**DOI Prefix:** 10.22624

## Improving Students Achievement in Chemistry and Physics Classes Using Activity-Based Approach

J.E. Ntibi & H.A. Neji  
Department of Science Education  
University of Calabar  
Calabar, Nigeria  
Oppee2004@yahoo.com

### ABSTRACT

The study investigated the effect of activity-oriented method of teaching Chemistry and Physics a panacea for students' academic performance and retention in secondary schools in Odukpani local government area of Cross River State, Nigeria. The selected experimental groups of students were taught rates of Chemical reactions and energy conversion using activity-based method to ascertain the learning outcome of the students in Chemistry and Physics. Research design adopted was posttest only Quasi - experimental design. A total of 200 SS2 students constituted the sample of the study. Two null hypotheses were formulated to guide the study. The respondents were exposed to series of activities using some local materials from the environment. Posttest and retention test were packaged and administered after the treatment. Reliability of the instruments Chemistry Achievement Test (CAT) and Physics Achievement Test (PAT), also Chemistry and Physics Retention Test (CRT and PRT) were used to ascertain the retention of concepts by the students, using Kudar-Richardson formular 20 which yielded a reliability of 0.89 and 0.83 respectively. Two experimental groups and two control groups were used for the study. The experimental and control respondents were taught the same concepts using activity-oriented and conventional methods. Treatment lasted for eight (8) weeks. Data obtained were analyzed using independent t-test at 0.05 level of significance. Results of findings revealed that the experimental groups taught with activity-oriented approach had a higher mean score of ( $X=7.93$  and  $SD=4.18$ ) than the control group taught with traditional method. More so, the two experimental groups had a significant retention scores variance as ( $X=5.86$  and  $SD=3.63$ ) respectively. Recommendations were made; the use of activity-oriented approach in teaching Chemistry and Physics serves as scalable a panacea for students' performance and retention.

**Keywords:** Activity-oriented, Chemistry, Physics, Students, Achievement.

---

## 1. INTRODUCTION

The performance of Chemistry and Physics students in the past years revealed a deplorable trend at the Senior School Certificate Examination on (SSCE) in Cross River State, Nigeria. Poor performance of students in Chemistry and Physics has been attributed to using the appropriate teaching methods during teaching. The methods which teachers use in teaching Physics concepts contribute to their poor performance.

Chemistry and Physics are natural sciences, students find difficulty learning due to calculations and balancing of chemical equations involve in the concepts. They fail to solve most Chemistry and Physics problems correctly even after doing and practicing many other similar problems as a result of teachers' mode of presentation, Inappropriate use of teaching methods result in students not being able to explore the natural environment; inability of the students to see, feel and touch science resources that will bring about creative thinking and learning of science in their natural state.

Activity-oriented instructional method of teaching encompasses learning or method paradigm that involves interaction with laboratory materials, use of sense organs in making observations, developing instruments for data collection analyzing and interpreting data, outlining possible explanations and creating predictions for future study. The major attribute of activity-based learning is exploring and solving problems through students' active role to create, integrate and generalize knowledge. Activity-oriented based learning encourages students to learn at their own pace. Through this method of teaching, there is flexibility in learning calculations, balancing equations and conducting practical in Chemistry and Physics. Learning is not a static but progressive with activity-package lessons. Activity-based learning contributes greatly to students' enthusiasm to learn is promoted. This learning strategy is an example of constructivist learning strategy which poses significant contextualized real world situations and provides resources, guidance and instruction to learners as they develop content, knowledge and problem-solving skills (Anyafalude, 2014).

## 2. LITERATURE REVIEW/ THEORETICAL BACKGROUND

Jerome Bruner's theory of discovery learning is a theory of learning which believes that it is best for learner to discover facts and relationships for themselves. The theory states that learning is best promoted when one is able to figure things out for oneself. The concept of activity-based approach implies that students construct their own knowledge for themselves when they are allowed to interact with materials in the laboratory through activities.

This theory emphasizes that learning is best maximized in a situation where the learner draws on his or her own past experience and existing knowledge to discover facts and new truth to be learned. Students interact with the world by exploring and manipulating objects, wrestling with calculations and equations questions or performing experiments. As a result, students may be more likely to remember concepts and knowledge discovered on their own (in contrast to a transmissions model) Models that are based upon activity learning model, problem-based learning and others. Bruner's theory of learning encourages activities encouragement and promotes motivation in the learner. The role of the teachers should be to facilitate the learning process and not rote memorization learning. This means that a good teacher will design lessons that will help students to be actively involved and discover the relationships between bits of information about Chemistry and physics concepts.

The National Science Standards Considers learning through activity to be an essential part of science education (National Research Council, 1996). Activity-based learning according to the National Standards Council involves engagement, exploration, making observations, explanation, elaboration and evaluation. When students learn through activity-based approach they will develop their understanding of the concepts rather than being told. They are actively learning the content using their sense organs and science process skills.

According to National Teacher's Institute (NTI) (2000), Ngada (2004) and Ibe (2004) Activity-based method is synonymous with discovery method of teaching because two of them are related by being activity-oriented that lead to generation of new knowledge. New knowledge is acquired as students collect data, analyze data, and solve problems, memorizing facts does not promote or develop problem-solving skills, but when students are allow to investigate, reason, organize knowledge, they are able to incorporate new knowledge into their understanding (Miller et al. 2010). Further assert that inquiry -based learning helps students understanding of the world around them through gathering knowledge. Students' scientific understanding is supported through the expansion of habits of the mind and using problem solving skills (Miller et al., 2010).

Activity-based learning is seen as a system of learning that support the development of problem solving and critical thinking skills, which is important for everyday activities. The role of the teacher is to provide the learners with necessary opportunities to discover new facts, new rules, new methods and techniques of solving problems, this method allow students to learn how to ask questions and figure out the answers, but they also learn what questions are important to ask; activity-based method involves active observation, measurement, manipulation of materials, collection and analysis of data, investigation of results and making conclusion.

The adoption of activity-based method in teaching embraces the use of scientific method as a basis for investigation and resolution of problems (Ngada, 2004; NTI, 2004; Iyiola 2010). The process include: definition of identified problem, formulation of hypothesis, design of investigation strategies for data collection and analysis, testing of hypothesis is tested against data, interpretation of results and making conclusion from results to arrive at generalization. If the activity is stimulating and well coordinated by the teacher, the activity may contribute in enhancing students' performance and retention of concepts due to acquisition of practical knowledge and skills.

Witt and Ulmer (2010) examined the purpose of using activity-based or constructivist, curriculum in the middle school classroom on student academic achievement. The study was developed to determine which teaching method, constructivism or traditionalism, was more effective in increasing students academic achievement. The data showed that using activity-based in the middle school classroom appeared to have an impact on student academic achievement. It showed that activity-based method as compared with traditional method, appeared to be more effective in increasing students academic achievement.

Similarly, Ndino and Nbina (2007) carried out a research too examined the effects of activity-based learning strategies on senior secondary school students academic achievement and retention in Biology. The study used a quasi-experimental pre-test –post test control design. Four research questions and four hypotheses were formulated to guide the study. The sample size consisted of one hundred and eighty (180) SS 2 Biology students selected from three (3) senior secondary schools in the study local government area by random sampling technique.

Data were obtained through a 30 items multiple choice biology achievement tests (BAT). The instrument was validated by experts and using a test-retest method, a reliability co-efficient of 0.85 was obtained. Standard deviation and paired t-test were employed in testing the hypothesis. Study findings revealed that both activity-based learning strategy enhances students' academic achievement and retention in Biology more than the expository (Lecture) method. It was therefore concluded that activity learning is an effective instructional strategies capable of stimulating students to greater interest and academic achievement and retention in Biology. Hence, it is recommended, among others, that activity-based strategy be encouraged in senior secondary schools.

#### **Statement of hypothesis**

- (1) There is no significant difference in the academic performance of Chemistry students taught with activity-based method.
- (2) There is no significant difference in the academic performance of Physics students taught with activity-based method,

### **3. METHODOLOGY**

The design for this study was quasi-experimental design. It involves manipulation of the independent variables in order to determine its effect on the dependent variable. Purposive sampling since it involves intact class setting. The design was considered appropriate since the nature of the study will not allow for and students' academic performance in Chemistry and Physics. randomization or students into experimental groups; and the control was necessary to provide basis for comparison of the students' performance since the study requires two experimental groups and a control group, the structural representation of the design was as follows: The research area for this study is Odukpani Local Government Area, Cross River State. The population of this study comprises all SS2 Chemistry and Physics students in secondary schools in Odukpani local government area. The sample for this study comprised of 220 Chemistry and Physics students drawn from four (4) secondary schools in Odukpani local government area, Cross River State. The instrument used to gather data was Physics Performance Test (PAT) and Chemistry Performance Test (CAT). The reliability of the instrument was established using Kudar-Richardson's formula (KR-20), which yielded a reliability coefficient of 0.97 and 0.92 respectively. Data was analyzed using analysis of covariance independent t-test analysis.

#### 4. RESULTS:

The influence of activity-based method on students' academic achievement in Chemistry.

**Table 1: Mean and Standard deviation and independent t-test analysis of the difference between students taught with guided discovery in Chemistry.(160)**

Variable type	n	Mean $\bar{X}$	Standard deviation(SD)	Cal t-value
Chemistry students taught with activity-based method	80	20.81	7.53	6.31
without activity-based method	80	13.26	4.35	

$P < 0.05$ ;  $df=148$ ; critical t-value =1.96

##### Hypothesis 1

This hypothesis sought to find out the difference in academic performance of students taught with activity-based approach in Chemistry. Finding revealed that Chemistry students taught with activity-based method obtained a higher mean score of (20.81) than those taught with conventional method with (14.27) at 0.05 level of significance. Therefore, the null hypothesis is rejected and the alternate re-stated. Thus, there is a significant difference in the academic performance of students taught with activity-based approach in Chemistry.

##### Hypothesis two

There is no significant difference in the academic performance of students taught with activity-based approach in Physics.

**Table 2: Independent t-test analysis of the relationship between the academic performance of students taught with activity-based Physics. (N=160).**

Variable type	n	Mean ( $\bar{X}$ )	Standard deviation(SD)	Cal t-value
Students taught with activity-based in physics	80	17.83	5.48	3.70
Students taught without activities	80	10.37	3.11	

$P < 0.05$ ;  $df=158$ ; critical t-value=1.96

Hypothesis 2 sought to find out the academic performance of students taught with activity-based-approach in Physics. Finding revealed that the students taught with activities had mean score of ( $x=17.83$  and  $t=5.48$ ) while the control group had mean score of ( $x=10.37$  and  $t=3.11$ ). Therefore since the calculated t-value of 3.70 is higher than the critical ( $t=1.96$ ) at 0.05 level of significance, the null hypothesis is rejected and the alternate hypothesis restated. There is a significant difference in the academic performance of students taught with activity-based approach in Physics.

## 5. DISCUSSION OF FINDINGS

Hypothesis 1 investigated the academic performance of students taught with Activity-based approach in Chemistry. Finding revealed that students taught with activity-based method had higher mean score than those taught without activities. This shows the efficacy of activities during presentation of instruction in Science teaching and learning.

This finding agrees with Neji and Edu (2016) whose study revealed that the use of environmental resources during Science practical significantly influenced pupils academic performance and retention in Basic science in Calabar municipality, Cross River State, Nigeria. The finding also collaborate with Asim and Hope (2017) examined the effect of activities in teaching primary Science, Mathematics and Agricultural science in Calabar Municipality, Cross River State, Nigeria. Finding revealed that students academic performance can be enhance through practical activities in Science and Mathematics.

Hypothesis 2 sought to find out the influence of activity-based approach on students' academic performance in Physics. Finding revealed that there is a significant difference students taught with activity-based approach has a significant difference in performance compared with their counterparts taught without activities. This finding is supported by According to National Teacher's Institute (NTI) (2000), Ngada (2004) and Ibe (2004) Activity-based method is synonymous with discovery method of teaching because two of them are related by being activity-oriented that lead to generation of new knowledge.

New knowledge is acquired as students collect data, analyze data, and solve problems, memorizing facts does not promote or develop problem-solving skills, but when students are allow to investigate, reason, organize knowledge, they are able to incorporate new knowledge into their understanding (Miller et al. 2010). Further assert that inquiry -based learning helps students understanding of the world around them through gathering knowledge. Students' scientific understanding is supported through the expansion of habits of the mind and using problem solving skills (Miller et al., 2010).

Activity-based learning is seen as a system of learning that support the development of problem solving and critical thinking skills, which is important for everyday activities. The role of the teacher is to provide the learners with necessary opportunities to discover new facts, new rules, new methods and techniques of solving problems (Ngada, 2004). This method allow students to learn how to ask questions and figure out the answers, but they also learn what questions are important to ask; activity-based method involves active observation, measurement, manipulation of materials, collection and analysis of data, investigation of results and making valid conclusion.

## 5. CONCLUSION

The research investigated the influence of activity-based approach in teaching Chemistry and Physics in secondary schools in odukpani local government area in Cross River State, Nigeria. Finding revealed that there a significant difference in the academic performance of students taught with activity-based approach in Chemistry and Physics in secondary schools.

## 6. RECOMMENDATIONS

- (1) Based on the findings of the study, it is therefore recommended that Chemistry and Physics teachers should employ the use of activity-based instructional approach to a panacea for enhancing students' learning outcome in the subjects.
- (2) The curriculum in the secondary schools should be reviewed to capture these teaching strategies that are not commonly used by teachers in public schools.
- (3) Training of Chemistry and Physics teachers in public schools should be encouraged.

## REFERENCES

- Anyafulude, J. C. (2014). Enhancing male and female secondary school students' achievement in Basic Science using inquiry-based teaching strategy. Enugu State University of Science and Technology, Nigeria. *Internal Journal of Scientific and Engineering Research*. <http://www.mercedataconsulting.org>.
- Brunner, J. S. (1996). *The act of discovery Harvard Education review*
- Jimoh, T. (2003). Evaluation of various methods of teaching Physics in Senior Science Schools in Kwara State. *Nigeria Journal of Educational Studies and Research*, 1(9),64-70.
- Miller, H. McNeal, K., & Herbert, B. (2010). Inquiry in the physical geology classroom: supporting students' conceptual model development. *Journal of Geography in Higher Education*, 34(4), 595-516.
- National Research Council (1996). National Education Standards, Washington D. C., National Academic Press.
- National Science Education Standards, (1996). National Academy Press. Washington, D.C.
- National Teachers Institute (NTI) (2000). *NCE/DLS course Book on Education, Cycle 1, Modules 6-8, Kaduna: National Teachers Institute*.
- Neji, A H. Ntibi,J.E and Agube, C.C. (2017) *Communicating Chemistry and Physics through hands-on activities: A scalable Innovative approach to promote students' performance and entrepreneurial skills*. Proceedings of Isteams conference (2017) Caleb University, Lagos.
- Neji, A. H and Merrmikwu, A(2016) *Investigating the effectiveness of using collaborative and individualized methods on under-graduate students' academic performance in Science and mathematics at the University of Calabar, Nigeria*. Journal Publication of faculty of Science, Adeleke University, Ede, State of Osun, Nigeria.
- Ndino, O. F. and Nbina, J. B. (2007). Effects of Guided Inquiry Strategy on Students Academic Achievement and Retention in Biology. University of Port Harcourt. African Social and Educational Journal.
- Ngada, A. J. (2004). Principles and Practice of Effective Education. Lagos: Kolas Printing Co.
- U.S. State University (2017). Learning problem solving. Online material: <http://education.stateuniversity.com/pages/2168/learning-problem-solving.html>
- Udeani, U. & Sunday, A. (2011). The Relationship among Teachers problem solving abilities, students' learning styles and students' achievement in Biology. University of Lagos, Lagos. *International Journal of Educational Research and Technology*.
- Ugwuadu, O. R. (2011). *Effects of Discourse Patterns of Student's Achievement and Interest in Biology. Unpublished Ph.D. thesis, University of Nigeria, Nsukka*.
- Witt, C. & Ulmer, J. (2010). *The impact of Inquiry-Based Learning on the Academic Achievement of Middle School Students*. Western AAAE Research Conference Proceedings 269.